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## Complementary and Alternative Medication Use and Adherence to Inhaled Corticosteroid Among Inner-city Asthmatics

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### Abstract

**Background**—Complementary and alternative medicines (CAM) are used widely by patients with chronic diseases such as asthma. However, it is unclear whether use of CAM is associated with decreased adherence to inhaled corticosteroids (ICS), a key component of asthma management.

**Methods**—We surveyed 326 adults with persistent asthma receiving care at two inner-city outpatient clinics. Patients were asked about CAM use for treatment of asthma in the prior six months. Medication adherence was assessed using the Medication Adherence Report Scale, a validated self-report measure. Univariate and multiple regression analyses were used to assess the relationship between CAM use, adherence to ICS, and medication and disease beliefs.

**Results**—Overall, 25% (95% CI: 20–30%) of patients reported CAM use. Of those who used CAM, 39% (95% CI: 19–59%) discussed it with their physician, and 21% (95% CI: 12–31%) used CAM in place of prescribed asthma therapy. Univariate analyses showed that CAM use was associated with decreased ICS adherence and increased asthma morbidity. In multivariable analysis, CAM use was associated with lower ICS adherence (odds ratio [OR]: 0.5, 95% CI: 0.3–0.9) after adjusting for age, gender, race/ethnicity, education, years since diagnosis, language, and co-morbidities. CAM users were also more likely to worry about side effects of ICS ( $p=0.01$ ).

**Conclusion**—CAM use was associated with decreased ICS adherence among inner-city asthmatics. Medication beliefs such as worry about ICS side effects may in part mediate this relationship. CAM use may be a marker for decreased adherence to ICS, particularly among patients with poor asthma control.

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## Background

Asthma is a common chronic illness, affecting 6–7% of the United States population.<sup>1</sup> Minority, inner-city populations suffer disproportionately higher rates and increased asthma morbidity.<sup>1–4</sup> Appropriate self-management (adherence to controller medications, peak flow monitoring, asthma action plans, and environmental control practices) is critical for achieving adequate asthma control. A substantial effort has been put forth nationally towards the improvement of asthma management, particularly increased use of long-term controller medications such as inhaled corticosteroids (ICS).<sup>5</sup> Despite these efforts, asthma self-management remains sub-optimal.<sup>6–9</sup> Thus, it is important to understand the factors associated with appropriate self-management among high-risk asthmatics in order to improve disease outcomes.

Many patients with chronic illnesses, such as asthma, use complementary and alternative medicine (CAM) to treat their conditions, and utilization of CAM is increasingly widespread in the United States.<sup>10</sup> A review of 17 articles reported that up to 70–80% of adult asthmatics use CAM.<sup>11</sup> While CAM may be acceptable for some patients, a potential concern is that CAM may be used in place of prescribed ICS. There is limited data regarding use of CAM and patient adherence to prescribed medications, with inconsistent results.<sup>12–14</sup> An important unanswered question is whether use of CAM, a common practice among asthmatics, is associated with decreased adherence to ICS, a critical component of asthma self-management.

The purpose of this study was to examine the association between CAM use, adherence to prescribed ICS, and medication and disease beliefs in an inner-city minority asthmatic population, a group at especially high risk for poor asthma outcomes.

## Methods

### Patient Population

We analyzed data collected as part of a cohort study of adult asthmatics receiving care at two hospital-based clinics located in East Harlem, New York City, and New Brunswick, New Jersey.<sup>15, 16</sup> Study participants were enrolled over a 33-month period, from July 2004 to March 2007.

The computerized registration systems were screened to identify potential participants with a physician diagnosis of asthma (ICD-9 codes 493.XX). Patients were eligible if they were  $\geq 18$  years old; spoke English or Spanish; and had mild persistent, moderate, or severe asthma.<sup>17</sup> Individuals with a smoking history of  $\geq 10$  pack-years or other chronic respiratory illness were excluded. The study protocol was approved by the Institutional Review Board of Mount Sinai School of Medicine and Rutgers University, and written informed consent was obtained from all participants.

### Data Collection and Measurements

Bilingual research staff conducted interviewer-administered surveys in English or Spanish. The Spanish translation of questions was back-translated into English, and the original and back-translated versions were compared to confirm their equivalence across languages.

