

Complementary and Conventional Medicine Use Among Youth With Recurrent Headaches

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KEY WORDS

headache, adolescents, complementary and alternative medicine, medical expenditures, multiple chronic conditions

ABBREVIATIONS

AOR—adjusted odds ratio

CAM—complementary and alternative medicine

CI—confidence interval

EMB—emotional, mental or behavioral health problem

HA—recurrent headache

MEPS—Medical Expenditures Panel Survey

NHIS—National Health Interview Survey

Dr Bethell led the study design and implementation of all associated data analysis and the writing of each section of the manuscript; Dr Kemper suggested the paper's focus on recurrent headache and contributed to the introduction, discussion, and reference list, and consulted and provided edits related to methods and results; Dr Gombojav implemented the data analysis plan and assisted in the production of data findings, tables, and graphs, participated in the drafting of the methods and results sections of the article, and conducted final data checks for all analyses; and Dr Koch participated in the development of the paper rationale and focus and design of analytic methods, co-wrote the discussion, and provided edits to all other sections as well as ongoing guidance on ensuring clinical relevance of analyses and presentation of findings.

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WHAT'S KNOWN ON THIS SUBJECT: Use of complementary and alternative medicine (CAM) is increasingly common among American youth; however, information on use of CAM among youth with recurrent headache (HA) is limited.



WHAT THIS STUDY ADDS: Youth across a range of chronic conditions experience HA. These youth are more likely to use CAM. Use and expenditures for conventional medical care, and increased difficulties in activity and functioning are greater for youth with HA who use CAM.

abstract



OBJECTIVE: To identify prevalence and patterns of complementary and alternative medicine (CAM) use among youth with recurrent headaches (HA) and evaluate associations with co-occurring health problems and limitations as well as with the use and expenditures for conventional medical care.

METHODS: Variables were constructed for youth aged 10 to 17 by using linked data from the 2007 National Health Interview Survey and the 2008 Medical Expenditures Panel Survey. Bivariate, logistic, and 2-part regression analyses were used.

RESULTS: Of the 10.6% of youth experiencing HA, 29.6% used CAM, rising to 41% for the many HA sufferers who also experienced difficulties with emotions, concentration, behavior, school attendance, or daily activities. Biologically based products (16.2%) and mind-body therapies (13.3%) were most commonly used, especially by the 86.4% of youth with HA experiencing at least 1 other chronic condition. Compared with non-CAM users, youth with HA who used CAM also had higher expenditures for and use of most types of conventional care.

CONCLUSIONS: CAM use is most common among youth with HA experiencing multiple chronic conditions and difficulties in daily functioning. Associations among CAM use, multiple chronic conditions, and higher use of conventional care highlight the need for medical providers to routinely ask about CAM use to meet the complex health needs of their patients and facilitate the optimal integration of care. Research is needed to identify models for coordinating complementary and conventional care within a medical home and to understand the health benefits or risks associated with CAM use in conjunction with conventional treatments for patients with HA. *Pediatrics* 2013;132:e1173–e1183

Recurrent headaches (HAs) are common, especially among adolescents.^{1–10} Publicly available data from the National Survey of Children's Health reveal that 5.3% of children aged 6 to 17 in the United States experience frequent and severe HA, including migraine.¹¹ Nearly three-quarters (72.8%) of these are adolescents aged 12 to 17 years, with overall prevalence of 7.5% for this age group. In addition, the prevalence of HA is 2 times greater among the 18.4% of youth aged 12 to 17 who have special health care needs (16.0%).¹² Studies suggest that many youth with HA experience HA on a weekly basis^{13–19} and that they are 4 times more likely to miss an above routine number of school days and to have repeated emergency department visits.²⁰

Common conventional recommendations to prevent HA include improving lifestyle, particularly diet, sleep, and stress.^{21–30} Dietary changes include avoiding dietary HA triggers, such as processed meats, cheeses, caffeine, chocolate, aspartame, MSG, and foods containing tyramine, histamine, phenylalanine, nitrites, and sulfites.^{31,32} Improved sleeping behavior (avoiding sleep deficits or erratic sleep behavior) is another fundamental strategy to prevent HA, particularly migraines.^{28,33} Stress-management strategies, such as slow deep breathing, self-hypnosis, autogenic training, biofeedback, mindfulness meditation, and progressive muscle relaxation have also been recommended.^{30,34–37} Based on emerging evidence, some clinicians also recommend dietary supplements that decrease inflammation (omega-3 fatty acids) and dietary supplements, such as riboflavin, magnesium, and coenzyme Q10.^{38–44} However, some clinicians are not familiar with these therapies; therefore, they do not use them and do not inquire about them. So, little is known about the extent of their impact or use by their patients who experience HA.

Within pediatrics, adolescents are the most common users of complementary and alternative medicine (CAM) therapies and have the highest prevalence of HA.⁴⁵ Based on clinical and population-specific studies, adolescents most commonly use biologically based dietary approaches (both avoiding dietary triggers and taking dietary supplements) and mind-body practices, many of which can be implemented at costs lower than CAM modalities requiring professional assistance.^{46–49} The efficacy of acupuncture, thermal biofeedback, and hypnosis for children with HA has been documented.⁵⁰ However, little is known about the extent of the use of these types of CAM therapies among youth experiencing HA. We especially lack population-based prevalence estimates on the use of CAM among youth with HA and knowledge regarding associations with co-occurring chronic conditions that may also impact HA symptoms, functioning, and treatment response.^{51–55} This information would be useful to clinicians who counsel children and families and to researchers seeking to understand the effectiveness of the most widely used CAM therapies. The relationship between the use of CAM and conventional medical care among youth with HA also requires further research. This information would be useful to inform clinicians and researchers interested in providing personalized, coordinated care, such as is advanced in the numerous national efforts to promote the primary care medical home model in pediatrics.⁵⁶ We conducted this study to answer 2 primary questions that address these knowledge gaps:

1. What is the population prevalence and patterns of CAM use for youth who experience HA overall and across clinically relevant subgroups of youth with HA?
2. Do the demographic, health, and conventional care utilization characteristics of youth with HA who use CAM

differ from those who do not use CAM?

