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Asthma medication adherence: The role of God and other health locus of control factors

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Introduction

It is well documented throughout the literature that medication adherence is a major contributor to disease outcomes,¹ and that poor adherence is common across a spectrum of diseases, especially chronic conditions such as asthma.²⁻⁵ Barriers to adherence are numerous and include a variety of patient factors (e.g., low prioritization), physician factors (e.g., the prescribing of complex medication regimens), and health delivery or financing issues (e.g., medication costs and limited access to appointments).^{1, 6-9} While many psychosocial factors have been studied, these usually only explain a limited proportion of the overall variation in medication adherence, suggesting that other important and understudied explanatory variables exist.^{7, 10, 11}

Perhaps one important factor, that deserves more research, is an individual's belief in "God" and God's perceived role in influencing health. In research to date, this construct has generally been grouped into part of a broader set of factors called health locus of control (HLC). HLC can be conceptualized as an individual's belief about whom or what determines health and health outcomes. At this point, most research on HLC and medication adherence has focused on internal control (i.e., personal behaviors), chance control (i.e., fate/luck), and control by powerful others (i.e., health professionals and other people).¹²⁻¹⁴ A fourth domain, God or Higher Power control has also been identified,¹⁵⁻¹⁷ but this has not been widely studied with respect to medication adherence.¹⁸

We hypothesize that individuals who place greater faith in God to manage their asthma control would be less likely to personally manage their asthma with regular adherence to controller medications. This hypothesis is based on previous qualitative research, which has shown that individuals who believed that God determined HIV outcomes were less likely to follow medical recommendations.¹⁹ To test our hypothesis, we examined this relationship

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among individuals enrolled in the Adherence Feedback for Improving Respiratory Medication Use (AFFIRM) trial.

Methods

Setting and population

The AFFIRM protocol was approved by the Institutional Review Board at Henry Ford Hospital. Informed consent was obtained from all participants. Participants were enrolled in a cluster-randomized controlled trial to improve medication adherence through adherence information feedback. Additional details regarding the trial are described elsewhere,²⁰ but briefly, participants were clustered by their primary care physician and each physician was randomly assigned to either the intervention or control group. The current study is based on questionnaire responses from mailed participant surveys and baseline measurements of ICS adherence prior to the start of the intervention. As the trial involved data collected as part of routine health system operations, passive implied consent, was obtained from all study participants in the form of a letter sent to all study individuals accompanied by the baseline questionnaire. Individuals were informed in the letter that their return of the survey was considered to be consent to participate, including an implied agreement to participate from both children (<18 years old) and their parent/guardian for all surveys of children. Eligible patients had to fulfill the following criteria: a previous electronic prescription for an ICS between January 19, 2005, and April 30, 2007; age 5 to 56 years as of April 30, 2007; continuous enrollment in the affiliated private, not-for-profit health maintenance organization (HMO) for at least 1 year before April 30, 2007; prescription drug coverage as of April 30, 2007; at least 1 physician diagnosis of asthma and no diagnosis of chronic obstructive pulmonary or congestive heart failure after January 19, 2005; and at least 1 visit to a primary care provider in the year before April 30, 2007. Adult participants (≥ 18 years old) and parents of children (<18 years old) were mailed surveys. Participants, age 18+, completed their own survey and parents, of children age 5-17, were asked to complete the survey with their child. In the latter scenario, the survey was designed to represent the views of the child.

Estimation of medication adherence

Similar to previous research conducted by the study team, ICS adherence was calculated based on automated data from electronic prescriptions and pharmacy claims.²¹ In short, the days' supply of a given inhaler dispensing was calculated using the information on the number of doses per canister (as derived from the National Drug Code for the inhaled steroid dispensed) and the number of prescribed puffs per day (as gleaned from electronic prescription information). Adherence was then estimated as a 'continuous, multiple-interval measure of medication adherence' (CMA)²² whereby the cumulative days supplied was divided by the number of days of observation. Baseline ICS adherence was measured over a 3-month period from May 1, 2007 through July 31, 2007 for all active daily prescriptions, and not including medications usually prescribed for episodic use (e.g., short-acting beta agonists). Patients with a baseline ICS CMA ≥ 80% were considered to be adherent and patients with a baseline CMA <80% were considered to be non-adherent. The CMA level of 80% is commonly used in medication adherence studies, and compares to an appropriate therapeutic level in our previous research.^{10, 21, 23, 24}