The primary variable of interest was use of CAM for asthma. Patients were asked whether they had used any complementary or alternative therapies to treat asthma during the prior six months. Participants who reported using CAM were then asked if they had used these remedies in place of their prescribed medicines and whether they had told their doctor about their use. The items addressing CAM use were adapted from the National Inner City Asthma Study.<sup>18</sup>

Predictors of interest included socio-demographic characteristics, number of years with asthma, emergency department visits during the prior year, hospitalizations, history of intubation, asthma self-management behaviors, and co-morbidities. To assess asthma control, we used the Asthma Control Questionnaire (ACQ), validated in English and Spanish, which includes items about wheezing, night awakenings, activity limitation, and bronchodilator use.<sup>19</sup> All questions were scored on a 7-point Likert scale, with higher scores indicating worse asthma control. Additionally, we administered the Mini Asthma Quality of Life Questionnaire (AQLQ) to assess the impact of asthma on patients' quality of life. This instrument, validated in English and Spanish, contains questions about activity limitations, symptoms, emotional function, and environmental stimuli; higher scores indicate better quality of life.<sup>20</sup>

The outcome of interest was self-reported ICS adherence. Adherence was assessed with the Medication Adherence Report Scale (MARS), a 10-item questionnaire previously validated against objective measures of adherence (electronic monitoring).<sup>9, 21, 22</sup> The MARS, available in English and Spanish, contains items measuring intentional non-adherence as well as non-intentional non-adherence, such as forgetting to use medication. Medication use is rated on a 5-point Likert scale, with higher scores indicating better adherence. Consistent with prior studies, a patient was classified as "adherent" if they had a MARS score of > 4.5. This corresponded to  $\geq 80\%$  ICS adherence in a prior study validating the MARS against an electronic adherence measure.<sup>22</sup>

The survey also included questions evaluating medication and disease beliefs which are potentially associated with self-management behaviors according to Leventhal's Self-Regulatory Model.<sup>23-25</sup> To assess disease beliefs, we asked patients whether they thought they had asthma all the time or only when they had symptoms<sup>26</sup> and whether they believed they would always have asthma. Patients were also asked if they expected their doctor to cure their asthma and whether they had asthma because their lungs were always a little inflamed. We ascertained medication beliefs about ICS use, in particular beliefs about necessity and concerns using the framework proposed by Horne et al.<sup>27</sup> Beliefs about ICS necessity included questions about importance of using ICS when asymptomatic, confidence in how well ICS work, and whether future health depended on ICS use. Concerns about ICS included worry about side effects and developing addiction. Additionally, patients' self-efficacy for asthma management was measured by assessing perception of control over future health, confidence in ability to control asthma, confidence in ability to use medications, and whether their asthma regimen was hard to follow.

We also evaluated use of other asthma self-management behaviors. Patients were asked about environmental control practices in the home (eliminating cockroaches, cleaning up dust or mold, and washing bed sheets in hot water), use of asthma action plans to manage asthma, frequency of routine asthma visits, and use of peak flow meters.

### Statistical Analysis

Differences in baseline characteristics and health beliefs of CAM users and non-users were evaluated using the t-test, chi-square test, or Wilcoxon rank sum test as appropriate. The univariate association of CAM use with medication adherence was assessed using the chi-square test.

Multiple logistic regression was used to assess whether CAM use was associated with medication adherence, after adjusting for age, gender, race/ethnicity, education, primary language, number of years with asthma, and disease co-morbidities. Odds ratios are presented with 95% confidence intervals (CIs). All analyses used two-tailed significance levels of  $p < 0.05$  and were conducted with SAS statistical software (SAS Institute, Cary, NC).

## Results

Between June 2004 and March 2007, 1,435 patients with a diagnosis of asthma were identified. Of these, 1,054 were excluded due to: no history of asthma (316 patients, 30%), mild intermittent asthma severity (232 patients, 22%), history of smoking  $\geq 10$  pack-years (180 patients, 17%), other chronic lung diseases (179 patients, 17%), cognitive impairment (42 patients, 4%), and other reasons (105 patients, 10%). Of the remaining 380 eligible patients, 55 (14.5%), did not participate in the study, leaving a cohort of 326 patients with asthma.

Consistent with the epidemiology of inner-city asthma, most subjects were female (83%), of Hispanic ethnicity (55%) or black race (27%), with  $<10\%$  of the participants being white. Most participants were insured by Medicaid or Medicaid and/or Medicare (76%), and 62% reported an annual income  $< \$15,000$  per year.

