# Use of Complementary and Alternative Medicine and Self-Rated Health Status: Results from a National Survey

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***BACKGROUND:*** Despite the absence of conclusive evidence of effectiveness, complementary and alternative medicine (CAM) is used by 4 of 10 adults in the US; little is known about the association between CAM use and health status.

***OBJECTIVE:*** To determine the relation between CAM use and self-reported health status and health improvement over time.

***DESIGN AND PARTICIPANTS:*** We performed a secondary database analysis using data from the 2007 National Health Interview Survey of non-institutionalized US residents conducted by the National Center of Health Statistics of the Center for Disease Control. We identified CAM users and compared them to non-users. We used multivariable logistic regression to model the health status of respondents. We controlled for confounders including socio-demographic, clinical, and behavioral factors. The models were evaluated for discrimination and calibration.

***MAIN MEASURES:*** The likelihood of respondents to report 'Excellent' current health and 'Better' health than in the prior year.

***KEY RESULTS:*** Based on 23,393 respondents, we found 37% of U.S. adults used complementary and alternative medicine and 63% did not use any CAM. Compared to those who did not use CAM, CAM users were more likely to rate their health as 'Excellent' (adjusted-odds ratio (AOR) = 1.14, 95% CI = [1.03,1.26]). Similarly, CAM users were more likely to report their health as 'Better' than in the prior year (AOR = 1.64, 95% CI = [1.49,1.83]). The c-statistics for the two models were 0.755 and 0.616, respectively.

***CONCLUSION:*** We found a significant association between CAM use and self-rated excellent health and health improvement over the prior year. Prospective trials are required to determine whether CAM use is causally related to excellent health status and better health than in the prior year.

*KEY WORDS:* NHIS; National; 2007; survey; self-rated; health; status; improvement; CAM use; mind–body; complementary; alternative; logistic regression; c-statistics; acupuncture; ayurveda; chiropractic; osteopathic; medicine; massage therapy; integrative care; energy healing; diet supplements; herbal; traditional medicine; yoga; tai chi; qigong; meditation; deep breathing; relaxation.

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## INTRODUCTION

Complementary and Alternative Medicine (CAM) is characterized as a group of diverse systems, practices, and products used extensively[1–3] in medical and health care that are not generally taught in conventional medicine. CAM therapies are often used to 'complement', or as an 'alternative' to, conventional treatments[2]. CAM therapies share a fundamental belief that the body can heal itself and healing often involves restoring the balance in the body, mind, and spirit[2,4,5]. CAM therapies are grouped into five broad categories[1,3,6]. These include alternative medical systems, energy healing, manipulative and body-based therapies, biologically-based therapies, and mind–body therapies.

Self-ratings of health are among the most frequently assessed perception in health research[7–9]. Poor self-rated health is associated with more functional limitations, greater use of resources[9–16], and subsequent mortality, independent of objective health status[7,9]. Little is known about how the practice of CAM affects self-rated health and its change over time on a population level. In this context, we evaluated the relation between use of CAM and self-ratings of health and improvement of health among respondents to a national survey.

## METHOD

### Data Source

We used data from the 2007 National Health Interview Survey (NHIS). The NHIS is a computer-assisted, face-to-face annual survey designed to provide accurate national estimates and conducted in English and/or Spanish by the National Center for Health Statistics, in the households of the civilian, non-institutionalized, population of the United States[17]. The survey asked information on socio-demographic characteristics, health status, insurance status, and health care access and utilization for each family member. One adult and one child from each household were randomly selected for details on common medical conditions and health care utilization.