Patient demographic and survey data

Contemporaneous with the measurement of baseline ICS adherence, eligible participants were sent a survey that included questions on demographics as well as validated measures of perceptions and beliefs regarding their asthma and asthma treatment,^{25, 26} asthma control,²⁷ social support/stressors,²⁸ depression,²⁹ perceived discrimination,³⁰ exposure to crime/

violence,³¹ and the Multidimensional Health Locus of Control (MHLC) scale.^{16, 32, 33} The MHLC includes four subscales (i.e., internal, chance, God or other Higher Power, and powerful others), and Form C can be tailored to specific disease conditions.^{16, 32-34} The 'powerful others' subscale is divided into two subscales (i.e., doctors and other people) on Form C.³⁴ An example of a statement rated by patients is: "Most things that affect my asthma happen because of God" (God/Higher Power). Each statement was rated via a 6-point Likert scale from strongly disagree (=1) through strongly agree (=6). We scored each domain as the average response for all of the statements in that domain. We also dichotomized the results for each subscale for overall disagreement and agreement (i.e., average subscale score <4 and ≥4, respectively). The MHLC forms can be found at <http://www.vanderbilt.edu/nursing/kwallston/mhlc scales.htm>. Information on sex, age, race, number of emergency department (ED) visits for asthma, and number of ICS fills were available via the health system's electronic records. Race as recorded in the health system's record is usually based on patient self-report, but in some instances could have been assigned by the health care personnel entering the record. We have previously found health system records to closely match patient self-reported race in other studies.³⁵

Analysis

Descriptive analyses of patient characteristics and baseline variables were estimated for the entire cohort. Additional descriptive analyses were conducted to stratify these variables between white and African Americans. We used the Mann-Whitney test (continuous) and the Chi-Square test (categorical) to examine baseline differences between white and African Americans.

The main study outcome was ICS adherence defined dichotomously as adherent (i.e. CMA ≥80%) and non-adherent (CMA<80%). For the main analysis, multivariable logistic regression was used to investigate the relationship between ICS adherence and each of the MHLC domains (continuous), while simultaneously adjusting for age, race, sex, number of historical asthma-related ED visits in the preceding 12 months, and the number of oral corticosteroid fills in the preceding 12 months. These last two variables were included as proxies of underlying disease severity. These models also adjusted for practice cluster (i.e., patients receiving care from the same practice group). Bivariable models were also used to investigate each of the above variables (i.e., adherence regressed on each variable adjusted by practice cluster). We also assessed for interactions between the God HLC variable and race, and performed stratified analyses by race after we found a significant interaction. As a check of the relationship between the HLC domains and adherence, we re-ran our regression models with the dichotomized subscale scores (i.e., agreement vs. disagreement). All analyses were performed using SAS v9.2; a *P* value of <0.05 was considered statistically significant.³⁶

Results

Survey and electronic medical record data were available for 1,025 participants. The overall level of participation on the mailed survey was 56.3% among eligible participants. Table 1 shows the sample characteristics of the survey respondents stratified by White (n=702) and African American (n=323) race. The mean level of ICS adherence was 36%, but was on average higher for white individuals as compared with African American individuals. White participants were older, but had fewer asthma-related ED visits when compared with African American individuals. Overall, MHLC scores were highest and lowest for the doctor and God/Higher Power subscales, respectively. African American individuals reported significantly higher scores, compared to white individuals, on the God locus of control scale, and lower scores on the internal domain. This suggested that African American individuals were more likely to report that God played an influential role in their asthma, whereas white

individuals were more likely than African American participants to suggest they played an influential role in their own asthma control.

Results of the bivariable and multivariable logistic regression analyses on ICS adherence are shown in Table 2. In both models, a higher reported value on the God HLC domain was associated with a lower likelihood of ICS adherence. Conversely, higher values on the doctor HLC domain were associated with a significantly higher likelihood of ICS adherence. The chance, internal, and other people control domains were not significantly associated with ICS adherence. White participants, older participants, and individuals with a prior ED visit for asthma were also more likely to be adherent in the multivariable regression models.

We examined potential interactions between age, race, and sex and the God HLC domain on ICS adherence. The only significant interaction was between race and God HLC (see Table E1). Accordingly, we stratified the regression models predicting ICS adherence by white and African American racial groups (Table 3). Both white and African American individuals demonstrated an inverse relationship between the God HLC variable and ICS adherence, but this relationship was only statistically significant among African American individuals. In contrast, the doctor domain was positively and significantly associated with adherence in white individuals but not in African American individuals.

