

COMPLEMENTARY ALTERNATIVE MEDICINE

Complementary and Alternative Medicine Use and Psychosocial Outcomes among Urban Adolescents with Asthma

CHRISTINA M. LUBERTO, B.A.,^{1,2} MICHAEL S. YI, M.D., M.SC.,^{3,4,5} JOEL TSEVAT, M.D., M.PH.,^{4,5,6}
ANTHONY C. LEONARD, PH.D.,² AND SIAN COTTON, PH.D.,^{2,3,4,*}

¹Department of Psychology, University of Cincinnati, Cincinnati, OH, USA.

²Department of Family and Community Medicine, University of Cincinnati College of Medicine, Cincinnati, OH, USA.

³Department of Pediatrics, University of Cincinnati College of Medicine, Cincinnati, OH, USA.

⁴Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA.

⁵Division of General Internal Medicine, Department of Internal Medicine, University of Cincinnati College of Medicine, Cincinnati, OH, USA.

⁶Health Services Research and Development, Veterans Affairs Medical Center, Cincinnati, OH, USA.

Objective. Many adolescents with asthma use complementary and alternative medicine (CAM) for asthma symptom management. The purpose of this study was to investigate cross-sectional and longitudinal differences in psychosocial health outcomes between high and low CAM users among urban adolescents with asthma. **Methods.** Adolescents (Time 1: $N = 151$, Time 2: $N = 131$) completed self-report measures regarding the use of 10 CAM modalities, mental health, and health-related quality of life (HRQoL) following two clinic visits 1 year apart as part of a larger observational study. Multivariable regression analyses using backward elimination examined relationships between CAM use at Time 1 and outcomes at Time 1 and Time 2, controlling for key covariates and, in longitudinal analyses, Time 1 functioning. **Results.** Participants ($M_{\text{age}} = 15.8$, $SD = 1.85$) were primarily African-American ($n = 129$ [85%]) and female ($n = 91$ [60%]) adolescents with asthma. High and low CAM users differed significantly in terms of several psychosocial health outcomes, both cross-sectionally and longitudinally. In cross-sectional multivariable analyses, greater frequency of praying was associated with better psychosocial HRQoL ($R^2 = 0.22$). No longitudinal relationships remained significant in multivariable analyses. **Conclusions.** Specific CAM techniques are differentially associated with psychosocial outcomes, indicating the importance of examining CAM modalities individually. Greater frequency of praying was cross-sectionally associated with better psychosocial HRQoL. When controlling for key covariates, CAM use was not associated with psychosocial outcomes over time. Further research should examine the effects of CAM use in controlled research settings.

Keywords anxiety, depression, health-related quality of life, prayer

INTRODUCTION

Asthma is a chronic lung disease that involves episodic airway inflammation and/or constriction, resulting in a range of respiratory symptoms (e.g., wheezing, shortness of breath) (1). Asthma is the most common chronic disease of childhood/adolescence (2), affecting in particular minority children from urban, low-income backgrounds (e.g., 12.8% of African-American children vs. 7.9% of white children and 4.9% of Asian children) (3–6). Not only is asthma more frequent among adolescent minorities, but minorities are also at greater risk of asthma-related morbidity and mortality (5). For example, African-American children are twice as likely to be hospitalized for their asthma (7) and have nearly an eightfold higher death rate from asthma when compared with their white peers (3).

Children with asthma also report greater internalizing, externalizing, and behavioral problems—particularly greater anxiety symptoms (8) and poorer health-related quality of life (HRQoL) (9)—than children without

asthma (10). In addition, in children with asthma, those with anxiety disorders have lower self-esteem, more restrictions on daily activities, and poorer social competence than their peers without anxiety disorders (8). Therefore, it is critical to examine asthma management strategies and their impact on psychosocial outcomes among urban adolescents with asthma.

Complementary and alternative medicine (CAM) is often used to manage symptoms of chronic illnesses (11, 12). Defined as a collection of health-related practices outside of conventional medicine, CAM practices include the use of natural products (e.g., vitamins, herbs), mind–body medicine (e.g., yoga, meditation, prayer), manipulative and body-based therapies (e.g., chiropractic, massage), and other practices such as naturopathy and energy healing (13). Some CAM techniques are inexpensive symptom management options that can be utilized independently once the necessary skills have been learned (e.g., deep breathing, meditation, guided imagery). In our previous report of 151 adolescents with asthma, 71% reported using CAM modalities (including prayer) for symptom management in the past month, and 64–87% of them felt that CAM improved their asthma symptoms (14). Predictors of greater CAM use included older age, African-American ethnicity, and greater number of asthma symptoms. Others have found similarly

*Corresponding author: Sian Cotton, Ph.D., Department of Family and Community Medicine, University of Cincinnati College of Medicine, PO Box 670840, Cincinnati, OH 45267-0840, USA; Fax: 513-558-2744; E-mail: sian.cotton@uc.edu

high rates of CAM use and perceived efficacy of CAM use among adolescents with asthma, as well as among other age and sociocultural groups with asthma (15–22).