In 2007, the selected adult and child were also asked about their past-12-month use of 36 CAM therapies in five broad categories[2,3,17]. The alternative medical systems category included homeopathic treatment[18], acupuncture[19–21], traditional healers, naturopathy, and ayurveda[22]. The biologically based category included non-vitamin, non-mineral, natural

products; diet-based therapies; and chelation therapy[23–32]. The manipulative and body-based category included chiropractic or osteopathic manipulation, massage, and movement therapies[33,34]. The mind–body category included deep breathing exercises, meditation, yoga/tai chi/qi gong, progressive relaxation, guided imagery, hypnosis, and biofeedback[2,3,35]. Energy healing included reiki, and therapeutic touch[2,3,36–40]. Following common practice in CAM research, we included all 5 CAM categories but excluded prayer, vitamins, and minerals from our analysis[41–45].

## Collected Data

Interviews were completed in 29,266 households with 75,764 persons. From these households, 23,393 adults responded to the CAM survey (final response rate = 67.8%)[17].

We focused our analysis on the type of CAM therapies that the respondents reportedly used and their answers to the demographic, clinical, behavioral, and health status questions. Demographic data included age, gender, race/ethnicity, birth region, marital status, income, education, residence region, health insurance, and usual source of care. Clinical data consisted of conditions such as asthma, emphysema, heart attack, stroke, ulcer, liver condition, arthritis, diabetes, weak/failing kidneys, cancer, functional and cognitive impairments, and mental health. Behavioral data included body mass index, amount and frequency of alcohol and cigarette use, and type and frequency of physical activity.

To elicit information about CAM use, respondents were asked a series of questions: "During the past 12 months, did you see a practitioner for (specific therapy)?"; For disability, respondents were asked: "By yourself, and without using any special equipment, how difficult is it for you to do/perform (activities)?"; "What condition or health problem causes you to have difficulty with (these activities)?"; For health conditions, respondents were asked: "Have you ever been told by a doctor or other health professional that you had (specific condition)?"; and "During the past 12 months have you had (specific condition)?"[2,17,46].

Our outcomes of interest include a global assessment of health status and whether the respondent's health status had improved over the prior year. The specific questions used in NHIS to obtain the outcome information were: "Would you say your health in general is excellent, very good, good, fair, or poor?" and "Compared with 12 months ago, would you say your health is better, worse, or about the same? " These questions were included previously in the MOS-SF 36, a validated and internationally used instrument[47–51].

## Analysis

***Primary Independent Variable – CAM Use.*** We partitioned the respondents into two mutually exclusive groups based on their reported use of CAM in the previous twelve months. The CAM group consists of respondents who used any type of CAM in the past 12 months. The No-CAM group consists of the respondents who did not report using any CAM in the past 12 months.

***Covariates - Comorbidity Index and Other Correlates.*** The Charlson Comorbidity Index (CCI) is a measure that has been used in health services research to predict mortality and resource use based on patient's clinical conditions[52,53]. To characterize the clinical condition of the respondents, we used the modified CCI that was used in a prior NHIS study[54]. Per personal communication with the author, this NHIS-specific, Charlson Comorbidity Index (CCI), ranged from 0 to 17, and was calculated as the total sum score for each respondent and took into account whether the respondent was 'ever' told by a doctor or other health professional that he/she had asthma or emphysema, heart attack, stroke, ulcer, liver condition, arthritis, diabetes, weak/failing kidneys, or cancer and whether cancer, diabetes, or senility/dementia/Alzheimer's disease caused him or her any difficulty with activity. Each confirmed condition was given 1 point with the exceptions of: cancer, 2 points; cancer with difficulty, 6 points; diabetes, 1 point; diabetes with difficulty, 2 points; and weak/failing kidney, 2 pts. To assess mental health conditions within the last 30 days, we used the validated Kessler-6 score (K6), which ranged from 0 to 24, based on six mental health questions[55]. For both CCI and K6, higher scores indicate more comorbidities.

To characterize health habits, we included data on body mass index, smoking status, alcohol intake, and physical activity level. For physical activity assessment, we used previously validated criteria to categorize respondents as having high (vigorous activity, 2 or more times/week, or moderate activity, 4 or more times/week), medium (vigorous activity, 1 time/week, or moderate activity, 1–4 times/week), or low (no vigorous or moderate activity/week) activity level[56,57].

