Asthma Beliefs Are Associated with Medication Adherence in Older Asthmatics

Anastasia Sofianou, MS¹, Melissa Martynenko, MPA, MPH¹, Michael S. Wolf, PhD, MPH³, Juan P. Wisnivesky, MD, DrPH^{1,2}, Katherine Krauskopf, MD, MPH¹, Elizabeth A. H. Wilson, PhD³, Mita Sanghavi Goel, MD, MPH³, Howard Leventhal, PhD⁴, Ethan A. Halm, MD, MPH⁵, and Alex D. Federman, MD, MPH¹

¹Division of General Internal Medicine, Mount Sinai School of Medicine, New York, NY, USA; ²Division of Pulmonary, Critical Care, and Sleep Medicine, Mount Sinai School of Medicine, New York, USA; ³Feinberg School of Medicine, Northwestern University, Chicago, USA; ⁴Institute for Health, Health Care Policy and Aging Research, Rutgers, The State University of New Jersey, Newark, USA; ⁵Division of General Internal Medicine, University of Texas Southwestern Medical Center, Dallas, USA.

BACKGROUND: Empirical research and health policies on asthma have focused on children and young adults, even though asthma morbidity and mortality are higher among older asthmatics.

OBJECTIVE: To explore the relationship of asthma-related beliefs and self-reported controller medication adherence in older asthmatics.

DESIGN: An observational study of asthma beliefs and self-management among older adults.

PARTICIPANTS: Asthmatics ages ≥ 60 years ($N=324$, mean age 67.4 ± 6.8 , 28 % white, 32 % black, 30 % Hispanic) were recruited from primary care practices in New York City and Chicago.

MAIN MEASURES: Self-reported controller medication adherence was assessed using the Medication Adherence Report Scale. Based on the Common Sense Model of Self-Regulation, patients were asked if they believe they only have asthma with symptoms, their physician can cure their asthma, and if their asthma will persist. Beliefs on the benefit, necessity and concerns of treatment use were also assessed. Multivariate logistic regression was used to examine the association of beliefs with self-reported medication adherence.

KEY RESULTS: The majority (57.0 %) of patients reported poor adherence. Poor self-reported adherence was more common among those with erroneous beliefs about asthma illness and treatments, including the “no symptoms, no asthma” belief (58.7 % vs. 31.7 %, respectively, $p < 0.001$), “will not always have asthma” belief (34.8 % vs. 12.5 %, $p < 0.001$), and the “MD can cure asthma” belief (21.7 % vs. 9.6 %, $p = 0.01$). Adjusting for illness beliefs, treatment beliefs and demographics, patients with a “no symptoms, no asthma” belief had lower odds of having good self-reported adherence (odds ratio [OR] 0.45, 95 % confidence interval [CI] 0.23-0.86), as did those with negative beliefs about the benefits (OR 0.73, 95 % CI 0.57-0.94) and necessity (OR 0.89, 95 % CI 0.83-0.96) of treatment.

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CONCLUSIONS: Illness and treatment beliefs have a strong influence on self-reported medication adherence in older asthmatics. Interventions to improve medication adherence in older asthmatics by modifying illness and treatment beliefs warrant study.

KEY WORDS: asthma; disease management; medication adherence; aging; health beliefs.

Abbreviations

NIA	National Institute on Aging
CSM	Common Sense Model of Self Regulation
FQHC	Federally Qualified Health Center
COPD	Chronic Obstructive Pulmonary Disease
ICS	Inhaled Corticosteroids
LTI	Leukotriene Inhibitors
MARS	Medication Adherence Report Scale
B-IPQ	Brief Illness Perceptions Questionnaire
BMQ	Beliefs about Medications Questionnaire

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BACKGROUND

Empirical research and treatment guidelines on asthma have focused largely on children and young adults, even though asthma morbidity and mortality are higher among older asthmatics than their younger counterparts.^{1–5} Specifically, older asthmatics are more likely to experience asthma related hospitalizations and deaths³ than young asthmatics.^{4,5} Asthma is also more commonly misdiagnosed¹ and undertreated² in older patients in comparison to younger cohorts.^{4,5} The recently published National Institute on Aging (NIA) white paper highlighting the burden of older asthmatics emphasizes the need for further research to identify and intervene on factors affecting the disease burden in this under-studied group.⁵

The correct and consistent use of controller medications is the single best available strategy for reducing symptoms and eliminating adverse outcomes.^{6–8} Nevertheless, over half of asthmatics on controller therapies underuse their asthma medications.^{9–11} This may be partly explained by barriers such as cost of medication, and age-related changes like cognitive decline and the chronic co-morbidities in older asthmatics.^{5,12–16}