While adolescents with asthma report high frequency of CAM use and perceived efficacy, the question still remains whether CAM use is actually associated with improved outcomes in this population—and if so, which particular modality and which particular outcome. A growing body of research indicates that CAM use, including prayer, is associated with poorer asthma control among children, adolescents, and adults with asthma (14, 15, 20, 23–26). For example, CAM use has been associated with more frequent asthma-related physician visits, conventional asthma medication use (e.g., oral steroids), asthma exacerbations, and emergency room visits due to asthma (20, 23). The relationship between CAM use and poor asthma control has been found to persist even when controlling for the effects of key covariates (e.g., demographic variables, conventional medication use) (27, 28). However, research examining the relationship between CAM use and psychosocial health outcomes (e.g., mental health symptoms) among adolescents with asthma is lacking. In other samples of adolescents and adults with a chronic illness, CAM use has been associated with improved psychosocial outcomes (29–31).

Previous studies of adolescent CAM use in asthma have focused primarily on non-African-American populations and clinical outcomes (e.g., asthma symptoms) rather than psychosocial outcomes; have relied largely on parental rather than adolescent self-report; and have been cross-sectional. Therefore, this study sought to extend previous work by investigating the relationship between adolescent-reported CAM use and psychosocial health outcomes—specifically, anxiety, depression, and psychosocial HRQoL—among mostly African-American urban adolescents with asthma both cross-sectionally and longitudinally. The primary goal of this study was to examine whether high versus low CAM users (measured via individual modalities) with asthma differ in terms of psychosocial health over time. Based on previous studies, we hypothesized that greater CAM use would be associated with fewer anxiety and depression symptoms and better psychosocial HRQoL at both time points when controlling for sex, age, ethnicity, asthma symptoms and, in longitudinal analyses, baseline functioning.

METHODS

Participants

We recruited 151 urban adolescents with asthma from the Teen Health Center at Cincinnati Children's Hospital Medical Center (CCHMC) as part of a larger longitudinal observational study examining spirituality and HRQoL among this population (14, 32). We previously reported results regarding spiritual and religious preferences and CAM behaviors and beliefs among this sample; in this article, CAM techniques (including prayer) are examined for their unique relationships to psychosocial outcomes at

two time points. Adolescents were eligible if they were between the age of 11 and 19 years, spoke fluent English, and had a physician diagnosis of asthma. Interested and eligible adolescents provided appropriate informed assent, and a primary caregiver provided informed consent. Adolescents were asked to complete a series of self-report questionnaires following two asthma clinic visits spaced approximately 1 year apart. Participants were paid \$25 for their time and effort. The CCHMC Institutional Review Board approved the study protocol.

Measures

Independent and Descriptive Variables.

Demographic/Clinical. Participants provided basic demographic data including age, sex, ethnicity, and education level. Physician-rated asthma severity and prescribed conventional asthma medications were obtained via chart review, and severity was categorized according to the National Heart Lung and Blood Institute (NHLBI) criteria as intermittent, mild persistent, moderate persistent, or severe persistent (33).

Asthma Symptoms. We used the Asthma Symptoms subscale of the PedsQL™ to measure frequency of self-reported asthma symptoms (e.g., chest tightness, wheezing). Items were measured on a 5-point Likert-type scale (1 = never to 5 = almost always) then recoded onto a 100-point Likert-type scale such that higher scores indicated better quality of life (i.e., fewer asthma symptoms) (34). The PedsQL Asthma Symptoms subscale shows good psychometric properties and is considered a valid measure of adolescent-reported asthma symptoms (34). Internal consistency in the currently sample was good (Time 1 Cronbach α = 0.88; Time 2 α = 0.90).

CAM Use. Use of 10 different CAM modalities (relaxation, guided imagery, prayer, meditation, yoga, biofeedback, massage, herbs/vitamins, dietary changes [e.g., modifying one's diet to include more vegetables or less dairy], and rubs [e.g., Vicks VapoRub]) was assessed using an author-developed self-report questionnaire. For CAM modalities that adolescents might not have been familiar with, brief definitions were provided. For example, relaxation was defined as “deep and slow breathing to relax,” and yoga was defined as “stretching and breathing exercises to help balance the mind and body.” The questionnaire included 4 questions for each of the 10 CAM modalities: (1) how frequently the participant used that CAM technique to manage his/her asthma in the past month (1 = never to 5 = once per day or more); (2) whether he/she would consider using that CAM technique for future asthma symptom management (yes/no); (3) whether he/she disclosed his/her use of that CAM technique to his/her medical provider (yes/no); and (4) whether he/she perceived that CAM technique to be effective in managing his/her asthma symptoms. Only current (past month) CAM use was examined in this study.