***Logistic Regression Modeling.*** We assessed the association between CAM therapies and health status by developing two multivariable logistic regressions of the dependent variables 'excellent' health and 'better' health than in the prior year. We included, as independent variables, 'CAM use' and other covariates, treated as potential confounders, including the aforementioned socio-demographic, clinical, and behavioral variables[58]. A description of this method was published elsewhere[59].

In a sensitivity analysis, we compared those who reported 'excellent' or 'very good' health to all others and those reported 'poor' health to all others. We also explored a model that had CAM use as dependent variable and health status among the independent variables. We report the summary results of these analyses.

We developed our models using an incremental process. We used socio-demographic covariates identified in previous studies as significantly correlated with use of CAM therapies[57,60,61] as the first set of explanatory variables, and then added clinical and behavioral variables to see how these health-related individual characteristic would affect the model. We retained the following socio-demographic factors in the model (age, sex, education, race/ethnic, birth region, and residence region) as well as covariates with p-values $\leq$ 0.20. We assessed covariates for collinearity and eliminated those with tolerance computed index >30. We report the Wald p-values, odd ratios (OR) and 95% confidence intervals of the covariates in each model using the Taylor linearization method to estimate variances. To characterize the discrimination, we report the c-statistic for each model. We evaluate the calibration of the models using the Hosmer–Lemeshow goodness-of-fit test and report their p-values[62]. To accommodate for the complex survey design, we

used SAS-callable SUDAAN v10.0 (RTI) analytic software and SAS statistical software (SAS institute, Cary, NC).

## RESULTS

As characterized in Table 1, approximately 4 of 10 United States adults used CAM therapy in the prior year. About 30% of each group rated their health as 'Excellent'. Respondents in the CAM group were about 1.5 times more likely than those in the No-CAM group to rate their health as 'Better' than the prior year.

CAM users were more likely than non-CAM users to be female. CAM users were more likely to be born in the US, college educated, or privately insured. CAM users had higher CCI and higher K6, suggesting more clinical conditions. The average respondents in both groups were overweight. Compared to the CAM group, the No-CAM group had about 2 times more alcohol abstainers and slightly (7%) more cigarette abstainers. While activity levels were about the same among the 2 groups, CAM users made more office visits, more emergency room visits, and spent more days in bed.

As shown in Table 2, in our 'Excellent' health model, we found significant odds ratio for the outcome of interest. Compared to the No-CAM users, CAM users were more likely to report their health as 'Excellent' (AOR = 1.14, 95%CI = [1.03, 1.26]). Similarly, our 'Better' health model also showed significant odds ratio for the outcome of interest. Compared to the No-CAM group, the CAM users were more likely to report their health as 'Better' than the prior year (AOR = 1.64, 95%CI = [1.49, 1.80]). Factors adjusted for in each model are listed in Table 2.

Both models demonstrated good calibration based on the Hosmer–Lemeshowtest (p=0.89 for the 'Excellent' health model and p=0.70 for the 'Better' health than prior year model). The c-statistics were 0.755 for the excellent health model and 0.616 for the better health model.

For our sensitivity analysis, we repeated the modeling process using 'very good or excellent health' and 'poor health' as dependent variables. We found that the results are similar. CAM users were more likely to have 'very good or excellent health' (AOR = 1.22, 95%CI = [1.10, 1.35]) and less likely (AOR = 0.61, 95%CI = [0.49, 0.76]) to have 'poor health'. We also modeled our data with CAM use as a dependent/response variable, and also found that 'Excellent' health status was associated with CAM use (AOR = 1.12, 95%CI [1.02, 1.22]).

