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Factors Associated with Complementary Medicine Use in Pediatric Musculoskeletal Conditions: results from a national survey

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Abstract

Objectives—Complementary and alternative medicine (CAM) use is common in children, but its use has only been investigated in children with musculoskeletal conditions (MSK) to a limited extent. We aimed to characterize factors associated with CAM use in children with MSK conditions.

Methods—Within the 2012 National Health Interview Survey dataset (including its child CAM supplement), we examined factors associated with CAM use in children with MSK conditions and performed an analysis examining the perceived usefulness of CAM therapies for MSK conditions.

Results—Overall, there were 10,218 children in the dataset. 28.0% of children with MSK conditions used CAM, compared to 8.8% of children without MSK conditions. Gender ($p = 0.003$), region ($p = 0.001$), race ($p = 0.001$), parental CAM use ($p < 0.001$), education (< 0.001), and having anxiety, stress or depression ($p = 0.030$) were correlated with CAM use. Among 90 children who reported on CAM use, 89.7% said that CAM helped some or a great deal for their MSK condition.

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Conclusions—Several factors, particularly parental education and parental CAM use, were associated with CAM use, and self-reported improvement rates were high. Interventional trials are needed to determine the efficacy of specific CAM therapies for treating different MSK conditions in children.

Keywords

complementary and alternative medicine; integrative medicine; pediatrics; rheumatology; musculoskeletal diseases

Introduction

Musculoskeletal (MSK) conditions in children are common, and comprise a large group of conditions including injuries, trauma, congenital skeletal anomalies, infections, inflammatory conditions, cancers and conditions of amplified pain. While it is difficult to provide estimates of overall prevalence, selected conditions have been studied. A large review by King et al. examined a number of different causes of musculoskeletal pain¹. Median prevalence of back pain in children and adolescents was estimated at 21%, based upon pooled results from two large studies^{2,3}. Estimates of limb pain ranged between 9 and 40%, but many were found to be sports-related¹. A large review of worldwide epidemiologic studies of juvenile idiopathic arthritis reported a prevalence ranging from 0.07 to 4.01 per 1,000 children, and incidence rates ranging from 0.08 to 2.26 per 10,000 children-years⁴. Though juvenile arthritis is far less common than MSK injuries, it accounts for approximately 827,000 ambulatory health care visits yearly⁵.

Current treatments for chronic pain in children suffer from modest effect sizes and a significant lack of evidence⁶. For MSK conditions caused by injury, the mantra ‘rest, ice, compression and elevation’ is often recommended, although existing evidence is equivocal⁷. Non-steroidal anti-inflammatory drugs (NSAIDs) and physical therapy also play an important role in recovery⁸. For chronic inflammatory conditions, steroids and disease-modifying antirheumatic drugs (DMARDs) have become the standard of care, but many children are left with pain despite outward evidence that inflammation has been suppressed⁹. Persistence of pain in children with these and other MSK conditions may have a significant impact on the functioning of family and child¹⁰. Many families turn to complementary and alternative medicine (CAM) therapies to treat pain in children.

CAM describes a set of practices and treatments which people choose in addition or as alternatives to Western medical practices¹¹. Current figures from the National Center for Complementary and Integrative Health, whose data is derived from the National Health Interview Survey (NHIS), estimate that about 30% of adults and 12% of children utilize CAM therapies¹². A recent briefing from the Department of Health and Human Services reported 41.6% CAM use in adults with musculoskeletal conditions¹³. Despite the high prevalence of CAM use in children overall, few studies have examined the prevalence of CAM use in children with MSK conditions. A study by Black et al. utilizing the National Health Interview Survey (NHIS) data from 2007–2012 estimated frequencies and age-adjusted percentages of CAM use in children with neck and back pain and other MSK

conditions, but they did not stratify further by CAM therapy or type of MSK condition¹⁴. Hagen et al. performed a survey study in 114 patients of types of CAM use in a population of children seen in rheumatology clinic, however, this study was primarily descriptive and did not identify predictors of CAM use¹⁵. In addition, given that it was restricted to patients seen in rheumatology clinic, it is not likely generalizable to more common causes of MSK pain in children, such as injuries. A study by Feldman et al. of 118 children with juvenile idiopathic arthritis (JIA) found that parental CAM use and identifying as “Canadian” (rather than belonging to a specific ethnic group) was associated with CAM use. Though informative about the JIA population, it was not a large enough to examine specific ethnic groups or to include other relevant demographic variables in its regression analysis.