Outcome Variables. Anxiety Symptoms. We used the 10-item Multidimensional Scale of Anxiety for Children

(MASC-10) (35) to measure adolescent-reported anxiety symptoms. The MASC-10 measures four basic dimensions of anxiety (physical symptoms, harm avoidance, social anxiety, and separation/panic). We converted scores into to sex- and age-specific *T*-scores according to published guidelines (35), with higher scores indicating more anxiety symptoms. The MASC-10 has acceptable psychometric properties, including internal consistency reliability ($\alpha = 0.68$) and test-retest reliability ($r = 0.83$, $p < .05$) (35). Internal consistency in the current sample was acceptable (Time 1: $\alpha = 0.74$, Time 2: $\alpha = 0.75$).

Depressive Symptoms. The Children's Depression Inventory (CDI) was used to measure symptoms of depression. The CDI is a 10-item measure that asks adolescents to choose which of three sentences describing depressive symptoms best reflects how they felt in the past 2 weeks (e.g., I hate myself, I do not like myself, I like myself). Items were recoded such that higher scores reflect more depressive symptoms, and *T*-scores were obtained according to mean population norms (36). The CDI has strong psychometric properties, including good reliability (37) and strong criterion and discriminant validity (38). In the current sample, internal consistency was good (Time 1: $\alpha = 0.86$, Time 2: $\alpha = 0.85$).

Psychosocial HRQoL. The Psychosocial Functioning subscale of the PedsQL™ was used to assess psychosocial HRQoL. The Psychosocial Functioning subscale score was computed as the mean of the PedsQL™ emotional, social, and school functioning subscale scores (39). Thus, it asks adolescents to indicate on a 5-point Likert scale how much of a problem negative emotions (e.g., sadness, anger), interpersonal difficulties (e.g., getting along with others, being teased), and school-related difficulties (e.g., forgetfulness, inattention) have been for them in the past month. Items were recoded onto a 100-point Likert-type scale such that higher scores indicate better psychosocial HRQoL. This measure shows good internal consistency reliability ($\alpha = 0.83$) and good convergent and discriminant validity (e.g., correlations with morbidity, illness burden). In the current sample, internal consistency was good (Time 1: $\alpha = 0.82$, Time 2: $\alpha = 0.84$).

Data Analytic Plan

We calculated descriptive statistics for sample demographics at baseline and for each predictor and outcome variable at both time points. Given their non-normal distributions, each CAM modality was examined as a dichotomous variable (i.e., high use: once a week or more often vs. low use: never or once a month) in all analyses. This cutoff point was used because it allowed for all available data to be included and produced theoretically coherent categories (i.e., at least weekly CAM use was considered consistent and frequent enough to be termed "high use"). Ethnicity was dichotomized as African-American versus non-African-American for all analyses. To check for bias introduced by the loss of some subjects between baseline and follow-up, baseline data were compared between Time 2 respondents and nonrespondents. Paired samples *T*-tests

were computed for each outcome variable to compare means at Time 1 and Time 2. McNemar's chi-square test for within-subjects designs was used to compare rates of CAM use at Time 1 and Time 2. Independent samples *T*-tests were conducted to compare Time 1 high and low CAM use groups in terms of psychosocial outcomes at Time 1 and Time 2. A *T*-score of 65 was used as the cutoff for clinical significance when describing the sample in terms of anxiety symptoms and depressive symptoms. CAM use variables associated at the bivariate level with outcomes at $p \leq .10$, along with key demographic and clinical covariates, were included as candidate predictors in multivariable analyses, and subjected to backward elimination until only variables significant at $p \leq .05$ remained. That is, the study α for statistical significance was a two-tailed $p \leq .05$ for each test, while a p -value of $\leq .10$ was used to establish candidacy for inclusion in regression analyses. For bivariate analyses, we reported the 95% confidence interval (95% CI) for the difference between group means. The covariates that were included as candidates before backward elimination were age, sex, ethnicity, and asthma symptoms. Asthma symptoms, rather than asthma severity, were used to account for the established link between CAM use and poor asthma control because (1) asthma symptoms are a key indicator of asthma control and (2) asthma control is distinct from, and does not necessarily reflect, underlying disease severity (40). In longitudinal analyses, Time 1 measure of any outcome was included as a covariate when modeling Time 2 instance of that outcome to control for baseline functioning. All analyses were performed using SPSS version 19.0 (41).

RESULTS

Descriptives

Participants. Participants, mean age was 15.8 years ($SD = 1.8$). Ninety-one participants (60%) were female and 129 (85%) were African-American (Table 1) (14, 32).

TABLE 1.—Baseline demographic and clinical characteristics.

Variable	
Mean (SD) age in years, range	15.8 (1.8), 12–19
Sex	
Male, <i>N</i> (%)	60 (40)
Female, <i>N</i> (%)	91 (60)
Ethnicity	
African-American, <i>N</i> (%)	129 (85)
Non-African-American, <i>N</i> (%)	21 (14)
Asthma severity	
Intermittent, <i>N</i> (%)	72 (48)
Mild persistent, <i>N</i> (%)	38 (25)
Moderate persistent, <i>N</i> (%)	36 (24)
Severe persistent, <i>N</i> (%)	5 (3)
Asthma medication	
Inhaled corticosteroids, <i>N</i> (%)	82 (54)
Oral corticosteroids, <i>N</i> (%)	4 (3)
Albuterol, <i>N</i> (%)	140 (93)
Other, <i>N</i> (%)	10 (7)

Notes: *N* = 151. Ethnicity data are missing for one subject. Medication data were not available for eight subjects.