METHODS

Data Sources

This study analyzes data from 2 national surveys: the 2007 National Health Interview Survey (NHIS) and the 2008 Medical Expenditures Panel Survey (MEPS). These survey years are the most recent available that allow linking data from the NHIS Child CAM Supplement to the MEPS health care expenditures data sets, which is required to evaluate conventional medical care expenditures (MEPS data) among youth using CAM (NHIS data). Five 2007 NHIS data files (Family, Imputed Income, Person, Sample Child, and Child Complementary and Alternative Medicine Supplement) were linked, resulting in 9417 sampled children. To obtain health care expenditure data, the linked NHIS file was further linked to the panel of the 2008 MEPS Full-Year Consolidated Household File that includes the NHIS sampling frame (Panel 13). The NHIS/MEPS linked file contains 2411 sample children.

Subjects

For purposes of this study, youth were defined as those aged 10 to 17 years. The NHIS data file includes 4263 youth and NHIS/MEPS linked file contains 1070 youth, resulting in a representative sample of an estimated 33.2 million youth aged 10 to 17 in the United States.

Key Variables

An overall CAM use variable indicates past year use of 1 or more of the 39 types of CAM modalities assessed in the 2007 NHIS, with the exception that multivitamin use was not included, and only specific vitamins and minerals used in the past 30 days were included.⁵⁷ CAM modalities were grouped in 2 ways. The first uses categories set forth by the National Center for Complementary and Alternative Medicine: biologically

based; mind-body, manipulative/body-based, alternative medical systems; and energy healing therapy.⁵⁸ Although normally a stand-alone category, due to small sample sizes, energy healing therapy was combined with alternative medical systems. The second grouping categorizes modalities according to whether they represent products (eg, herbs), practices (eg, yoga), or services (eg, acupuncture) (Table 2).

A recurrent headache (HA) chronic condition variable was based on responses to 2 questions in the NHIS Sample Child Core file indicating whether in the past 12 months youth had (1) frequent or severe HA, including migraine, or (2) recurring headaches, other than migraine. In addition, 10 categories of health conditions (other than HA) were constructed based on NHIS questions assessing if the youth was ever diagnosed with and/or experienced in the past 12 months any of the 56 other (non-HA) health conditions asked about (Fig 2); 43 of which were categorized as chronic (Table 1) and 13 as common acute or other/chronicity unclear. Because most youth with any condition experience more than 1 condition, it is not possible to construct mutually exclusive categories of health conditions. Note that small samples prevent construction of separate categories for each condition included in the admittedly diverse "Other Conditions" group.

Finally, functional status variables assessing whether youth experienced definite or severe difficulties in emotions, concentration, or behavior; had missed 2 or more weeks of school in the past year; or were limited in daily activities were also constructed to differentiate whether, beyond presence of HA and other conditions, CAM use is further associated with functioning in daily life.

Analytic Methods

All data were weighted to represent the US population of children 10 to 17

years old. Weights for the NHIS/MEPS-linked file were constructed adjusting the MEPS Panel 13 weights to reflect the NHIS probabilities of selection for subsampling of children and then, as recommended, weights were further adjusted through raking by age, gender, race/ethnicity, and US geographic region.^{59,60} Differences in the prevalence of CAM use and associations with youth demographic, health, and health care use characteristics were assessed using standardized *t* tests and χ^2 tests. Simple rate-ratio calculations were used to compare CAM use across condition groups according to whether youth in each group also experienced HA. Logistic regression analyses were further used to assess the significance of differences in CAM use observed among youth with multiple chronic conditions in which 1 of the conditions is or is not HA and youth with HA who do or do not also experience difficulties with daily functioning. A standard 2-part model was used to estimate health care expenditures controlling for child's age, gender, race, US geographic region, and family income.⁶¹ SPSS 19.0 (IBM SPSS Statistics, IBM Corporation, Chicago, IL) with complex samples was used for all analyses.

RESULTS

Characteristics of Youth With HA Who Used CAM

As shown in Table 1, 10.6% of all US youth aged 10 to 17 were estimated to experience HA based on the NHIS. Of these, 29.6% had used 1 or more types of CAM in the past 12 months, representing 1.03 million youth. Compared with youth with HA who do not use CAM, CAM users were significantly ($P < .05$) more likely to be older (41.3% vs 32.1% aged 16 to 17) and white (73.4% vs 54.4%), and to live in homes with higher incomes (26.7% vs 19.7% 400% Federal Poverty Level [FPL] or above), to have

private health insurance (69.5% vs 55.0%), and higher maternal education (71.9% vs 55.8% more than high school). Youth with HA who used CAM were also significantly more likely than their non-CAM-using counterparts to experience at least 1 of the other 43 conditions assessed in the NHIS and categorized as chronic (94% vs 83.3%), including 51% who experienced co-occurring emotional, mental, or behavioral health problem (EMB) conditions and 51% experiencing co-occurring pain-related conditions other than HA. Youth with HA who used CAM were also significantly more likely than those who did not use CAM to have experienced difficulties with emotions, concentration, or behavior (19.5% vs 12.6%); school attendance (22.1% vs 7.7% missing 2+ weeks); and functioning in daily activities (25.4% vs 14.5%). No differences were observed in CAM use among youth with HA across regions of the United States ($P = .16$; data not shown).