Overall, 25% (95% CI: 20–30%) reported use of CAM for asthma management during the prior six months. Of those, 39% (95% CI: 19–59%) reported telling their physician about the use, and 21% (95% CI: 12–31%) reported using CAM in place of their prescribed asthma therapy. Consistent with other studies of CAM use for asthma, teas (48%) and herbs (9%) were the most commonly used therapies.

As shown in Table 1, patients using CAM were younger ( $p=0.02$ ) and more likely to have been hospitalized ( $p=0.02$ ) or intubated ( $p=0.004$ ) for asthma. Race ( $p=0.38$ ) and rate of high school graduation ( $p=0.12$ ) were similar among the groups. Number of years with asthma and emergency department visits in the past year were not different between the groups ( $p > 0.1$ ). Both groups had similar asthma control as measured by the ACQ score ( $p=0.07$ ). Those who reported CAM use had lower AQLQ scores, indicating poorer quality of life ( $p=0.02$ ).

In univariate analyses, use of CAM was significantly associated with ICS adherence. Among CAM users, 32% were adherent compared to 47% of non-users ( $p=0.02$ ). Similarly, multivariable analyses showed that CAM use was significantly associated with lower ICS medication adherence after controlling for age, race/ethnicity, gender, education, language, number of years with asthma, and co-morbidities (Table 2). The odds of adherence among CAM users were approximately 50% that of non-users (OR: 0.5, 95% CI: 0.3–0.9).

CAM use was also associated with some medication and disease beliefs (Table 3). Patients reporting concern about ICS side effects were more likely to use CAM ( $p=0.01$ ). Similarly, difficulty following a medication schedule was associated with increased CAM use ( $p=0.001$ ). In regards to disease beliefs, patients who believed they had asthma because their lungs are always a bit inflamed were more likely to use CAM ( $p=0.04$ ). Finally, other measures of asthma self-management were not associated with CAM use in this population (Table 4). There was no difference in the use of environmental control practices, following an asthma action plan, frequency of routine asthma visits, or use of peak flow meter ( $p > 0.1$  for all comparisons).

## Discussion

Asthma is a common chronic illness that causes considerable morbidity among minority inner-city populations.<sup>1–4</sup> Suboptimal medication adherence is one of the main factors contributing to poor outcomes.<sup>26, 27</sup> This study examined the association between CAM use for asthma and ICS adherence among inner-city adults. We found that in these patients, CAM use was associated with decreased ICS adherence but not related to other self-management behaviors. Additionally, CAM use was associated with increased worry about ICS side effects, suggesting that some patients may replace their ICS for CAM because of concerns about the safety of asthma controller medications.

There is limited data in the literature about CAM use and medication adherence. Our results are consistent with those of George et al. who studied this relationship among patients with COPD.<sup>12</sup> In this study of 276 patients with COPD, 24% of CAM users had high adherence compared to 43% of CAM non-users. Conversely, Feldman et al. examined this issue among 118 patients with juvenile idiopathic arthritis and found no association between CAM use and medication adherence.<sup>13</sup> Similarly, Shalansky et al. studied this relationship among 367 patients taking chronic cardiovascular medication therapy and found comparable rates of adherence among CAM users and non-users.<sup>14</sup> Potential explanations for these discrepancies include differences in type and severity of illness, patient population affected, or types of medications prescribed for the disease. Our results are similar to the study of patients with COPD, a disease process similar to asthma, also requiring patients to take inhaled medications. Our study extends the results of prior research by evaluating medication and disease beliefs potentially mediating the relationship between CAM use and medication adherence among patients with chronic disease.

In our study, CAM users had worse asthma morbidity and poorer quality of life. Due to the cross-sectional nature of this study, it is not possible to determine the directionality of this association. Decreased medication adherence may be responsible for worse outcomes among patients using CAM. However, increased severity of illness may lead patients to use CAM in an attempt to achieve better asthma control. Regardless of the mechanism of association, physicians should routinely discuss CAM use with their patients, especially those with increased severity and poor control, as they may be more prone to CAM use and potential medication non-adherence. Other measures of self-management were similar between the two groups, indicating that medication adherence is the primary component of asthma management associated with CAM use.