Using the 2012 NHIS, we aimed to describe the prevalence of CAM use in children with MSK conditions and the types of CAM therapies used for different MSK conditions. We also examined demographic variables associated with CAM use and explored self-reported response rates to CAM therapies in children with MSK conditions. Given that CAM use in children with MSK problems is common, the clinical significance of our endeavor was to better understand what factors were associated with CAM use, so as to inform investigation of specific therapies in the future.

Methods

Study Population

We conducted an analysis of the 2012 National Health Interview Survey using data from the Household, Family, Person, Adult, and Child Core surveys, as well as the CAM supplements. NHIS is a multi-purpose survey conducted by the National Center for Health Statistics (NCHS) and the Centers for Disease Control (CDC)¹⁶. This cross-sectional, in-person survey oversamples underrepresented minorities and uses a complex sampling design to provide estimates for the U.S. civilian, non-institutionalized population. The NHIS 2012 survey interviewed 42,366 households, yielding 108,131 persons from 43,345 families. Overall, there were 10,218 children age 4 to 17 with responses to the CAM supplement. The total household response rate was 77.6%.

Definition of CAM Use

The 2012 NHIS CAM supplement collected information about all children between the age of 4 and 17 on the use of CAM within the 12 months prior to being surveyed. We categorized the CAM practices included in the survey into six groups: 1) mind-body therapies (hypnosis, biofeedback, meditation, guided imagery, progressive relaxation, yoga, tai chi, and qi gong), 2) manipulation therapies (chiropractic, massage, craniosacral therapy), 3) movement therapies (Feldenkrais, Alexander, Pilates, Trager), 4) dietary therapies, 5) non-vitamin and non-mineral supplements, and 6) other CAM therapies (acupuncture, energy healing, naturopathy, ayurveda, chelation, homeopathy, traditional healer). For all questions about use of CAM for specific medical conditions, NHIS asked only about the use of the interviewee’s top three CAM modalities.

We defined use of any CAM therapy in the past year as use of any of the aforementioned modalities in that time span. We defined having a MSK condition as a composite variable, including children who reported in the last 12 months: 1) joint pain/stiffness, arthritis, sprain, muscle or bone pain, neck or back pain or 2) use of CAM therapies for any of these conditions. We restricted all analyses to children greater than or equal to 4 years of age (up to 18), because the CAM supplement was only offered in this age range. We defined response to CAM therapy as reporting ‘helped a great deal’ or ‘helped some’ for a specific MSK condition.

Statistical Analyses

NHIS survey weighting procedures were used to provide statistically accurate estimates for the U.S. civilian, non-institutionalized population¹⁷. Wald Chi-squared tests were used in unadjusted analyses to examine the frequency of covariates within different subgroups (MSK and non-MSK groups, different MSK conditions). We included the following covariates in our logistic regression analysis of CAM use in children with MSK conditions: age, sex, race, Hispanic ethnicity, region, presence of anxiety, depression or stress, highest education of one parent, school days missed, parental use of CAM therapy in the last year, ratio of poverty threshold based upon household income, insurance category, and self-reported health status. Presence of anxiety, depression or stress was defined as the report of any of these symptoms in the past 12 months or the use of CAM therapies for these conditions.