Patterns of CAM Use

Of the 4 CAM categories assessed, those most often used by youth with HA were biologically based (16.2%) and mind-body therapies (13.3%), with higher rates of use across all CAM types for youth with HA who also experience other chronic conditions. Patterns of use across CAM categories vary depending on the nature of the other conditions experienced, with mind-body therapies being more likely for youth with HA and EMB conditions; whereas, manipulative-body-based therapies were more common for those also experiencing other pain-related conditions (Table 2). CAM products (17.0%) and practices (15.3%), which do not necessarily require provision by a trained professional, were more commonly used than CAM services requiring trained professionals (10.1%). Among youth with HA, the most commonly used CAM modalities were specific

TABLE 1 Characteristics of Youth Aged 10 to 17 With HA: By Use of CAM Therapies, 2007 NHIS Data

| Characteristics Evaluated | All Youth Aged 10 to 17 y (<i>n</i> = 4263, Estimated 33.2 million in United States), % | Youth With HA (10.6%; <i>n</i> = 434; Estimated 3.52 million), % | Youth With HA who DID NOT Use CAM (70.4%; <i>n</i> = 296; Estimated 2.46 million), % | Youth with HA Who Used CAM (29.6%, <i>n</i> = 133; Estimated 1.03 million), % |
|---|---|--|--|---|
| Age^a | | | | |
| 10–12 y (<i>n</i> = 1437) | 36.7 | 31.4 | 35.4 | 22.0 |
| 13–15 y (<i>n</i> = 1591) | 36.7 | 33.9 | 32.6 | 36.7 |
| 16–17 y (<i>n</i> = 1235) | 26.5 | 34.7 | 32.1 | 41.3 |
| Gender | | | | |
| Male (<i>n</i> = 2248) | 51.3 | 46.5 | 48.9 | 40.7 |
| Female (<i>n</i> = 2015) | 48.7 | 53.5 | 51.1 | 59.3 |
| Race/ethnicity^a | | | | |
| Hispanic (<i>n</i> = 1160) | 19.0 | 21.0 | 23.6 | 14.4 |
| White, non-Hispanic (<i>n</i> = 2028) | 59.1 | 59.5 | 54.4 | 73.4 |
| African American, non-Hispanic (<i>n</i> = 743) | 15.1 | 13.6 | 16.0 | 6.8 |
| Asian, non-Hispanic (<i>n</i> = 208) | 3.6 | 1.3 ^b | 1.2 ^b | 1.7 ^b |
| Multi/Other, non-Hispanic (<i>n</i> = 124) | 3.3 | 4.5 | 4.9 | 3.7 |
| Family income^a | | | | |
| 0% to 99% FPL (<i>n</i> = 676) | 15.3 | 21.4 | 25.1 | 11.9 |
| 100% to 199% FPL (<i>n</i> = 990) | 23.7 | 26.0 | 27.3 | 23.6 |
| 200% to 399% FPL (<i>n</i> = 1325) | 31.7 | 30.8 | 27.9 | 37.9 |
| 400% FPL or above (<i>n</i> = 1272) | 29.4 | 21.9 | 19.7 | 26.7 |
| Maternal education^a | | | | |
| Less than high school (<i>n</i> = 692) | 14.8 | 15.5 | 17.9 | 10.1 |
| High school or GED (<i>n</i> = 1031) | 26.9 | 23.9 | 26.3 | 18.0 |
| More than high school (<i>n</i> = 2103) | 58.3 | 60.6 | 55.8 | 71.9 |
| Insurance type^a | | | | |
| Public insurance only (<i>n</i> = 1065) | 24.2 | 28.2 | 29.4 | 24.8 |
| Any private insurance (<i>n</i> = 2664) | 65.0 | 59.1 | 55.0 | 69.5 |
| Uninsured (<i>n</i> = 513) | 10.9 | 12.7 | 15.6 | 5.7 ^b |
| Co-occurring chronic conditions | | | | |
| Has at least 1+ chronic conditions or problems assessed in NHIS ^c (other than HA) (<i>n</i> = 2383) | 56.6 | 86.4 | 83.3 | 94.0 [§] |
| Has 1+ emotional, mental or behavioral health condition or problem ^d (<i>n</i> = 858) | 20.7 | 44.8 | 42.5 | 51.0 |
| Has 1+ non-HA pain related conditions ^e (<i>n</i> = 517) | 12.1 | 38.1 | 32.7 | 50.9 [§] |
| Other limitations and difficulties | | | | |
| Missed 2+ weeks of school/year (<i>n</i> = 202) | 4.7 | 12.0 | 7.7 | 22.1 [§] |
| Limited in daily activities due to health ^f (<i>n</i> = 380) | 9.4 | 17.8 | 14.5 | 25.4 [§] |
| Definite/severe difficulties in emotions, concentration or behavior (<i>n</i> = 224) | 6.2 | 14.6 | 12.6 | 19.5 [§] |

^a χ^2 test: differences between youth with HA who used CAM and who did not use CAM are statistically significant at a .05 level of significance.