For attrition purposes, there were no significant differences at baseline between Time 2 respondents and nonrespondents on any of the predictor or outcome variables of interest.

CAM Use. Details regarding the frequency of use, willingness to use, disclosure of use, and efficacy of use of specific CAM modalities have been previously reported (14). One hundred and three adolescents (68%) at Time 1 and 93 adolescents (71%) at Time 2 reported high use of more than one CAM modality simultaneously for past month asthma symptom management. McNemar's test indicated that there was a trend for meditation use to increase over time ($p = .07$). No other CAM variables changed significantly from Time 1 to Time 2.

Psychosocial Outcomes. Twenty-two adolescents (15%) reported clinically significant levels of anxiety symptoms, and nine (6%) reported clinically significant levels of depressive symptoms at Time 1 (42). The reported level of psychosocial HRQoL in the current sample ($M = 75.5$) was similar to that of other adolescent chronic illness populations ($M = 77.1$) (39). Depressive symptoms increased over time whereas anxiety symptoms and psychosocial HRQoL both remained relatively stable (Table 2).

TABLE 2.—Descriptive statistics for health outcomes at baseline and 1-year follow-up.

	Time 1 ($N = 151$)			Time 2 ($N = 131$)			p
	M	SD	Range	M	SD	Range	
Anxiety symptoms	52.5	12.4	29–88	52.3	12.1	29–90	.44
Depressive symptoms	46.6	10.3	39–90	48.2	11.1	39–90	.03
Psychosocial HRQoL	75.5	16.0	7.6–100	75.9	17.1	25–100	.78

Notes: p , p -value for paired samples t -test; t -tests were conducted on Time 2 sample ($N = 131$); M , mean; SD , standard deviation; HRQoL, health-related quality of life. Anxiety symptoms assessed by the 10-item Multidimensional Scale of Anxiety for Children (MASC-10); depressive symptoms assessed by the Children's Depression Inventory (CDI); psychosocial HRQoL assessed by PedsQL™ – Psychosocial Functioning subscale. Anxiety and depressive symptoms are scaled such that higher scores reflect more symptoms; psychosocial HRQoL is scaled such that higher scores reflect better HRQoL.

Time 1 Cross-Sectional Associations between CAM Use and Outcomes

In Time 1 bivariate cross-sectional analyses, adolescents with high use of guided imagery reported less anxiety than those with low use of guided imagery ($p = .06$), fewer depressive symptoms ($p = .02$), and better psychosocial HRQoL ($p = .14$) (Table 3). Adolescents frequently using massage reported less anxiety as compared with those with low use of massage ($p = .12$). Those praying more frequently had better psychosocial HRQoL than those who prayed less or did not pray ($p = .14$). In Time 1 multivariable analyses (Table 4), higher prayer frequency continued to be associated with better psychosocial HRQoL (std $\beta = 0.21$, $R^2 = 0.22$, $p = .01$). Asthma symptoms were also a significant predictor in the final step of this model, such that fewer asthma symptoms were associated with better psychosocial HRQoL (Table 4). No other CAM use variables were significantly related to any health outcomes at Time 1 when controlling for key covariates.

Longitudinal Associations between CAM Use and Outcomes

In bivariate longitudinal analyses, greater use of relaxation at Time 1 was associated with fewer depressive symptoms at Time 2 ($p = .10$). Greater use of guided imagery at Time 1 was also associated with fewer depressive symptoms at Time 2 ($p = .09$). Those reporting frequent herb/vitamin use at Time 1 had poorer psychosocial HRQoL at Time 2 as compared with those reporting less frequent or no herb/vitamin use ($p = .09$). Adolescents with more dietary changes at Time 1 reported greater anxiety symptoms at Time 2 than those with fewer dietary changes ($p = .11$). However, none of these relationships remained significant in multivariable analyses when controlling for the effects of age, sex, ethnicity, asthma symptoms, and baseline functioning.

DISCUSSION

Although adolescents with asthma have consistently reported using CAM for symptom management, and while CAM use has been associated with improved clinical outcomes (29–31), little is known about whether CAM use

TABLE 3.—Bivariate analyses of complementary and alternative medicine use versus psychosocial outcomes.