The differences in certain medication beliefs highlight possible explanations for the decreased adherence among CAM users. Those reporting CAM use were more worried about ICS side effects, which may partially explain decreased adherence to those medications. Also CAM users found their medication schedule more difficult to follow, another potential reason for decreased adherence among these patients. In addition, CAM users were somewhat less likely to believe that ICS would protect them from getting worse ( $p=0.08$ ). Interestingly, CAM users were more likely to believe they had asthma because their lungs were always a little inflamed, reflecting appropriate understanding of the disease process. Further research is necessary to evaluate if targeting these beliefs can help improve ICS adherence among CAM users.

These results have important implications for the education and counseling of patients with asthma. This study underscores the importance of consistently eliciting a history of CAM use, particularly among patients with poor asthma control. Furthermore, beyond obtaining a history of use, it is important to discuss associated medication beliefs, such as concerns about prescribed medications.<sup>27</sup> Although CAM may be acceptable for some patients with preferences for using these products, it needs to be used in conjunction with prescribed ICS to obtain optimal asthma control. By engaging in open and nonjudgmental discussion with patients about CAM use as well as concerns or difficulties regarding ICS, clinicians can potentially improve adherence to ICS, a critical component of asthma self-management.

This study has some strengths and limitations worth noting. Because study subjects were enrolled from two hospital-based outpatient clinics, patients without a regular place of care were not represented in the study. Additionally, we excluded patients with mild intermittent asthma and the impact of CAM use may be different among patients with less severe disease. The questionnaire item assessing CAM use was adapted from a validated survey<sup>18</sup> and asked patients about their use of teas, rubs, and herbs for asthma. However, we did not collect data regarding other types of CAM, such as yoga or prayer. The relationship between medication

beliefs, adherence to ICS, and CAM use may be different among patients using other types of CAM; thus, our results may not be applicable to these practices. Adherence was assessed using MARS, a self-report measure and potentially less accurate than electronic measures of adherence. However, this scale has been validated and shown to be an accurate predictor of adherence.<sup>9, 21, 22</sup>

An important strength is that this study is theoretically grounded. Leventhal's Self-Regulation Model, outlining relationships between health beliefs and disease self-management, has been used extensively to help explain the management of different diseases, including diabetes, hypertension, and heart failure.<sup>25, 28, 29</sup> Horne's necessity/concern framework extends the Self-Regulation Model, which is focused on disease beliefs, by including treatment beliefs as well. Our study builds on these theoretical frameworks to suggest potential mechanisms for ICS non-adherence among patients using CAM.

In summary, we found a strong association between CAM use and medication adherence among inner-city asthmatics. These data can be helpful to healthcare providers in identifying patients who are potentially at increased risk of medication non-adherence. Exploring medication beliefs in an open dialogue with asthmatics who report CAM use could be especially important among inner-city, minority patients, a group who is already at higher risk for asthma morbidity and mortality.

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**Table 1**

Baseline Characteristics of Study Subjects According to Complementary and Alternative Medicine Use

Characteristic	No CAM Use	Uses CAM	P-value
Age (mean $\pm$ SD)	49.0 $\pm$ 14.1	45.6 $\pm$ 10.3	0.02
Female (%)	82.5	82.9	0.94
Race/ethnicity (%)			0.37
White	14.9	8.5	
Black	27.0	25.6	
Latino	53.3	58.5	
Other	4.6	7.3	
English as Native Language (%)	58.6	59.8	0.85
High School Graduate	65.0	74.4	0.12
Insurance Status (%)			0.74
Medicaid or Medicaid/Medicare	77.5	73.2	
Medicare only	2.5	2.4	
Other (private and no insurance)	19.9	24.4	
Annual Income (%)			0.99
<\$5000	21.2	22.2	
\$5000-15,000	39.4	38.3	
\$15,000-30,000	13.3	11.1	
\$30,000-50,000	9.2	11.1	
>\$50,000	11.20	11.1	
Don't Know/Refused	5.8	6.1	
Asthma History			
Number yrs. with asthma (mean $\pm$ SD)	26.8 $\pm$ 16.1	24.2 $\pm$ 15.0	0.22
On controller medication (%)	79.2	75.6	0.69
Ever Hospitalized (%)	49.2	64.6	0.02
Ever Intubated (%)	7.5	18.8	0.004
Number ED visits past yr (mean $\pm$ SD)	1.9 $\pm$ 3.5	2.1 $\pm$ 2.7	0.57
Asthma control <sup>2</sup> (mean $\pm$ SD)	2.9 $\pm$ 1.2	3.2 $\pm$ 1.3	0.07
Quality of Life <sup>3</sup> (mean $\pm$ SD)	4.3 $\pm$ 1.5	3.9 $\pm$ 1.3	0.02
Co-morbidities			
Seasonal Allergies	63.07	72.0	0.14
Sinusitis	20.0	34.1	0.01
Depression	43.6	54.9	0.08
Anxiety or panic attacks	35.7	40.2	0.43