Furthermore, we assessed possible variation between children (5-17 years old; n=221) and adults (18+ years old; n=804) to examine variation in ICS adherence as a function of age (Table E2). Statistically significant variation in adherence and covariates of interest among adults mirrored the results found in the main analyses (see Table 2), but these relationships were not present among children. For example, children and adults had similar inverse relationships between God HLC and adherence, but only the relationship for adults was statistically significant. In addition, as a post-hoc analysis, education (high school degree, some college, college degree) was included in the adult-only model, but an association ($p=0.251$) was not found and the estimates in the model shown did not change appreciably.

As additional post-hoc checks of our data, we repeated our analysis using a dichotomous variable for each HLC variable (i.e., agree vs. disagree). These analyses are shown in the online supplement (Table E3). We again found the same relationship for the God HLC domain, but not the doctor HLC domain. Agreement with the God HLC domain was associated with a lower likelihood of ICS adherence, whereas there was not a statistically significant agreement between the doctor domain and the likelihood of ICS adherence. We also assessed the relationship between God/Higher Power HLC and adherence controlling for beliefs and perceptions about asthma and asthma treatment as measured by subscales from the Illness Perception Questionnaire (IPQ) and the Beliefs about Medicines Questionnaire (BMQ).^{25, 26} While the medication necessity subscale from the BMQ was consistently associated with ICS adherence, the analysis also showed that the God/Higher Power HLC variable was still significantly associated with adherence and that the magnitude of the effect estimate was minimally affected (i.e., <10% change) after these additional adjustments (Table E4). Moreover, the God/Higher Power HLC measure was not independently associated with the IPQ and the BMQ subscales (Table E5). These findings suggest that the constructs measured by these subscales did not confound or mediate the relationship between God/Higher Power HLC and ICS adherence.

Discussion

To our knowledge this is one of the first studies to look at the relationship between patient beliefs about God's role in disease control and objective measures of medication adherence, and the first in the context of asthma. Furthermore, the composition of our patient

population allowed us to examine potential differences in these relationships between white and African American individuals.

Consistent with earlier smaller studies,^{19, 37} this research found that individuals who believed that God or a Higher Power determined their health were more likely to be non-adherent. While this relationship was similar among African American and white participants in our study, it was both stronger and statistically significant only among African American participants. One hypothesis is that this may be due to the estimated greater number of positive religious coping strategies often used among African American individuals to deal with health concerns.³⁸ This may also comport other research suggesting that African American patients may have a stronger belief in religion, especially when dealing with chronic disease.³⁹

Moreover, it is also interesting that the doctor locus of control domain, which is a measure of one's faith in their doctor's control over disease, was only significantly associated with medication adherence among white participants with asthma. In contrast, the relationship between the doctor HLC and adherence was virtually non-existent among African American individuals. This is consistent with reports of higher levels of physician distrust among African American patients, as compared with White patients, which may be attributed to historical and/or personal injustices experienced by the former group.⁴⁰⁻⁴³

It is difficult to determine whether these same relationships would exist for conditions other than asthma. For example, asthma, unlike other chronic conditions, can be punctuated by sudden and symptomatically severe exacerbations.^{44, 45} The frequency of severe asthma exacerbations also differ by race, with African American individuals experiencing rates of asthma-related emergency room visits, hospitalizations, and deaths up to three times higher than those of white individuals.⁴⁶ It is unknown, but conceivable that the severity of sudden asthma exacerbations may contribute to the observed differences in HLC between groups. Nonetheless, further investigation into these relationships both with population groups and for different disease conditions is warranted.

While the results are intriguing, they must be taken in the context of study limitations. First, this study did not assess type of religion. Nonetheless, it is believed that belief in God's control over health is a more appropriate measure for the underlying construct, and thus was chosen for this study. Second, all of the patients in this sample were covered by health insurance and resided in one metropolitan area. Results might vary elsewhere. However, the study as conducted in this health system has a major strength in that adherence data could be obtained without the constraint of lack of health care coverage.¹⁰ Third, while the electronic records allow us to measure when a prescription is filled, we are not able to determine if a patient actually uses the medication. It is possible that some patients refill a prescription without completing a previous dose. Nonetheless, we have shown that these measures of adherence have predictive validity as they are strongly related to outcomes in disease conditions.^{3, 4, 20} Fourth, the observed differences between children and adults may have been related to statistical power. Additional research may help to clarify the findings. Fifth, the survey participation level was 56% and non-respondents were more often younger, male, and non-white.⁷ The findings may have differed if complete capture of patients were achieved. Finally, we did not identify an intermediary mechanism by which God HLC affects asthma medication adherence. For example, perceptions of asthma and attitudes about asthma medication did not appear to mediate the relationship between God/Higher Power HLC and ICS adherence. Nevertheless, awareness of the latter relationship alone may be sufficient to promote physician-patient discussion