CAM modality	Psychosocial outcome	High use M (SD)	Low use M (SD)	95% CI
Guided imagery	Time 1 anxiety symptoms	49.7 (13.2)	53.8 (11.9)	−0.1 to 8.5
Guided imagery	Time 1 depressive symptoms	43.7 (6.9)	48.0 (11.4)	1.3 to 7.3
Guided imagery	Time 1 psychosocial HRQoL	78.3 (14.8)	74.1 (16.5)	−9.8 to 1.4
Massage	Time 1 anxiety symptoms	49.8 (10.8)	53.4 (12.8)	−1.0 to 8.2
Prayer	Time 1 psychosocial HRQoL	77.1 (16.2)	73.2 (15.4)	−9.2 to 1.3
Relaxation	Time 2 depressive symptoms	47.0 (10.0)	50.2 (12.4)	−0.6 to 7.2
Guided imagery	Time 2 depressive symptoms	46.0 (8.3)	49.4 (12.1)	−0.1 to 7.1
Herbs/vitamins	Time 2 psychosocial HRQoL	68.9 (15.7)	76.8 (17.1)	−1.4 to 17.1
Dietary changes	Time 2 anxiety symptoms	56.7 (9.1)	51.6 (12.4)	−11.2 to 1.2

Notes: CAM, complementary and alternative medicine; HRQoL, health-related quality of life; 95% CI, 95% confidence interval. Anxiety symptoms assessed by 10-item Multidimensional Scale of Anxiety for Children (MASC-10); depressive symptoms assessed by the Children's Depression Inventory (CDI); psychosocial HRQoL assessed by PedsQL™ – Psychosocial Functioning subscale.

TABLE 4.—Multivariable regression results.

CAM model final predictors	β	95% CI	<i>t</i>	<i>p</i> -Value
Outcome: Time 1 psychosocial HRQoL				
Prayer use				
Asthma symptoms	0.46	0.34–0.58	6.12	.00
Prayer frequency	0.21	–4.57 to 4.99	2.82	.01
Guided imagery use				
Race ^a	0.17	–6.55 to 6.89	2.29	.02
Asthma symptoms	0.40	0.28–0.52	5.38	.00
Outcome: Time 1 anxiety symptoms				
Guided imagery use				
Asthma symptoms	–0.40	–0.30 to –0.50	–5.25	.00
Massage use				
Asthma symptoms	–0.40	–0.30 to –0.50	–5.21	.00
Outcome: Time 1 depressive symptoms				
Guided imagery use				
Race ^a	–0.19	–4.64 to 4.26	–2.52	.01
Asthma symptoms	–0.33	–.41 to –0.25	–4.36	.00
Outcome: Time 2 depressive symptoms				
Relaxation use				
Sex ^b	0.18	–3.17 to 3.53	2.33	.02
Time 1 depressive symptoms	0.50	0.34–0.66	6.62	.00
Guided imagery use				
Sex ^b	0.17	–3.22 to 3.56	2.27	.03
Time 1 depressive symptoms	0.50	0.34–0.66	6.59	.00
Outcome: Time 2 psychosocial HRQoL				
Herb use				
Asthma symptoms	0.16	0.02–0.30	2.07	.04
Time 1 psychosocial HRQoL	0.50	0.32–0.68	6.28	.00
Outcome: Time 2 anxiety symptoms				
Dietary changes use				
Time 1 anxiety symptoms	0.66	0.54–0.78	9.90	.00

Notes: CAM, complementary and alternative medicine; β , standardized beta weight; 95% CI, 95% confidence interval; HRQoL, health-related quality of life. 95% CI for standardized beta weight. Only significant final predictors are presented.

^aNon-African-American was the reference case.

^bMale was the reference case.

is associated with psychosocial outcomes in this population. This study investigated the relationships between the self-reported use of 10 different CAM modalities and psychosocial health outcomes both cross-sectionally and at 1-year follow-up in a sample of urban adolescents with asthma. In the absence of a full randomized controlled trial (RCT) to test actual effects of CAM use, we conducted a preliminary self-report study of CAM use and outcomes to begin to examine these relationships.

In bivariate analyses, differential associations were shown between CAM modalities and psychosocial outcomes. That is, in some cases, CAM use was associated with better outcomes (e.g., greater use of massage and fewer anxiety symptoms; greater use of relaxation and fewer depression symptoms), while in others, it was associated with poorer outcomes (e.g., greater herbs/vitamins use and poorer psychosocial HRQoL; greater dietary changes and more anxiety symptoms). These findings suggest that specific CAM modalities may have unique effects on psychosocial health outcomes. Indeed, there are functional differences between specific CAM techniques, which might differentially impact health outcomes. For example, yoga involves a greater degree of physical activity than meditation and therefore might accord additional physical health benefits. In most previous work documenting an association between CAM use and poor asthma

control, CAM use was collapsed across different modalities e.g., (15, 20, 23–25)—making it difficult to ascertain which CAM modality was related to asthma control. Future studies should assess CAM modalities individually in order to further tease out these distinct relationships between CAM use and outcomes.

In multivariable baseline analyses, praying more frequently was associated with better psychosocial HRQoL. These findings are consistent with some prior studies showing that greater use of prayer is associated with better psychological (e.g., fewer anxiety and depression symptoms) and social functioning (e.g., greater social support and connectedness) (43–45). However, other studies have reported that prayer use is associated with worse psychosocial outcomes (e.g., greater depressive symptoms) (39). One hypothesis is that adolescents who are depressed may turn to religion in a time of need, though further longitudinal work is needed to clarify the directionality of this relationship. Clinicians caring for urban adolescents with asthma should be aware of the use of prayer and its relationship to improved quality of life.