^b Cells do not meet standards of precision (relative SE >30%).

^c Chronic conditions: arthritis, other chronic pain, anxiety/stress, depression, attention-deficit disorder/attention-deficit/hyperactivity disorder, phobia/fears, insomnia/trouble sleeping, bedwetting/incontinence, food/digestive allergies, frequent diarrhea/colitis, acid reflux/heartburn, recurring constipation, asthma, hay fever, respiratory allergies, other lung/breathing problem, other allergies, 3 or more ear infections, autism, cerebral palsy (only last 2 quarters of data due to data validity issue noted by the National Center for Health Statistics),⁶² Down syndrome, muscular dystrophy, mental retardation, speech problems, developmental delay, learning disability, seizure, other neurologic problems, hearing problems, vision problems, eczema/skin allergy, severe acne, cancer, congenital heart disease, cystic fibrosis, diabetes, other heart problems, problems with being overweight, menstrual problems, fatigue/lack of energy, gum disease, anemia, and sickle cell anemia.

^d EMB conditions/problems: anxiety/stress, depression, attention-deficit disorder/attention-deficit/hyperactivity disorder, phobia/fears, insomnia/trouble sleeping, and incontinence/bedwetting.

^e Non-HA pain-related conditions/problems: arthritis, abdominal pain, back/neck pain, and other chronic pain.

^f Limited in personal care, difficulty walking without using any special equipment, difficulty remembering or experience periods of confusion, receive Special Education or Early Intervention Services or limited in any way not previously mentioned.

[§] *t* test: differences between youth with HA who used CAM and who did not use CAM are statistically significant at a .05 level of significance.

vitamins/minerals used in the past 30 days (17.6%); herbal supplements (9.8%); deep-breathing exercises (8.7%); chiropractic or osteopathic manipulation (5.4%); yoga, tai chi, or qi gong (5.0%); meditation (3.1%); and massage (2.8%). Nearly half of youth with HA who used CAM used more than 1 CAM modality (47.2%), compared with only one-third of youth who used CAM but did not experience HA ($P = .02$). Common combinations included naturopathy and herbal supplements (all youth using naturopathy used herbal supplements), progressive relaxation and deep breathing exercises (all youth using progressive relaxation used deep breathing exercises [DBE]), support group meeting and deep breathing exercises (87.3% of youth using support group meeting used DBE), and meditation and deep breathing exercises (82.3% of youth using meditation used DBE).

CAM Use for Youth With HA, Multiple Conditions, and Difficulties With Daily Functioning

As shown in Table 2, the rate of CAM use among youth with HA is 1.7 times higher than the rate of CAM use among adolescents without HA (29.6% vs 17.4%, $P < .0001$). Logistic regression models revealed that, overall, youth with HA had 2.13 greater odds of using CAM (95% confidence interval [CI] 1.61–2.91) compared with youth without HA, after controlling for differences in age, gender, race/ethnicity, household income and US region of residence. As shown in Fig 1, regardless of HA status, youth experiencing multiple chronic conditions (2+ of those assessed in the NHIS) were also more likely to use CAM. However, when 1 of these conditions was HA, CAM use prevalence was even greater (32.2% vs 26.3%). Across the full range of condition categories evaluated, youth were 1.15 to 2.84 times more likely

to use CAM if they also experienced HA than if they did not experience HA. As shown in Fig 2, despite small sample sizes in several condition categories, higher rates of CAM use for youth with HA were statistically significant for 6 of the 10 condition categories evaluated: gastroenterological, respiratory, common acute, neurologic, dermatological, and the diverse “other” category of conditions. Finally, as shown in Fig 3, 41% of youth with HA who also had difficulties with emotions, concentration or behavior, school attendance, or daily activities (32.1% of youth with HA) used CAM, compared with 24.2% of those with HA who did not experience these difficulties (adjusted odds ratio [AOR] 2.34; 95% CI 1.38–3.97).

Conventional Medical Care Use and CAM Use

As shown in Table 3, youth experiencing HA who used CAM had significantly

TABLE 2 Prevalence of CAM Use Among Youth, by HA and Multiple Chronic Condition Status

| CAM Modalities Assessed | All Youth 10–17 y, 100% | Youth Without HA, 89.4% | Youth With HA, 10.6% | Youth With HA + Other Chronic Conditions, 9.2% | Youth With HA + EMB Conditions, ^a 4.8% | Youth With HA + Other Pain-Related Conditions, ^b 4.0% |
|---|----------------------------|----------------------------|-------------------------------|---|--|--|
| Any CAM modalities ^c ($n = 760$), % | 18.7 | 17.4 | 29.6 (AOR: 2.13) ^d | 32.2 (AOR: 3.65) ^e | 33.6 (AOR: 3.24) ^e | 39.5 (AOR: 3.47) ^e |
| 2 or more CAM modalities, among CAM users ($n = 266$), % | 36.1 | 33.8 | 47.2 ^d | 47.8 ^d | 55.2 ^d | 45.5 ^d |
| Biologically based therapies ^c ($n = 402$), % | 10.3 | 9.5 | 16.2 ^d | 17.6 ^d | 17.0 ^d | 18.2 ^d |
| Mind-body therapies ($n = 261$), % | 6.7 | 5.9 | 13.3 ^d | 14.9 ^d | 20.6 ^d | 17.0 ^d |
| Manipulative and body-based therapies ($n = 211$), % | 5.1 | 4.9 | 7.4 | 7.6 | 7.6 | 14.8 ^d |
| Alternative medical system/Energy healing ($n = 94$), % | 2.5 | 2.2 | 4.7 | 5.5 ^d | 6.9 ^d | 8.0 ^d |
| CAM services ($n = 266$), % | 6.5 | 6.1 | 10.1 ^d | 10.7 ^d | 11.7 ^d | 18.4 ^d |
| CAM products ^c ($n = 418$), % | 10.5 | 9.8 | 17.0 ^d | 18.5 ^d | 18.4 ^d | 19.6 ^d |
| CAM practices ($n = 317$), % | 8.1 | 7.2 | 15.3 ^d | 16.5 ^d | 22.6 ^d | 20.3 ^d |

Data Source: 2007 NHIS Data.