A growing body of research suggests that certain health and illness beliefs represent another important barrier to good asthma medication adherence.^{17–22} This body of research is grounded in the Common Sense Model (CSM) of Self-Regulation, which delineates five domains of illness representations that shape self-management behaviors: *identity*, *timeline*, *cause*, *consequences*, and *control*.^{23,24} Identity refers to the symptoms that patients use as indicators of disease activity. Timeline conveys beliefs about rates of onset, duration, and decline of symptoms, and whether the condition is acute or chronic. Control encompasses expectations that the illness can be cured. Cause refers to the patient's understanding of the etiology and triggers of disease. And consequences are the perceived impact of symptoms and illness on physical health and aspects of well-being.

Our prior work and work by others shows that certain beliefs within the identity, timeline and control domains are strongly associated with poor medication use in asthmatics under the age of 65.^{17–21} For instance, the beliefs that asthma can be cured or is only intermittently present associated strongly with poor asthma medication adherence.^{17–21} Beliefs about treatment, such as the notion that treatment is not necessary or safe, are also correlated with decreased adherence and lower prescription refill.^{17–21}

We have shown that these beliefs are frequently held by older asthmatics,²² yet their influence on medication adherence has not been demonstrated among these older patients. This is an important deficit in the literature, as associations observed in younger asthmatics may not necessarily apply to older patients. For example, older adults experience unique physiologic conditions such as fatigue, frailty, and age-related changes in lung function and inflammation⁵ that may affect the way individuals interpret and respond to symptoms. Illness and treatment beliefs may also be subject to change as adults age and gather experience with healthcare. Similarly, medication management may improve as a result of increased practice of care for other chronic conditions.

OBJECTIVE

We examined the association between asthma illness and treatment beliefs with self-reported medication adherence in older asthmatics using the CSM framework. With this work, we seek to expand knowledge on asthma self-management

to older populations, and help lay the foundation for interventions that address the asthma disease burden faced by older asthmatics. Unlike many immutable barriers to self-care, health beliefs serve as modifiable risk factors that have clear implications for clinicians and health policy.²⁵

DESIGN

We used data from an ongoing observational study of health literacy, cognition, beliefs and self-management among older asthmatics. We recruited asthmatics ages 60 years and older from outpatient practices in New York City, NY and Chicago, IL. The New York City practices were based in the general medicine, geriatrics primary care, and pulmonary clinics at Mount Sinai Medical Center in East Harlem community of Manhattan and the Lutheran Family Health Services, a federally qualified health center (FQHC) in Brooklyn. The Chicago-based practices included the general internal medicine clinic affiliated with Northwestern Memorial Hospital, and the Mercy Health Clinic, an FQHC. We identified subjects through electronic medical record queries and chart review, and included those with moderate to severe asthma as defined by the appropriate ICD-9 codes (493.X). Those with a documented history of chronic obstructive pulmonary disease (COPD), other chronic lung illnesses, a smoking history of ten or more packs per year, or dementia were excluded. Eligible patients received a mailed letter informing them of the study and two weeks later, they received a recruitment call by a trained, bilingual (English and Spanish) research assistant. The research assistants obtained signed informed consent and conducted the interviews in the clinical sites or in the patients' homes. The study was approved by the Institutional Review Boards of the Mount Sinai School of Medicine, Lutheran Medical Center, and the Feinberg School of Medicine at Northwestern University.

MAIN MEASURES

Primary Outcome

The primary outcome was self-reported adherence to daily asthma controller medications (inhaled corticosteroids [ICS] and leukotriene inhibitors [LTI]) at baseline. Self-reported medication adherence was measured using the Medication Adherence Report Scale (MARS), a ten-item instrument that assesses general attitudes and behaviors towards primary controller medication use. Examples of some questions include “I use my {controller medication} only when I need it” “I decide to miss out a dose of my {controller medication}” and “I change the dose of my {controller medication}” (Appendix with full list of questions available

online).²⁶ Interviewers replace the bracketed text with the actual name of the patient's primary controller medication when asking the participant these questions. If a participant reported use of both LTI and ICS, the ICS medication was the focus of all subsequent questions on the scale, as well as any questions relating to medication use throughout the remainder of the interview. Responses are rated on a 5-point Likert scale (always to never) and the instrument is scored as an average of the ten responses, with higher numbers indicating better self-reported adherence. The MARS has demonstrated good performance in comparison to electronic reports of asthma medication use.²⁷ A MARS score of ≥ 4.5 indicates good adherence based on a prior study that validated the MARS against electronic measures of ICS adherence.²⁷