Within the subset of children with a MSK condition, we constructed a multivariable logistic regression model with any CAM use in the past year as the outcome variable and with the independent variables above as covariates. Collinearity was assessed by evaluating percent change in standard errors with the presence or absence of a given variable. Missing data were included in the model as separate categories. Associations between these variables and CAM use were described as odds ratios (OR) with 95% confidence intervals. The level of significance was set as a two-tailed $p < 0.05$. All statistical analyses were performed using Stata version 14.0. This study was deemed exempt by the Partners Institutional Review Board.

Results

Patient characteristics

Children with MSK conditions in the last year comprised 15.5% of all children (Table 1). Of the children with MSK conditions in the last year, 42.2% reported neck or back pain, 29.5% reported sprain, and 61.3% reported muscle, joint or bone pain. Children who reported arthritis constituted 0.8% of children with MSK conditions. Compared with children without MSK conditions, children with MSK conditions were predominantly white (77.9% vs. 74.1%; $p = 0.0002$), non-Hispanic (81.7% vs. 78.2%, $p = 0.0002$), with private insurance (60.3% vs. 56.3%, $p = 0.04$), and had a mean age of 13.2 (vs. 10.4, $p < 0.0001$) years. 70.6% of their parents had more than a high school education, compared to 65.1% in the non-MSK group ($p = 0.0002$). There was an approximately equal distribution of gender and regions from the United States.

By Whom CAM Therapies Were Recommended

In children with MSK conditions, 66.7% reported that their child used CAM because it was recommended by a family member, and 26.9% reported they used at least one CAM therapy because it was recommended by a friend. 25.6% of parents reported that they used at least one CAM therapy because it was recommended by a medical doctor, and 3.8% stated that CAM therapy was recommended by a co-worker.

Prevalence of CAM use by MSK condition

In the past year, 28.0% of children with MSK conditions used at least one CAM therapy, compared to 8.8% in the group without MSK conditions. Unadjusted analyses examining the prevalence of specific types of CAM use in MSK versus non-MSK populations are shown in Table 2. Children with MSK conditions reported more use of manipulation therapies (14.8% vs. 2.1%), non-vitamin, non-mineral supplements (10.9% vs. 3.6%), mind-body therapies (7.6% vs. 3.1%), special diets (2.0% vs. 0.5%), movement therapies (1.7% vs. 0.2%), and other therapies (4.5% vs. 1.7%) than those without MSK conditions. Among children with neck or back pain, 25.2% of reported use of manipulation therapies, compared to 13.1% of children with sprains and 12.5% of children with muscle, bone, or joint pain. There were no other statistical differences between uses of other CAM modalities across different types of MSK pain.

Factors associated with CAM use among children with MSK conditions

There were significant associations between multiple factors and CAM use in the last year (Table 3). Females were more likely to report CAM use than males (OR 1.5, CI 1.2–2.0). Those living in the Western U.S had a higher likelihood of CAM use than those living in the Northeast (OR 1.7, CI 1.0–2.8). Compared to whites, American Indians/Alaskan Natives (AIAN) were significantly more likely to report CAM use (OR 2.7, CI 1.0–7.0) while blacks were less likely to use CAM (OR 0.4, CI 0.2–0.6). Compared to children who did not have a parent who used CAM, those who had a parent who used CAM were more likely to use CAM (OR 2.8, CI 2.1–3.9). Children with parents who graduated from high school (OR 3.2, CI 1.5–6.7) or had additional schooling (OR 4.6, CI 2.3–9.1) were significantly more likely to use CAM, compared to those whose parents did not graduate from high school. Finally, children with anxiety, stress or depression were more likely to report CAM use than children who did not report anxiety, stress or depression (OR 1.3, CI 1.0–1.8). Age, insurance category, ratio to poverty line, Hispanic ethnicity, school days missed and health status were not associated with CAM use.

Self-Reported Response to CAM Therapies

Among children who used one of their top 3 CAM therapies for an MSK condition (N = 90), 63.4% (95% CI = 50.9–74.3) reported that this therapy helped ‘a great deal,’ and 26.3% (17.1–38.3) reported that it helped ‘some.’