In summary, this study demonstrates that patients who believe that God (or Higher Power) determines their health are less likely to be adherent to their asthma controller medication. It is important to note that belief in God does not equate to belief that God determines health. As such, this study found that patient's who believe that God determines health outcomes were less adherent – not that those who believe in God were less adherent. It is also possible that individuals believe that multiple factors (doctors, God/High Power, etc.) coexist in order to determine health outcomes. Nonetheless, the God/Higher Power domain was associated with poorer adherence even when controlling for the other HLC factors in our analyses. This suggests that beliefs about whether God/Higher Power determines health are important in medical decision making. Thus, future adherence research should include measures of spirituality as a possible influential factor in health and participation in health care, especially when designing interventions to address medication use.

These findings also have important ramifications for physicians as they seek to improve medication adherence among their patients with asthma. First, physicians and others should be aware that their credibility as a force to improve health may differ among population groups, and therefore may require different approaches to establish a trusting rapport. For example, this study found significant differences in God HLC between white and African Americans. Therefore, physicians should talk with their patients about health locus of control factors. A brief conversation about whether patients have religious or spiritual related health needs in the treatment process should aid in building rapport and tailoring the treatment approach. While lengthy for a typical office visit, physicians and other health professionals with additional time during clinic visits may consider using the MHLC scale to assess their patients' needs. Second, by understanding HLC and specifically the God/Higher Power dimension, physicians may be more mindful of patient beliefs which seem to influence the taking of prescribed medications so as to engender respectful and appropriately tailored physician-patient discussions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1

Baseline characteristics of study sample stratified by race/ethnicity.

	Total sample (n=1,025)	White individuals (n=702)	African American individuals (n=323)	P value *
Age (in years) – mean $\pm$ SD	37.59 $\pm$ 14.77	38.41 $\pm$ 14.65	35.81 $\pm$ 14.90	0.004
Female sex – no. (%)	675 (65.9)	464 (66.2)	211 (65.3)	0.786
Health locus of control – mean $\pm$ SD [†]				
God/Higher power	1.92 $\pm$ 1.18	1.71 $\pm$ 1.05	2.38 $\pm$ 1.31	0.001
Internal	3.90 $\pm$ 1.00	3.96 $\pm$ 0.97	3.77 $\pm$ 1.05	0.008
Chance	2.09 $\pm$ 0.87	2.09 $\pm$ 0.83	2.09 $\pm$ 0.95	0.354
Doctors (Powerful others)	4.94 $\pm$ 0.92	4.95 $\pm$ 0.93	4.94 $\pm$ 0.90	0.643
Other People (Powerful others)	2.65 $\pm$ 1.09	2.69 $\pm$ 1.06	2.57 $\pm$ 1.15	0.059
Medical History [‡]				
No. ED visits for asthma – mean $\pm$ SD	0.04 $\pm$ 0.23	0.02 $\pm$ 0.16	0.08 $\pm$ 0.32	0.001
No. oral corticosteroid fills - mean $\pm$ SD	0.57 $\pm$ 1.17	0.61 $\pm$ 1.27	0.50 $\pm$ 0.91	0.414
ICS Adherence (%) – mean $\pm$ SD [§]	36% $\pm$ 40% (n=1,004)	39% $\pm$ 41% (n=687)	28% $\pm$ 36% (n=317)	0.001

SD denotes standard deviation; ED, emergency department; and ICS, inhaled corticosteroid.

* For the comparison on white and African American individuals. Comparisons of continuous variables were performed using the Mann-Whitney test, and categorical variables were compared using a chi-square test.

[†] Each health locus of control domain is scored using a Likert scale of values 1-6. Higher values represent a greater belief that that domain controls a patient's asthma. For example, higher scores on the doctor locus of control scale represent an individual's belief that their health provider is influential in the control of their asthma.

[‡] Represents the number of asthma-related events in the 12-month window preceding date of the survey.