## DISCUSSION

As previously reported, four out of 10 United States adults used CAM therapies in the prior 12 months[3]. We found, similar to previous reports[61,63], that CAM users in general reported more health problems in the prior year as evidenced by an increased number of clinical conditions included in the Charlson Comorbidity Index and Kessler Score. CAM users also reported higher numbers of visits to health care offices and emergency rooms and days spent in bed in the prior year.

In contrast to other findings that associated CAM use with worse health[64,65], we found CAM use was associated with better current health status as well as improved health over the prior year. Our findings present an interesting paradox in that the respondents using CAM were more likely to have chronic illness, as evidenced by the high CCI and K6 scores, yet also were

**Table 1. Characteristics of CAM Therapy Groups (% of each Group Total)**

| (n, Estimated Percent of US Adult Population) | CAM Therapies (8487, 37.20%) | No CAM Therapies (14906, 62.80%) |
|---|---|---|
| Health Status | | |
| Excellent | 30.42 | 28.14 |
| Very good | 33.50 | 30.59 |
| Good | 23.99 | 27.25 |
| Fair | 9.48 | 10.19 |
| Poor | 2.61 | 3.82 |
| Health Compared to 12 Months Ago | | |
| Better | 22.72 | 14.29 |
| Sex | | |
| Female | 57.81 | 48.11 |
| Age (years) | | |
| Mean (95% CI) | 45.93 (45.44, 46.42) | 45.71 (45.25, 46.16) |
| Median | 45.08 | 43.51 |
| 18-29 | 19.52 | 23.62 |
| 30-39 | 18.53 | 17.52 |
| 40-49 | 20.86 | 19.25 |
| 50-64 | 26.92 | 22.20 |
| >65 | 14.17 | 17.40 |
| Race & Ethnicity | | |
| White | 85.30 | 79.61 |
| Black /African American | 8.14 | 14.24 |
| Others | 6.56 | 6.15 |
| Region of Birth | | |
| United States | 88.43 | 80.98 |
| Central & South America | 4.57 | 11.80 |
| Elsewhere | 7.00 | 7.22 |
| Marital Status | | |
| Married | 57.72 | 54.75 |
| Single/Divorced/Widow | 16.70 | 17.38 |
| Never Married | 25.58 | 27.87 |
| Region of Residence | | |
| Northeast | 16.87 | 17.27 |
| Midwest | 26.08 | 22.94 |
| South | 31.19 | 39.92 |
| West | 25.86 | 19.87 |
| Highest Education Level | | |
| <HS Graduate | 8.08 | 20.17 |
| HS Graduate | 22.62 | 32.69 |
| Some College | 32.96 | 25.80 |
| ≥College Graduate | 36.34 | 21.33 |
| Health Insurance | | |
| Private | 65.26 | 54.17 |
| Public | 22.15 | 27.41 |
| Uninsured | 12.59 | 18.41 |
| Usual Place of Care | | |
| Yes | 86.96 | 83.71 |
| NHIS-Charlson Comorbidity Index (CCI) | | |
| Mean (95% CI) | 0.85 (0.82, 0.88) | 0.69 (0.67, 0.72) |
| Median[a] | N/D[a] | N/D[a] |
| 0 | 53.89 | 63.68 |
| 1 | 25.05 | 19.64 |
| 2 | 10.83 | 8.71 |
| 3 | 5.96 | 3.95 |
| 4 or More | 4.27 | 4.02 |
| Told Have Hypertension | | |
| Yes | 27.50 | 26.92 |
| Kessler-6 Mental Health Index | | |
| Mean (95% CI) | 2.74 (2.64, 2.84) | 1.77 (1.69, 1.85) |
| Median[a] | 0.87 | N/D[a] |
| 0 | 40.19 | 61.51 |
| 1-3 | 31.54 | 20.37 |
| 4-12 | 24.95 | 15.09 |
| 13 or More (Emotional Distress) | 3.32 | 3.03 |
| Body Weight Status (BMI) | | |
| Mean (95% CI) | 27.30 (27.12, 27.47) | 27.34 (27.22, 27.47) |
| Median[a] | 26.18 | 26.51 |