^a EMB conditions/problems: anxiety/stress, depression, attention-deficit disorder/attention-deficit/hyperactivity disorder, phobia/fears, insomnia/trouble sleeping, and incontinence/bed-wetting.

^b Other pain-related conditions/problems: arthritis, abdominal pain, back/neck pain, and other chronic pain. Biologically based therapies: chelation, herbal supplements, specific vitamins/minerals used in past 30 d, and special diets (Vegetarian, Macrobiotic, Atkins, Pritikin, Ornish, Zone, South Beach). Mind-body therapies: biofeedback, meditation, guided imagery, progressive relaxation, deep breathing exercises, hypnosis, yoga, tai chi, qi gong, support group meeting, and stress management class. Manipulative and body-based therapies: chiropractic or osteopathic manipulation, massage, and movement therapies (Feldenkreis, Alexander technique, Pilates, Traeger psychophysical integration). Alternative Medical System/Energy healing therapies: acupuncture, ayurveda, homeopathic treatment, naturopathy, traditional healers (Curandero, Espiritista, Hierbero or Yerbera, Shaman, Botanica, Native American Healer or Medicine Man, Sobador), and energy healing therapy. CAM services: acupuncture, ayurveda, biofeedback, chelation, chiropractic or osteopathic manipulation, energy healing therapy, hypnosis, massage, naturopathy, traditional healers (Curandero, Espiritista, Hierbero or Yerbera, Shaman, Botanica, Native American Healer/Medicine Man, Sobador), and movement therapies (Feldenkreis, Alexander technique, Pilates, Traeger psychophysical integration). CAM products: specific vitamins/minerals used in past 30 d, herbal supplements, homeopathic treatment, and special diets (Vegetarian, Macrobiotic, Atkins, Pritikin, Ornish, Zone, South Beach). CAM practices: movement therapies (Feldenkreis, Alexander technique, Pilates, Traeger psychophysical integration), yoga, tai chi, qi gong, meditation, guided imagery, progressive relaxation, deep breathing exercises, special diets, support group meetings, and stress management class.

^c Does not include multivitamins/minerals; only includes specific vitamins/minerals used in past 30 days.

^d AOR or t test is statistically significant. Comparison/reference group is youth without HA.

^e AOR is statistically significant. Comparison/reference group is youth without HA or any other chronic condition; EMB; pain condition.

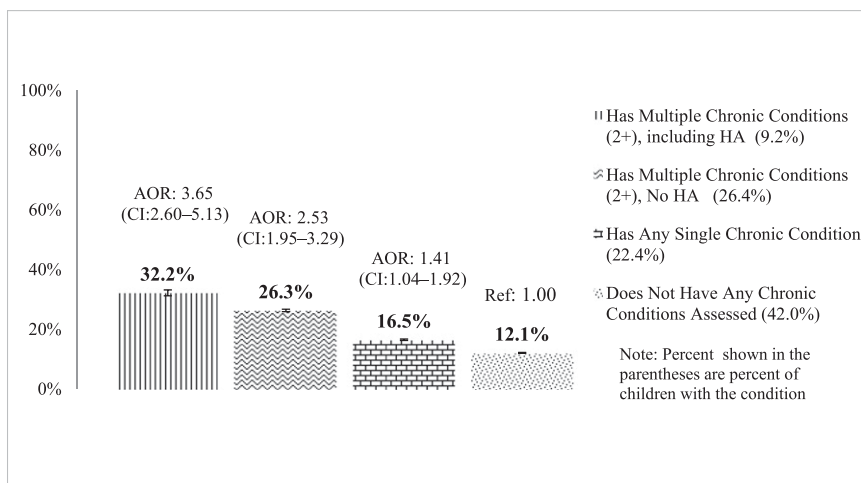


FIGURE 1 Prevalence of CAM use among youth, by multiple chronic condition and HA status. Data Source: 2007 NHIS. AORs are adjusted for age, gender, race/ethnicity, household income, and US region in which the child lives. Note: HA as measured in this study is considered a chronic condition.

higher use of conventional medical care compared with youth experiencing HA who did not use CAM, including 6 or more physician or other health care professional office visits (38.6% vs 25.1%, $P = .03$), care from a specialist (40.2% vs 22.1%, $P = .003$), mental health visits (26.8% vs 13.8%, $P = .02$), or special therapies, such as physical, speech, respiratory, or occupational therapist or audiologist (17.0% vs 4.9%, $P = .03$) (Table 3). Both the amount and type of conventional medical care use is predictive of CAM use among youth with HA. Although a full exploration is beyond the scope of this paper, to illustrate, whereas 8.7% of youth with HA used deep-breathing exercises, 24.9% did so if they also saw a mental health provider.