[§] Represents a 3-month measure of ICS use from the time of the initial survey

Table 2

Predictors of inhaled corticosteroid adherence among individuals with asthma.*

	Two-variable Models [†]		Multivariable Model [‡]	
	OR (95% CI)	P value	OR (95% CI)	P value
Age, years	1.45 (1.25, 1.69)	0.001	1.41 (1.23, 1.63)	0.001
Female, sex [§]	0.90 (0.58, 1.42)	0.664	0.73 (0.47, 1.23)	0.192
African American, race	0.48 (0.33, 0.70)	0.001	0.51 (0.37, 0.72)	0.001
Medical History [¶]				
ED visits for asthma	1.58 (0.96, 2.60)	0.069	2.21 (1.36, 3.61)	0.001
Oral corticosteroid medication fills	0.94 (0.81, 1.08)	0.375	0.89 (0.77, 1.03)	0.128
Health Locus of Control ^{**}				
God/Higher power	0.74 (0.63, 0.86)	0.001	0.80 (0.67, 0.94)	0.008
Internal	1.07 (0.93, 1.24)	0.344	0.97 (0.84, 1.12)	0.660
Chance	0.89 (0.70, 1.13)	0.332	1.08 (0.79, 1.48)	0.611
Doctors (Powerful others)	1.40 (1.12, 1.75)	0.003	1.34 (1.08, 1.67)	0.008
Other People (Powerful others)	0.97 (0.88, 1.07)	0.509	0.98 (0.89, 1.09)	0.747

OR denotes odds ratio; CI, confidence interval; and ED, emergency department.

* All models are predicting inhaled corticosteroid (ICS) adherence defined as 80% use (adherent) and <80% use (non-adherent).

[†] Odds ratio for ICS adherence for the variable shown adjusted by the practice cluster (i.e., the group of physicians from whom the patient usually receives care).

[‡] Odds ratio for ICS adherence for the variable shown adjusted for all other variables shown and the practice cluster (i.e., the group of physicians from whom the patient usually receives care).

[§] As compared with males.

^{||} As compared with white individuals.

[¶] Represents the number of asthma-related events in the 3-month window preceding the date of the survey. Odds ratios represent the likelihood of being adherent for each increased number of event in the preceding 3-month period.

^{**} Each health locus of control domain is scored using a Likert scale of values 1-6. Higher values represent a greater belief that that domain controls a patient's asthma. Odds ratios represent the likelihood of being adherent for each point increase in the Likert scale for that particular domain.

Table 3

Predictors of inhaled corticosteroid adherence among individuals with asthma stratified by race.^{*}

	White individuals		African American individuals	
	OR (95% CI) [†]	P value	OR (95% CI) [†]	P value
Age, years	1.37 (1.19, 1.59)	0.001	1.60 (1.07, 2.38)	0.022
Female, sex [‡]	0.82 (0.48, 1.40)	0.462	0.43 (0.16, 1.13)	0.086
Medical Hi story [§]				
ED visits for asthma	0.97 (0.24, 3.91)	0.966	3.85 (2.05, 7.24)	0.001
Oral corticosteroid medication fills	0.89 (0.75, 1.05)	0.173	0.89 (0.68, 1.16)	0.398
Health Locus of Control [¶]				
God/Higher power	0.89 (0.75, 1.04)	0.149	0.68 (0.47, 0.99)	0.044
Internal	0.92 (0.78, 1.08)	0.308	1.21 (0.90, 1.64)	0.208
Chance	1.12 (0.78, 1.61)	0.522	1.07 (0.69, 1.65)	0.759
Doctors (Powerful others)	1.44 (1.13, 1.85)	0.004	1.04 (0.70, 1.53)	0.860
Other People (Powerful others)	0.97 (0.85, 1.09)	0.580	0.93 (0.73, 1.19)	0.587

OR denotes odds ratio; CI, confidence interval; and ED, emergency department.

^{*} All models are predicting inhaled corticosteroid (ICS) adherence defined as ≥80% use (adherent) and <80% use (non-adherent).

[†] Odds ratio for ICS adherence for the variable shown adjusted for all other variables shown and the practice cluster (i.e., the group of physicians from whom the patient usually receives care).

[‡] As compared with males.

[§] Represents the number of asthma-related events in the 3-month window preceding date of the survey. Odds ratios represent the likelihood of being adherent for each increased number of event in the preceding 3-month period.

[¶] Each health locus of control domain is scored using a Likert scale of values 1-6. Higher values represent a greater belief that that domain controls a patient's asthma. Odds ratios represent the likelihood of being adherent for each point increase in the Likert scale for that particular domain.