<sup>1</sup> Assessed by Asthma Control Questionnaire score

<sup>2</sup> Assessed by Asthma Quality of Life Questionnaire score



**Table 2**

Results of Multivariable Analyses of Predictors of Adherence to Inhaled Corticosteroids

Variable	Odds Ratio	95% Confidence Interval
Use of Complementary or Alternative Medicine	0.5	0.3–0.9
Age	1.0	0.9–1.0
Female Gender	1.4	0.7–2.9
Race		
White	Reference	
Black	0.4	0.1–1.3
Latino	0.3	0.1–0.9
Other	0.5	0.1–2.2
High school Graduate	2.1	1.2–3.8
Number of Years with Asthma	1.0	0.9–1.0
English as Native Language	0.6	0.3–1.2
Co-morbidities		
Sinusitis	1.0	0.6–1.8
Allergies	1.0	0.6–1.8
Depression	0.8	0.4–1.5
Anxiety	0.8	0.4–1.6

**Table 3**

Differences in Health Beliefs According to Complementary and Alternative Medicine Use

<b>Disease Beliefs</b>	<b>No CAM Use Mean ± SD</b>	<b>Uses CAM Mean ± SD</b>	<b>P-value</b>
Have asthma all the time, not just with symptoms	2.4 ± 1.3	2.2 ± 1.2	0.24
Expect doctor to cure asthma	1.4 ± 0.9	1.7 ± 1.1	0.19
Have asthma because lungs are always inflamed	2.2 ± 1.0	2.5 ± 1.1	0.04
Believe always will have asthma	2.9 ± 1.1	2.9 ± 1.0	0.71
<b>Medication Beliefs</b>			
Worry about side effect of ICS	2.6 ± 1.5	3.2 ± 1.7	0.01
Worry about addiction to ICS	2.2 ± 1.5	2.6 ± 1.8	0.13
Confidence that ICS works well	3.9 ± 1.1	3.9 ± 1.1	0.93
Believe that ICS protects from becoming worse	4.1 ± 1.1	3.9 ± 0.9	0.08
Important to use ICS when <i>no</i> symptoms	3.4 ± 1.0	3.4 ± 1.0	0.69
Future health depends on asthma controller medicines	4.2 ± 0.8	4.0 ± 1.0	0.29
<b>Self-Efficacy</b>			
Have control over future health	3.1 ± 0.9	3.2 ± 1.0	0.13
Confidence in ability to control asthma	3.6 ± 1.1	3.4 ± 1.2	0.24
Confidence in ability to use ICS	4.1 ± 0.9	4.2 ± 0.9	0.75
Difficulty Following Medication Schedule	1.2 ± 0.5	1.6 ± 1.1	0.001

CAM: Complementary and Alternative Medicine

ICS: Inhaled Corticosteroids

**Table 4**

Association Between Complementary and Alternative Medicine Use and Asthma Self Management Behaviors

Environmental Control Practices (%)	No CAM Use	Uses CAM	P-value
Removed pet from home	24.1	25.6	0.92
Removed carpets from home	24.9	25.6	0.83
Wash bed sheets in hot water	86.7	90.2	0.56
Eliminate cockroaches from home	80.9	82.9	0.55
Clean up dust or mold in home	93.8	97.6	0.38
<b>Other Self-Management Behaviors (Mean <math>\pm</math> SD)</b>			
Follow asthma verbal instructions to make management decisions	3.5 $\pm$ 1.2	3.4 $\pm$ 1.1	0.74
Follow asthma written instructions to make management decisions	3.1 $\pm$ 1.0	3.0 $\pm$ 1.1	0.91
Frequency of routine asthma visits	3.5 $\pm$ 1.2	3.5 $\pm$ 1.2	0.82
Frequency of peak flow use	2.5 $\pm$ 1.3	2.7 $\pm$ 1.3	0.56
Use peak flow to make medication adjustments	2.1 $\pm$ 1.4	2.3 $\pm$ 1.3	0.13