Maybe not surprisingly, the relationship between prayer use at Time 1 and psychosocial HRQoL at Time 2 did not remain significant. Indeed, although significant bivariate results were shown, none of the measured CAM use variables were significantly associated with psychosocial outcomes in longitudinal multivariable analyses when controlling for key covariates. One possible interpretation could be the effects of prayer and other CAM modalities diminish over time. A more likely explanation is that baseline functioning (e.g., psychosocial HRQoL at Time 1) is a fairly strong predictor of health outcomes 1 year later (e.g., psychosocial HRQoL at Time 2) and thus limits the impact of prayer use on Time 2 outcomes. Further research utilizing RCTs is needed to examine both the short- and long-term effects of prayer and other CAM techniques on psychosocial HRQoL in this population.

Contrary to our hypotheses, no significant relationships other than prayer and psychosocial HRQoL were shown between CAM use and psychosocial outcomes in cross-sectional analyses. There are several possible explanations for this. One possibility is that CAM use and psychosocial outcomes are actually related, but it is difficult to model the effects of CAM use in uncontrolled settings. Alternatively, CAM use truly may not be related to psychosocial outcomes in urban adolescents with asthma; rather, the effects of CAM use might be specific to clinical (i.e., asthma-related) outcomes, as supported by previous studies e.g., (20,23). Along these lines, it is worth noting that in our current analyses, asthma symptoms remained the only significant predictor of psychosocial outcomes in six out of the nine regression models, a finding consistent with literature documenting an association between asthma and psychological problems (46–50). As such, another interpretation is that CAM use is only related to psychosocial outcomes insofar as it is related to asthma-specific functioning. Future research might therefore examine asthma-related outcomes as mediators of the relationship between CAM use and psychosocial health. Finally, it is also

possible that CAM use is more strongly related to psychosocial health outcomes among adolescents with more acute clinical levels of psychological problems.

With the exception of the trend toward an increase in meditation frequency, there were no significant changes in the level of CAM use over the 1-year follow-up. This lack of change in CAM use suggests that adolescents continue to use the same CAM modalities over time, possibly because they feel the techniques may be effective in managing their asthma symptoms. Indeed, between 64% and 87% of participants perceived CAM to be effective, depending on the specific technique (14). Similarly, the only outcome that significantly changed was depressive symptoms, which showed worsening over time. Urban adolescents with asthma appear somewhat resilient to anxiety-related difficulties, despite the developmental, physical, and psychosocial challenges that exist for this population. Given that the purpose of the current study was not to examine change in CAM use per se, and any significant change to evaluate was absent, future research might examine how change in CAM use relates to change in various health outcomes over time.

There are several limitations to this study. First, this observational study design does not allow for causal conclusions regarding the relationship between greater prayer frequency and better psychosocial functioning. That is, it is not possible to determine whether greater prayer frequency leads to better psychosocial functioning or whether individuals with better psychosocial functioning are more likely to pray. Further research (e.g., RCTs, cross-lag panel analyses [longitudinal models that can approximate causal links]) is needed to determine the causal nature of these relationships. Second, we did not measure adherence to conventional asthma medications, which may be an important factor in the relationship between CAM use and outcomes. For example, adolescents who use CAM in combination with conventional medications may show different health outcomes than those who use CAM exclusively. Third, as this study relied on adolescent self-report, it was not possible to definitively assess how and even whether adolescents used the CAM techniques. Fourth, although this study examined most different CAM modalities independently, some modalities continued to be collapsed into categories (e.g., herbs/vitamins and rubs). Such categories do not allow for potentially unique effects of specific CAM modalities to be determined. For example, different herbs and vitamins have been shown to have different biochemical effects (51) and might therefore differentially impact health outcomes. Lastly, most outcomes remained relatively stable over time; this lack of variability could impair the ability to detect the effect of CAM use on longitudinal outcomes. Nonetheless important conclusions can still be drawn.

CONCLUSIONS/KEY FINDINGS

The relationship between CAM use and psychosocial health outcomes may be dependent on the specific CAM

modality. In multivariable analyses, more frequent prayer use was associated with better psychosocial HRQoL at baseline. Clinicians caring for urban adolescents with asthma should be aware of the use of prayer and its relationship to improved quality of life. Given the high rates and stability of CAM use among urban adolescents with asthma, further research of CAM use and outcomes in controlled settings is needed. Mediation models of the relationships between CAM use, asthma outcomes, and psychosocial health are warranted.

ACKNOWLEDGEMENT

This study was funded by a grant from the National Institute of Child Health and Human Development, #K23HD052639 (Cotton, PI).

DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

REFERENCES

1. ALA. Asthma and children fact sheet. Available at: <http://www.lungusa.org/lung-disease/asthma/resources/facts-and-figures/asthma-children-fact-sheet.html>. Accessed December 12, 2011.
2. Patterson JM. The epidemiology of asthma among children in the U.S. *Healthy Genes* 2003; 3(4):1–12.
3. Akinbami LJ, Moorman JE, Garbe PL, Sondik EJ. Status of childhood asthma in the United States, 1980–2007. *Pediatrics* 2009; 123(3): 131–145.
4. Strunk RC, Ford JG, Taggart V. Reducing disparities in asthma care: priorities for research—National Heart, Lung, and Blood Institute Workshop Report. *J Allergy Clin Immunol* 2002; 109(2):229–237.
5. Hill TD, Graham LM, Divgi V. Racial disparities in pediatric asthma: a review of the literature. *Curr Allergy Asthma Rep* 2011; 11(1):85–90.
6. McDaniel M, Paxson C, Waldfogel J. Racial disparities in childhood asthma in the United States: evidence from the National Health Interview Survey, 1997 to 2003. *Pediatrics* 2006; 117(5):868–877.
7. Crocker D, Brown C, Moolenaar R, Moorman J, Bailey C, Mannino D, Holguin F. Racial and ethnic disparities in asthma medication usage and health-care utilization. *Chest* 2009; 136(4):1063–1071.
8. Vila G, Nollet-Clemenson C, de Blic J, Mouren-Simeoni MC, Scheinmann P. Prevalence of DSM IV anxiety and affective disorders in a pediatric population of asthmatic children and adolescents. *J Affect Disord* 2000; 58(3):223–231.
9. Merikallio VJ, Mustalahti K, Remes ST, Valovirta EJ, Kaila M. Comparison of quality of life between asthmatic and healthy school children. *Pediatr Allergy Immunol* 2005; 16(4):332–340.
10. McQuaid EL, Kopel SJ, Nassau JH. Behavioral adjustment in children with asthma: a meta-analysis. *Dev Behav Pediatr* 2001; 22(6):430–440.
11. Barnes PM, Powell-Griner E, McFann K, Nahin RL. Complementary and alternative medicine use among adults: United States, 2002. *Semin Integr Med* 2004; 2(2):54–71.
12. Eisenberg DM, Davis RB, Ettner SL, Appel S, Wilkey S, Van Rompay M, Kessler RC. Trends in alternative medicine use in the United States, 1990–1997. *JAMA* 1998; 280(18):1569–1575.
13. National Center for Complementary and Alternative Medicine. What is complementary and alternative medicine. Available at: <http://nccam.nih.gov/health/whatiscom/2011>. Accessed December 12, 2011.