Discussion

To our knowledge, this is the first study to comprehensively characterize factors associated with CAM use in children with MSK conditions. Children with MSK conditions used CAM

therapies at approximately 3 times the rate of children without MSK conditions, corresponding to 1.18 million U.S. children (28%). The study by Hagen et al. reported 64% CAM use by children seen in rheumatology clinic. Part of this difference may be explained by the fact that the average child seen in rheumatology clinic has more longstanding symptoms than the average child reporting musculoskeletal pain, and as a consequence, he or she may have had more time to explore CAM treatments for refractory symptoms. Compared to children with other MSK conditions, children with neck or back pain used manipulation therapies (chiropractic, massage, and craniosacral therapy) more frequently than children with other MSK conditions. The frequency of good response to CAM therapies for MSK conditions was high, but the sample size for this analysis was small (N = 90) because only a small proportion of children using CAM reported using one of their three top CAM therapies specifically for an MSK condition.

One of our key findings is that family members strongly influence the use of CAM therapy. The majority of parents reported that their child used CAM therapy because it was recommended by a family member. In addition, of all the assessed characteristics, parental CAM use and parental education were the most strongly associated with CAM use. These findings are consistent with previously reported findings in the study by Feldman et al. of children with JIA, which reported an adjusted OR for parental CAM use of 5.1¹⁸. Although not surprising, these results underscore the importance of providing evidence-based information regarding the safety and efficacy of CAM therapies in children to parents, so that parents can make informed decisions regarding CAM therapy for their children.

We also observed significant differences in CAM use across races. Black children were less likely to report CAM use compared to whites, whereas AIAN children were more likely to report CAM use compared to whites. The definition of CAM therapy is likely to influence these comparisons. An analysis of the 2002 adult NHIS data by Barnes et al. reported that 71.3% of blacks are users of CAM, but only when prayer for health reasons was included¹⁹. Whereas prayer (not included in this study) may be more common in blacks, other modes of healing (which were included in the NHIS definition of CAM therapy) may be more common in AIAN due to a long tradition of culturally embedded healing practices in many of these nations²⁰. These findings highlight the importance of considering cultural customs and backgrounds when studying CAM use.

We also found significant associations between CAM use and location in the western region of the United States (compared to the Northeast). A number of studies have demonstrated an increased use of CAM among adults in the American West compared to other regions^{21–23}. It is possible that these practices are longer established in the American West, or that there is a greater supply of these practitioners in the West. Future studies are needed to understand whether supply and demand for CAM is matched in different geographic regions, as this could inform interventions to improve access to CAM therapies.

Our finding that girls were more likely to use CAM than boys is consistent with studies in adult populations, showing that women more frequently use CAM than men. Studies in adult populations have also shown that women use more medical services in general compared to men^{24,25}. In adults, potential causes for these differences include gender differences in levels

of reported symptoms, as well as overall interest in health. It is not clear how these factors would affect gender differences in CAM utilization among children, since parents often make healthcare decisions for their children. Further studies are needed to examine potential differences in the way parents make healthcare decisions, based on the gender of their child.

Prior studies have found an association between anxiety or depression and CAM use in adults, and many studies report an increasing use of CAM therapies to treat anxiety and depression ^{26,27}. It is important to clarify that we found an association between presence of anxiety, stress or depression and CAM use for any condition rather than CAM specifically to treat anxiety, depression or stress. Because the number of children with MSK conditions who specifically reported CAM use for anxiety, stress or depression was small, we were not able to determine if the association between anxiety, stress or depression and CAM use was due to children using CAM therapies to treat these symptoms. It is possible that children with medical problems (including stress, anxiety and depression) in general are more likely to seek treatment in general, whether CAM or traditional.