Table 3 also shows that total health care expenditures are estimated to be significantly higher for youth with HA who used CAM compared with both those without HA (\$2929 vs \$1503 average adjusted expenditures, $P < .05$) and youth with HA who did not use CAM (\$2929 vs \$2031, $P < .05$). Total health care expenditures increase further for youth with HA who used CAM when they also experienced multiple health conditions. Total out-of-pocket expenditures

for conventional medical care were also significantly higher among youth with HA who used CAM, with significantly higher rate of expenditures for prescription medications if they also experience EMB conditions (79.5%) ($P = .03$).

DISCUSSION

Previous studies have reported on factors associated with CAM use in pediatrics⁶⁵ and CAM use among youth with HA in specific clinical settings or populations.^{30,34–37} In contrast, this study examined the use of CAM among representative samples of all youth in the United States who experience HA. We describe the demographic and health-related characteristics of youth with HA who use CAM and document key patterns of both CAM and conventional medical care use among these youth. These population-based findings integrating information about CAM use with conventional medical care are consistent with clinically focused studies on CAM use among youth with HA. For example, CAM use is higher among chronically ill populations than among those without such conditions.⁴⁵

Findings also point to policy issues related to health insurance coverage

for CAM modalities and potential disparities in access to those approaches that are potentially beneficial. For instance, greater use among youth living in higher income households with private sector health insurance may be presumed to be due to the financial access these youth enjoy. To the extent that CAM has been demonstrated to be helpful for HA (eg, relaxation and mindfulness practices that relieve pain and stress, thermal biofeedback, acupuncture, hypnosis),⁵⁰ this disparity in access may further disadvantage minority and impoverished youth. Low rates of those modalities with the greatest evidence of benefit among all youth with HA may suggest a potential underuse of CAM modalities overall (eg, some mind-body therapies).

Greater use of CAM among older youth is consistent with earlier studies that suggest that biological therapies, such as herbs and supplements, are the most commonly used CAM therapies by young adults.⁴⁸ Higher use of these products among older teens may reflect their greater mobility and independence, which allows them to seek these remedies in supermarkets, pharmacies, health food stores, and online more easily than younger children. It also means that parents as well as clinicians may not be aware an older adolescent is using these products unless he or she is specifically asked. Higher use of CAM among older teens may also reflect their increasing maturity and comfort with CAM modalities that involve self-regulation, self-reflection, and taking responsibility for one's own health.

Our findings have cross-cutting implications for clinicians and researchers working with the nation's estimated 3.5 million youth aged 10 to 17 who experience HA and who have a 2.1 times greater likelihood of using CAM compared with youth who do not experience HA. Findings may compel many conventional care providers treating HA