14. Cotton S, Luberto CM, Yi MS, Tsevat J. Complementary and alternative medicine behaviors and beliefs in urban adolescents with asthma. *J Asthma* 2011; 48(5):531–538.
15. Reznik M, Ozuah PO, Franco K, Cohen R, Motlow F. Use of complementary therapy by adolescents with asthma. *Arch Pediatr Adolesc Med* 2002; 156:1042–1044.
16. Braganza S, Ozuah PO, Sharif I. The use of complementary therapies in inner-city asthmatic children. *J Asthma* 2003; 40(7):823–827.
17. Mazur LJ, De Ybarro L, Miller J, Colasurdo G. Use of complementary therapies for pediatric asthma. *Tex Med* 2001; 97(6):64–68.
18. Sidora-Arcoleo K, Yoos HL, Kitzman H, McMullen A, Anson E. Don't ask, don't tell: parental nondisclosure of complementary and alternative medicine and over-the-counter medication use in children's asthma management. *J Pediatr Health Care* 2008; 22(4):221–229.
19. Pachter LM, Cloutier MM, Bernstein BA. Ethnomedical (folk) remedies for childhood asthma in a Mainland Puerto Rican community. *Arch Pediatr Adolesc Med* 1995; 149(9):982–988.
20. Shenfield G, Lim E, Allen H. Survey of the use of complementary medicines and therapies in children with asthma. *J Paediatr Child Health* 2002; 38(3):252–257.
21. Singh V, Sinha H, Gupta R. Barriers in the management of asthma and attitudes towards complementary medicine. *Respir Med* 2002; 96: 835–840.
22. Ernst E. Complementary therapies for asthma: what patients use. *J Asthma* 1998; 35(8):667–671.
23. Orhan F, Sekerel BE, Kocabas CN, Sackesen C, Adalioglu G, Tuncer A. Complementary and alternative medicine in children with asthma. *Ann Allergy Asthma Immunol* 2003; 90(6):611–615.
24. Torres-Llenza V, Bhogal S, Davis M, Ducharme FM. Use of complementary and alternative medicine in children with asthma. *Can Respir J* 2010; 17(4):183–189.
25. Ng TP, Wong ML, Hong CY, Koh KTC, Goh LG. The use of complementary and alternative medicine by asthma patients. *Q J Med* 2003; 96(10):747–754.
26. Sibbritt D, Adams J, Lui C-W. A. Longitudinal analysis of complementary and alternative medicine use by a representative cohort of young Australian women with asthma, 1996–2006. *J Asthma* 2011; 48(4): 380–386.
27. Shen J, Oraka E. Complementary and alternative medicine (CAM) use among children with current asthma. *Prev Med* 2012; 54:27–31.
28. Marino LA, Shen J. Characteristics of complementary and alternative medicine among adults with current asthma, 2006. *J Asthma* 2010; 47(5):521–525.
29. Kuttner L, Chambers CT, Hardial J, Israel DM, Jacobson K, Evans K. A randomized trial of yoga for adolescents with irritable bowel syndrome. *Pain Res Manag* 2006; 11(4):217–224.
30. Bakke AC, Purtzer MZ, Newton P. The effect of hypnotic-guided imagery on psychological well-being and immune function in patients with prior breast cancer. *J Psychosom Res* 2002; 53(6):1131–1137.
31. Sloman R. Relaxation and imagery for anxiety and depression control in community patients with advanced cancer. *Cancer Nursing* 2002; 25(6):432–435.
32. Cotton S, Weekes JC, McGrady ME, Rosenthal SL, Yi MS, Pargament KI, Succop P. Spirituality and religiosity in urban adolescents with asthma. *J Relig Health* 2010; 51(1):118–131.
33. National Heart Lung and Blood Institute. Guidelines for the diagnosis and management of asthma. Available at: <http://www.nhlbi.nih.gov/guidelines/asthma/asthgdlnh.htm>. Accessed July 15, 2010.
34. Varni JW, Burwinkle TM, Rapoff MA, Kamps JL, Olson N. The PedsQL in pediatric asthma: reliability and validity of the Pediatric Quality of Life Inventory generic core scales and asthma module. *J Behav Med* 2004; 27(3):297–318.
35. March JS, Parker JDA, Sullivan K, Stallings P, Conners CK. The Multidimensional Anxiety Scale for Children (MASC): factor structure, reliability, and validity. *J Am Acad Child Adolesc Psychiatry* 1997; 36(4):554–565.
36. Kovacs M. Children's Depression Inventory Technical Manual Update. New York: Multi-Health Systems Inc., 2003.
37. Saylor CF, Finch AJ, Spirito A, Bennett B. The Children's Depression Inventory: a systematic evaluation of psychometric properties. *J Consult Clin Psychol* 1984; 52(6):955–967.
38. Timbremont B, Braet C, Dreesen L. Assessing depression in youth: relation between the Children's Depression Inventory and a structured interview. *J Clin Child Adolesc Psychol* 2004; 33(1):149–157.
39. Varni JW, Seid M, Kurtin PS. PedsQL 4.0: reliability and validity of the Pediatric Quality of Life Inventory, version 4.0 generic core scales in healthy and patient populations. *Med Care* 2001; 39(8): 800–812.
40. William MV. Assessment of asthma control and severity. *Ann Allergy Asthma Immunol* 2004; 93(5):409–414.
41. SPSS. SPSS for Windows, 19.0. Somers. Chicago, IL: SPSS Inc., 2011.
42. McGrady ME, Cotton S, Rosenthal SL, Roberts YH, Britto M, Yi MS. Asthma and anxiety symptoms in urban adolescents with asthma: the mediating role of illness perceptions. *J Clin Psychol Med Settings* 2010; 17(4):349–356.
43. Nooney J, Woodrum E. Religious coping and church-based social support as predictors of mental health outcomes: testing a conceptual model. *J Sci Study Relig* 2002; 41(2):359–368.
44. van Olphen J, Schulz A, Israel B, Chatters L, Klem L, Parker E, Williams D. Religious involvement social support and health among African-American women on the east side of Detroit. *J Gen Intern Med* 2003; 18(7):549–557.
45. Pearce MJ, Little TD, Perez JE. Religiousness and depressive symptoms among adolescents. *J Clin Child Adolesc Psychol* 2003; 32(2): 267–276.
46. Goodwin RD, Jacobi F, Thefeld W. Mental disorders and asthma in the community. *Arch Gen Psychiatry* 2003; 60(11):1125–1130.
47. Lehrer P, Feldman J, Giardino N, Song H-S, Schmaling K. Psychological aspects of asthma. *J Consult Clin Psychol* 2002; 70(3): 691–711.
48. Strine TW, Mokdad AH, Balluz LS, Berry JT, Gonzalez O. Impact of depression and anxiety on quality of life, health behaviors, and asthma control among adults in the United States with asthma, 2006. *J Asthma* 2008; 45(2):123–133.
49. Yellowlees PM, Haynes S, Potts N, Ruffin RE. Psychiatric morbidity in patients with life-threatening asthma: initial report of a controlled study. *Med J Aust* 1988; 149(5):246–249.
50. Lavoie KL, Cartier A, Labrecque M, Bacon SL, Lemièrre C, Malo J-L, Lacoste G, Barone S, Verrier P, Ditto B. Are psychiatric disorders associated with worse asthma control and quality of life in asthma patients? *Respir Med* 2005; 99(10):1249–1257.
51. Mainardi T, Kapoor S, Bielory L. Complementary and alternative medicine: herbs, phytochemicals and vitamins and their immunologic effects. *J Allergy Clin Immunol* 2009; 123(2):283–94.e10.

Copyright of Journal of Asthma is the property of Taylor & Francis Ltd and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.