There is a paucity of data about response rates to CAM therapies in children with MSK conditions. The efficacy of CAM modalities for adult MSK conditions is somewhat better established. A systematic review by Kumar et al. concluded that massage was effective for low back pain with a modest effect size, although the conclusion was tempered by heterogeneity and lack of blinding in many studies ²⁸. An analysis by MacPherson et al. concluded that for headache, osteoarthritis, and back, neck and shoulder pain, acupuncture was superior to control, whether sham or non-sham ²⁹. A meta-analysis by Ward et al. concluded that yoga is safe and may be effective in a variety of MSK conditions ³⁰. It is possible that these therapies may have a similar effect in the pediatric population, though more research is necessary. One potential confounder is that many MSK conditions in children are acute injuries, and therefore are likely to improve after time on their own. Thus it is difficult to differentiate the effects of CAM from the effects of time itself. To answer this question, controlled study designs (i.e. randomized controlled trials) are needed.

Our study has some limitations. Due to the cross-sectional study design, it is not possible to assess temporality or causality. The dataset is also limited in its assessment of response to CAM therapies. Only a small proportion of those with MSK conditions reported their perceived response to CAM therapies, and there was no information about the specific type of responses (e.g., which symptoms improved). Another shortcoming of the dataset is that all conditions are identified by self-report, so it is difficult to know if a subject who reports 'pain or stiffness in the joint' in fact has juvenile arthritis. Finally, MSK conditions comprise a wide variety of conditions with different etiologies, so inferences about the effects of treatments on specific MSK conditions are not possible.

Despite these limitations, our study has many strengths. The NHIS is a rigorously conducted survey that provides reliable estimates for the U.S. population and is used to inform U.S. health policy. This dataset sampled 10,218 children, of whom 1,511 had MSK conditions. With this large sample size, we were able to evaluate the association between multiple sociodemographic factors and CAM use. In addition, the subjective assessment of

improvement in symptoms with CAM therapies is a useful addition to the literature, as there is increasing emphasis on patient satisfaction and assessment of utility as quality measures.

Conclusion

Utilizing the 2012 NHIS Child CAM Supplement, we demonstrated that race, gender, parental education, parental CAM use, region of residence, and presence of anxiety, stress or depression were all associated with CAM use in children with MSK conditions. This cohort reported a relatively high rate of response to CAM therapies. Given these findings, future research should seek to understand the demographic factors that influence response to CAM, the specific types of CAM therapies that improve specific MSK symptoms, and the mechanisms by which they produce these improvements. Furthermore, we will need to better understand how use of CAM therapies in these conditions changes healthcare utilization.

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HIGHLIGHTS

- Children with musculoskeletal (MSK) conditions use CAM more than three times as much as children without MSK conditions
- Race, parental education and parental CAM use are associated with CAM use in children with MSK conditions
- Children with MSK conditions demonstrate a high rate of response to CAM therapies

Table 1

Demographic characteristics of children (4–17 years) with and without an MSK condition. Values are percentages (except in first row).*

	No MSK condition N = 8,707	Any MSK condition N = 1,511
Estimated US population size (%)	23,082,268 (84.5)	4,227,562 (15.5)
Gender		
Male	51.9	51.0
Female	48.1	49.0
Age (years)		
4–6	23.3	2.0
7–11	34.8	26.7
12–18	41.9	71.2
Ethnicity		
Hispanic	21.9	18.3
Non-Hispanic	78.2	81.7
Race		
White	74.1	77.9
Black	15.0	11.5
American Indian/Alaskan Native	1.1	1.3
Asian	5.0	3.4
Race not reported	0.2	0.1
Multiple races	4.6	5.9
Highest education of parent		
Less than high school diploma	10.9	8.2
High school diploma or GED	19.3	17.9
More than high school	65.1	70.6
Region		
Northwest	18.0	15.3
Midwest	21.8	27.1
South	38.3	33.9
West	21.9	23.8
Insurance		
Not covered	7.6	7.0
Public	36.0	32.7
Private	56.3	60.3
Child CAM use in last year	8.8	28.0

* All comparisons between children with and without MSK conditions (chi-squared tests) are significant except for gender.