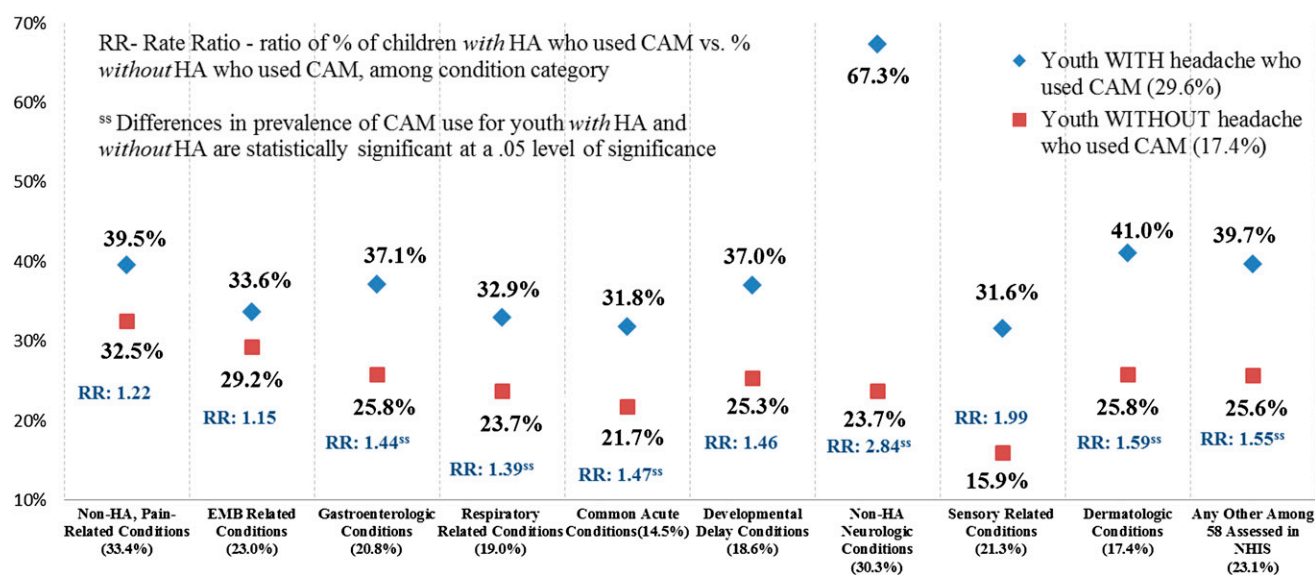


FIGURE 2

Prevalence of CAM use among youth aged 10 to 17 across 10 health condition categories, by co-occurring HA status. Data Source: 2007 NHIS. Note: Percents shown in the parentheses are percentages of children with condition type who experience headache. Non-HA, Pain-Related: arthritis, abdominal pain, back/neck pain, other chronic pain. EMB: anxiety/stress, depression, attention-deficit disorder/attention-deficit/hyperactivity disorder, phobia/fears, insomnia/trouble sleeping, bed-wetting/incontinence. Gastroenterologic Related: food/digestive allergies, frequent diarrhea/colitis, acid reflux/heartburn, nausea/vomiting, recurring constipation. Respiratory/pulmonary: asthma, hay fever, respiratory allergies; other lung/breathing problem, sinusitis, other allergies. Common acute: 3 or more ear infections, fever, head/chest cold, influenza/pneumonia, strep sore throat, other sore throat, urinary tract infection, nausea/vomiting. Developmental: autism, cerebral palsy (only last 2 quarters of data due to data validity issue noted by the NCHS),⁶² Down syndrome, muscular dystrophy, mental retardation, speech problems, developmental delay, learning disability. Non-HA Neurologic: seizure, other neurologic problems. Sensory Related: hearing problems, vision problems. Dermatologic: eczema/skin allergy, severe acne, warts, skin problems other than eczema. Any Other: cancer, congenital heart disease, chickenpox, cystic fibrosis, diabetes, other heart problems, problems with being overweight, menstrual problems, fatigue/lack of energy, gum disease, anemia, and sickle cell anemia.

to learn and inquire about CAM therapies and to proactively recommend and coordinate care with youths' use of CAM products or practices as well as with

CAM service providers directly. Although notable gaps exist, important evidence supports the use of many types of CAM for treating HA, including some of the

modalities used by youth with HA, such as special diets, dietary supplements, herbs, and deep-breathing practices.^{39,50}

These findings have especially important implications for conventional care providers who care for the nation's 11.2 million children with chronic conditions and special health care needs that national surveillance data have routinely shown most often experience multiple co-occurring conditions. In this study, we find that nearly all children experiencing HA have other chronic conditions, especially if they also use CAM (94%) and that youth across the range of other chronic conditions who also experience HA are significantly more likely to use CAM compared with children with these same types of conditions who do not experience HA. Because CAM users are substantially more likely to experience functional difficulties affecting daily life (eg, problems with emotions, concentration, or

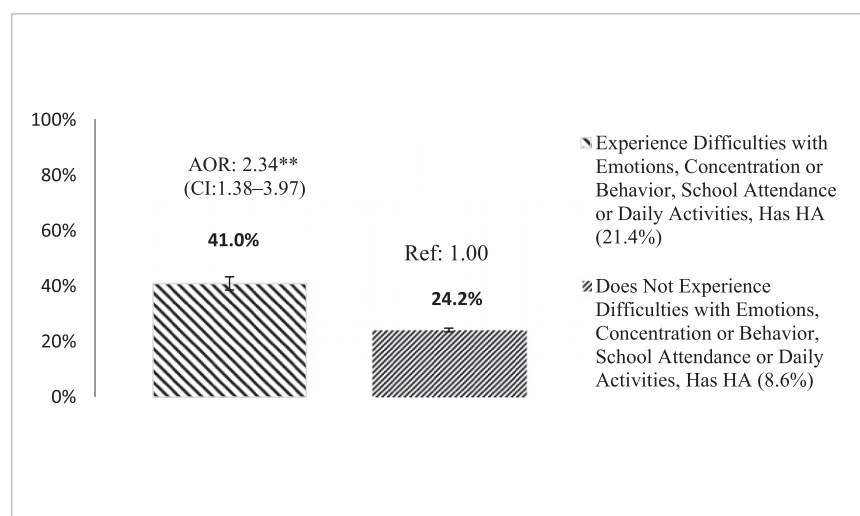


FIGURE 3

Prevalence of CAM use among youth with HA, by presence of difficulties with emotions, concentration or behavior, school attendance, or daily activities.*Data Source: 2007 NHIS. CI, 95% CI. *Includes definite or severe difficulties in emotions, concentration, or behavior; missing more than 2 weeks of school during the year and limitations in performing daily activities, such as personal care, movement, cognitive ability, and memory. **Adjusted for age, gender, race/ethnicity, family income, and US region child lives.

TABLE 3 Rates of Conventional Medical Care Use (Annual) and Average Adjusted Overall Medical Expenditures for Youth With HA, By CAM Use and Multiple Chronic Condition Status