Table 1. (continued)

| (n, Estimated Percent of US Adult Population) | CAM Therapies (8487, 37.20%) | No CAM Therapies (14906, 62.80%) |
|---|---|---|
| Underweight ( <18.5) | 1.49 | 2.08 |
| Healthy Weight (18.5-24.9) | 38.11 | 35.81 |
| Overweight (25-29.9) | 34.36 | 35.84 |
| Obese (30-34.9) | 16.33 | 16.83 |
| Extreme Obese (≥ 35) | 9.70 | 9.44 |
| Activity Level | | |
| Low | 0.66 | 0.35 |
| Medium | 5.21 | 3.13 |
| High | 94.13 | 96.52 |
| Alcohol Status | | |
| Abstainer | 14.31 | 29.75 |
| Former & Current, Light | 62.83 | 52.92 |
| Current, Moderate | 16.74 | 12.78 |
| Current, Heavy | 6.12 | 4.55 |
| Smoking Status | | |
| Never | 54.69 | 61.13 |
| Former | 26.46 | 18.55 |
| Current, Sometimes | 5.11 | 3.95 |
| Current, Everyday | 13.75 | 16.37 |
| Visits To A Health Care Provider, Past 12 Months | | |
| Mean (95% CI) | 4.90 (4.75, 5.04) | 3.39 (3.30, 3.48) |
| Median[a] | 2.27 | 1.38 |
| 0 | 12.52 | 24.24 |
| 1 | 14.73 | 19.18 |
| 2-3 | 26.87 | 25.67 |
| 4-7 | 23.20 | 17.68 |
| 8 Or More | 22.69 | 13.22 |
| Times In Emergency Room, Past 12 Months | | |
| Mean (95% CI) | 0.42 (0.38, 0.45) | 0.38 (0.36, 0.41) |
| Median[a] | N/D[a] | N/D[a] |
| 0 | 78.15 | 80.98 |
| 1 | 14.07 | 11.96 |
| 2-3 | 5.77 | 5.08 |
| 4 Or More | 2.01 | 1.98 |
| Days Spent In Bed, Past 12 Months | | |
| Mean (95% CI) | 5.13 (4.52, 5.74) | 4.19 (3.65, 4.72) |
| Median[a] | N/D[a] | N/D[a] |
| 0 | 55.44 | 69.04 |
| 1-2 | 22.13 | 15.85 |
| 3-7 | 13.35 | 8.96 |
| 8 Or More | 9.08 | 6.14 |

[a]*Median values not-determined (N/D) due to limitation of software's approximation algorithm*

Table 2. Logistic Regression Models: Primary Predictor's Adjusted Odds-ratios and other Adjusted Covariates

| Models (Dependent Variable) | Independent Variables | Adjusted Odds Ratio | Lower 95% Limit OR | Upper 95% Limit OR |
|---|---|---|---|---|
| Excellent Health | CAM Used (p=0.01) | 1.14 | 1.03 | 1.26 |
| | No CAM Used | 1.00 | 1.00 | 1.00 |
| | **Adjusted for:** age[ξ], education[ξ], type of health insurance[ξ], ethnicity[ξ], CCI[ξ], BMI[ξ], Kessler-6[ξ], hypertension[ξ], alcohol use[ξ], cigarette use[ξ], region of birth, sex, marital status, activity level, and region of residence. | | | |
| Better Health Than In The Prior Year | CAM Used (p<0.001) | 1.64 | 1.49 | 1.80 |
| | No CAM Used | 1.00 | 1.00 | 1.00 |
| | **Adjusted for:** health status[ξ], age[ξ], ethnicity[ξ], region of residence[ξ], CCI[ξ], hypertension[ξ], Kessler-6[ξ], activity level[ξ], alcohol use[ξ], cigarette use[ξ], sex, BMI, region of birth, marital status, education, and type of health insurance. | | | |