Percentage prevalence (and 95% confidence intervals) of CAM therapies used in children (> 4 years) with MSK conditions (overall and broken down into type of MSK condition) compared to those without MSK conditions.

Table 2

	Children without MSK conditions (N = 8,707)	Children with MSK conditions (N = 1,511)	Among children with MSK conditions		
			Neck or back pain (N = 651)	Sprain (N= 439)	Muscle, bone or joint pain (N= 936)
Manipulation therapies	2.1 (1.8–2.5)	14.8 (12.6–17.2)	25.2 (21.5–29.4)	13.1 (9.7–17.5)	12.5 (10.0–15.6)
Non-vitamin, non-mineral supplements	3.6 (3.2–4.0)	10.9 (9.2–12.9)	13.8 (11.0–17.2)	11.3 (8.2–15.2)	11.8 (9.6–14.5)
Mind-body therapies	3.1 (2.7–3.6)	7.6 (6.2–9.2)	9.1 (7.0–11.8)	7.5 (5.2–10.7)	8.1 (6.3–10.5)
Movement therapies	0.2 (0.1–0.3)	1.7 (1.1–2.7)	1.8 (1.0–3.2)	3.4 (1.8–6.2)	1.6 (0.8–3.0)
Special diet	0.5 (0.3–0.7)	2.0 (1.3–3.1)	1.5 (0.8–2.9)	3.1 (1.5–6.2)	1.8 (1.1–3.2)
Other CAM use	1.7 (1.3–2.1)	4.5 (3.4–5.9)	6.0 (4.3–8.4)	5.4 (3.4–8.4)	3.8 (2.7–5.5)

Table 3

Factors associated with CAM use in children with MSK conditions in a multivariable model (N =1,502). *

	Odds ratio	95% CI	p-value
Gender			0.003
Male	REF		
Female	1.5	1.2 – 2.0	
Age (years)			0.155
4–6	REF		
7–11	0.5	0.1 – 1.4	
12–18	0.6	0.2 – 1.8	
Ethnicity			0.315
Hispanic	REF		
Non-Hispanic	1.2	0.8 – 1.8	
Race			0.001
White	REF		
Black	0.4	0.2–0.6	
American Indian/Alaskan Native	2.7	1.0 – 7.0	
Asian	0.7	0.3 – 1.4	
Multiple races	1.2	0.7 – 2.0	
Highest education of at least one parent			<0.001
Less than high school diploma	REF		
High school diploma or GED	3.2	1.5 – 6.7	
More than high school	4.6	2.3 – 9.1	
Region			0.001
Northeast	REF		
Midwest	1.3	0.8 – 2.2	
South	0.8	0.5 – 1.3	
West	1.7	1.0 – 2.8	
Parental CAM use in last year			<0.001
No	REF		
Yes	2.8	2.1 – 3.9	
Ratio to Poverty Line			0.816
<0.50–1.00	REF		
1.00–1.99	0.8	0.5 – 1.4	
2.00–3.99	0.9	0.5 – 1.6	
4.00 and above	1.0	0.5 – 1.8	
Health Status			0.175
Excellent	REF		
Very good	0.7	0.5 – 1.0	

	Odds ratio	95% CI	p-value
Good	1.0	0.7 – 1.5	
Fair	0.6	0.3 – 1.3	
Poor	1.5	0.3 – 8.3	
Access to care			0.297
Not covered	REF		
Public	0.7	0.4 – 1.3	
Private	1.0	0.6 – 1.6	
School days missed			0.085
0–5	REF		
5–10	0.9	0.6 – 1.4	
10–20	1.9	1.2 – 3.0	
20	1.2	0.6 – 2.7	
Presence of anxiety, stress or depression			0.030
No	REF		
Yes	1.3	1.0 – 1.8	

* The represented subpopulation size differs from Table 1 because of 9 observations, which were dropped due to missing data (N = 1,511 to N = 1,502). CAM use is within a 12 month period prior to survey, rather than ever use. P-values report global tests for each category.