| Categories of Conventional Medical Care Use and Expenditures | All Youth 10–17 y, 100% | Youth Without HA, 89.4% Youth | Youth With HA, 10.6% Youth | Youth With HA Who Did NOT Use CAM, 70.4% Youth With HA | Youth With HA + Other Chronic Conditions Who Used CAM, 29.6% Youth With HA | Youth With HA + EMB Conditions Who Used CAM, 4.8% Youth | Youth with HA + other pain-related conditions who used CAM (4.0% Youth) |
|---|-------------------------|-------------------------------|---------------------------------|--|--|---|---|
| Conventional medical care (NHIS), % | 58.0 | 55.7 | 77.3 ^a | 75.5 | 83.9 | 90.8 ^b | 88.5 ^b |
| 2 or more office visits (n = 2382) | 11.9 | 9.8 | 29.0 ^a | 25.1 | 40.9 ^b | 58.4 ^b | 50.4 ^b |
| 6 or more visits (n = 462) | 18.6 | 16.7 | 34.5 ^a | 33.2 | 40.1 | 49.1 ^b | 42.9 |
| 1 or more emergency department visit (n = 737) | 15.4 | 13.5 | 30.9 ^a | 28.1 | 39.9 ^c | 58.1 ^b | 45.5 ^b |
| Prescription medications for 3+ months (n = 601) | 14.8 | 13.3 | 27.4 ^a | 22.1 | 41.2 ^b | 38.8 ^b | 52.0 ^b |
| Specialist visit (n = 585) | 8.7 | 7.6 | 17.6 ^a | 13.8 | 28.3 ^b | 47.3 ^b | 28.8 ^b |
| Mental health visit (n = 354) | 4.6 | 4.2 | 8.5 ^a | 4.9 | 18.1 ^b | 23.9 ^{b,c} | 20.7 ^b |
| Ancillary services (PT, OT, Speech, RT, etc) (n = 182) | 2.1 | 1.7 | 5.1 ^a | 3.9 | 8.6 | 12.1 ^{c,d} | 8.4 ^c |
| Hospitalization (n = 89) | | | | | | | |
| Medical care expenditures (NHIS/MEPS) | \$ amount (95% CI) | \$ amount (95% CI) | \$ amount (95% CI) | \$ amount (95% CI) | \$ amount (95% CI) | \$ amount (95% CI) | \$ amount (95% CI) |
| Adjusted total health care expenditures ^e (n = 1070) | \$1601 (1550–1651) | \$1503 (1449–1557) | \$2219 ^a (2061–2377) | \$2031 (1866–2196) | \$2929 ^b (2541–3318) | \$3167 ^b (2810–3525) | \$3557 ^b (2683–4031) |
| Percent of children with out-of-pocket expenditures for prescription medications (n = 370), % | 41.4 | 38.8 | 59.5 ^a | 55.3 | 73.0 | 79.5 ^b | 72.2 |
| Adjusted out-of-pocket expenditures ^e (n = 1070) | \$388 (356–410) | \$418 (393–444) | \$411 (352–470) | \$350 (291–409) | \$595 ^b (461–730) | \$453 ^d (362–543) | \$607 ^b (406–807) |

Data Sources: 2007 NHIS and 2007 NHIS/2008 MEPS linked file. PT, physical therapist; OT, occupational therapist; RT, respiratory therapist.

^a Statistically significant at $P < .05$ level comparing youth with HA versus without HA.

^b Statistically significant at $P < .05$ level comparing youth with HA or with other co-occurring conditions who used CAM versus youth with HA who did not use CAM.

^c Cells do not meet standards of precision (relative SE is $> 30\%$).

^d Statistically significant at $P = .1$ level of significance.

^e Estimated by 2-part model adjusting for child's age, gender, race/ethnicity, family income, and US geographic region.

behavior or missed school), clinical assessments of functioning in addition to diagnostic status may be good indicators to alert clinicians to inquire further about the use and potential benefit of CAM.⁶⁴

The prevalence of EMB conditions and other pain conditions among CAM-using youth with HA (about 51% each) was substantially higher than the prevalence of these problems among youth without HA (18% and 9% respectively). When clinicians see youth with HA, it is worthwhile probing about other health conditions, including emotional and mental health conditions, as well as CAM use. CAM use among youth with HA may serve as a red flag to alert clinicians to poor functional status and perhaps the need for additional health services, such as mental/behavioral health and social work to address all the factors contributing to functional limitations.

Higher use of conventional care suggests that youth are not using CAM instead of conventional care, but in addition to it. For example, CAM users were almost twice as likely to receive care from specialist physicians and mental health professionals as non-CAM users. Furthermore, among those with HA and EMB who used CAM, nearly 60% also used prescription medications for 3 or more months. This finding raises

concerns about the potential for CAM-conventional care interactions. Also, clinicians who are unaware of CAM use may misattribute observed improvements or toxicity to a conventional therapy rather than CAM, undermining the basis for suggesting modifications in therapy.

Overall findings on higher conventional medical care use and expenditures among CAM users suggest that CAM use may point to key health needs requiring further attention and proactive care coordination.⁶⁵

This study was based on national cross-sectional survey data and did not address questions that can only be answered in prospective controlled trials (eg, whether CAM use is beneficial or harmful) or longitudinal studies (eg, impact of CAM on health across time). Furthermore, a survey in which parents answer retrospectively on behalf of youth may not detect the entire range and extent of CAM use that might be detected by directly asking youth to complete daily diaries prospectively. It did not include all types of care that some might consider complementary care, such as prayer and home remedies, and did not ask about the intensity and frequency of CAM use or severity of HA. In addition to demographic factors and co-occurring conditions, CAM use might be influenced by disease severity

or local variations in availability of CAM therapies. Although state licensure for CAM practitioners varies state by state, the sample was insufficient to conduct analyses on a state-by-state level. The linked MEPS-NHIS file does allow for basic evaluation of whether children experience care reflective of having a medical home. However, sample sizes in the linked file for children with HA were insufficient to include the analyses in this study.

CONCLUSIONS

The study found that CAM use is common among youth with HA with multiple chronic conditions and functional difficulties, along with higher rates of conventional medical care among youth with HA who use CAM. The study findings support for proactive efforts among pediatricians and pediatric specialists to ask patient's about co-occurring health conditions, functioning, and CAM use and to integrate CAM into conventional care. The study suggests that there is a need to support clinicians with easy access to available information about effectiveness, availability, and indicators of quality CAM modalities/practitioners. Additional research is needed to determine how comprehensive history taking and integration of care within the context of a medical home affects CAM use and health outcomes.

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