[ξ]*significant covariates (p<0.05)*

more likely to report that their health status was excellent and better than the prior year. One interpretation of this finding is that the current 'excellent' health status reflects what the respondents felt at the moment of being interviewed for the survey while their answers to the questions on chronic conditions reported what the respondents had experienced in the prior 12 months. Since the timeframes for these questions differed, the responses could be consistent with one another. Alternatively, the respondents' perceptions of health may be affected by patients' expectations after their investment in CAM or a sense of empowerment or optimism related to the CAM use of interest[4,66].

Our analytic approach used in this study is novel. In reviewing the literature on the relationship between health status and CAM use, most previous studies have modeled CAM use as a dependent (or response) variable and have included health status or change in health status as independent variables. Since it is reasonable to assume the CAM use and clinical conditions reported by the respondents took place before the respondents reported 'current health status' and 'health improvement', we took the opposite approach where health status and change in health status were our dependent variables and CAM use was included among our independent covariates. In this way, we were specifically adjusting for the statistical effects of other factors on the likelihood of the health status and its improvement over time, as well as identifying potential confounders of the relationship between CAM use and health status and health improvement.

While our decision to categorize health status as excellent compared to other responses may have affected our results, our sensitivity analysis confirmed our finding that CAM use is associated with health status and change in health over the prior year.

Due to the observational nature of the database we analyzed, our finding does not determine causation and it is worth noting that, in general, CAM effectiveness research, at best, has been contradictory. Most studies for botanicals have been negative[67] and while there are positive reports of small benefits for acupuncture[68,69], most studies show no difference between acupuncture and sham acupuncture[21,70]. Studies of mind–body therapies seem to be more positive and suggest benefits for reducing blood pressure[71], preventing falls[72], low back pain[73], and irritable bowel syndrome[74]. Alternatively, hypotheses on the relationship of CAM to health benefits could be explained by anthropological research which shows that participation in healing rituals can confer subjective perceptions of benefit irrespective of any changes in pathophysiology or symptomatology[66].

Our study has several limitations. Many of them are inherent in survey research[75]. Questions are subject to varied interpretations by respondents of different cultures and social and educational backgrounds; thus subjective answers, such as health status being good, fair, or poor, may be reported inconsistently by subjects of different backgrounds and may be affected by expectation and other factors. Recall bias and a limited set of CAM therapies affect prevalence estimates. For example, modalities such as deep breathing exercises may not be generally viewed as CAM therapy; failing to include this therapy would likely lead to a biased estimate of CAM prevalence. The self-reported symptoms, conditions, and health status may not meet standard clinical definitions. The absence of data on quantity, duration, and timing of CAM use limits our ability to distinguish the characteristics of one-time users from more frequent ones and to ascertain any dose response

treatment effects on health status. Finally, since the survey was administered only in English and Spanish, it may have underrepresented certain immigrant populations.

Although CAM use is increasingly popular, response to CAM is complex and not readily understood; research on its effectiveness is still in developmental stages. Methodological constraints, such as small sample size, inadequate controls, and poor specificity of eligibility criteria and interventions, have plagued the field and hampered the interpretation and generalizations of results[76–78]. Our findings, however, suggest that, on a population basis, CAM use may have implications for better health status and health improvement over time. Clearly, large-scale randomized controlled studies are required to establish a causal relationship between CAM treatments and their effects on health status. Our results suggest that such studies are needed.

***Author Contributions:*** *Dr. Nguyen had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Nguyen and Phillips were responsible for study concept and design as well as acquisition of data. Nguyen, Phillips, Davis, and Kaptchuk were responsible for analysis and interpretation of data and critical revision of the manuscript for important intellectual content. Nguyen, Phillips, and Kaptchuk drafted the manuscript. Nguyen and Davis carried out the statistical analysis, while Phillips obtained funding and supervised the study*

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