Independent Variables

We evaluated illness beliefs relating to the identity, timeline and control domains of the CSM. We chose these three domains because they have shown to be more closely related to treatment adherence than perceived cause and consequence.^{19,22} The precise wording of these belief measures is provided in the [Appendix](#) (available online). Identity was assessed with a question about whether the patient has asthma all of the time or only with symptoms ("no symptoms, no asthma" belief). Timeline was evaluated by asking patients if they thought they would always have asthma ("will not always have asthma" belief). Control was assessed by asking patients if they expected their doctor to cure their asthma ("doctor can cure" belief). Four answer categories were provided for each of these items: *all of the time*, *most of the time*, *some of the time*, and *only with symptoms* for the "no symptoms, no asthma" belief question; and *definitely*, *probably*, *possibly* and *no* for the "will not always have asthma" and "doctor can cure" belief questions. Responses were dichotomized (all of the time, most of the time vs. some of the time, only with symptoms for the "no symptoms, no asthma" belief; and definitely, probably vs. possibly, no for the "will not always have asthma" and "doctor can cure" beliefs) to indicate the mistaken belief as we have done in previous.^{19,22}

Treatment beliefs were measured using scaled items from the Brief Illness Perceptions Questionnaire (B-IPQ)²⁸ and the Beliefs about Medicines Questionnaire (BMQ).²⁹ One item in the B-IPQ assesses beliefs about the benefits of treatment by asking the respondent to choose a number between '0' and '10' that best describes how much they think their asthma treatment can help their asthma (higher values indicate greater benefit). Concerns about asthma medications and beliefs about the necessity of their asthma medications were each represented by five statements, for which the respondent was asked to indicate their agreement on a 5-point scale ([Appendix](#) available online). Unweighted

scores were created for each domain by adding the responses for the five statements (range 5–25). All items were scaled so that higher values indicate more negative beliefs. These items were handled as continuous variables in all analyses.

Analysis

Differences in illness and treatment beliefs between those with good versus poor self-reported adherence were examined using the chi-square test, t-test, and Wilcoxon rank sum test, as appropriate. Multivariate logistic regression was used to determine which beliefs remained associated with good self-reported medication adherence after performing sequential adjustments. Our first model controlled for illness beliefs (Model 1), our second model included both illness and treatment beliefs (Model 2), and our final model added age, sex, income, education, and race (Model 3). All analyses were conducted in SAS version 9.0 (SAS Institute, Cary, NC).

RESULTS

Participants

Between January 2010 and January 2012, we identified 1,236 patients with asthma from the electronic clinic encounter databases at all study sites. We were unable to reach 162 (13.1 %) of these patients. An additional 258 (20.9 %) patients actively declined, 426 (34.5 %) were ineligible, and 5 (0.4 %) were deceased, resulting in a sample of 385 enrolled study participants. Before completing baseline interviews, eleven (2.9 %) of these enrolled patients dropped out, 19 (4.9 %) were lost to follow-up, and 31 (8.1 %) were screened but had not yet completed their scheduled baseline interview, resulting in a sample of 324 patients available at the time of this analysis. After excluding those who were not using LTI or ICS controller medications (n=70) missing complete MARS assessments (n=11), or missing responses to the health belief questions (n=1) we obtained our final analytic sample of 242.

The mean age of our final sample was 67.4 ± 6.8 years, 32.2 % percent were black, 29.7 % Hispanic, 27.7 % had no high school education, 49.2 % earned a monthly income of \$1,350 or less (Table 1). Seventy-two percent reported three or more chronic conditions, and the average number of years [$\pm$ SD] with asthma was 30.4 (19.7) (Table 1).

One hundred and sixty-three, or 67 %, of our patients relied on ICS as their primary controller medication; while 14 patients reported using LTI (5.79 %) and 65 (26.9 %) reported use of both an LTI and an ICS. More than half of patients (57 %) were poor adherers with asthma controller medications (Table 1). Those reporting

Table 1. Baseline Patient Characteristics of Asthma Patients by Medication Adherence

	All n (%)	Poor Adherence n (%)	Adequate Adherence n (%)	p
	242	138 (57)	104 (43)	
Age, years				
60-64	107 (44.4)	64 (46.4)	43 (41.4)	0.66
65-69	59 (24.4)	31 (22.5)	28 (26.9)	
70+	76 (31.4)	43 (31.2)	33 (31.7)	
Male gender	39 (16.1)	22 (15.9)	17 (16.4)	0.93
Race/Ethnicity				
White	67 (27.7)	26 (18.8)	41 (39.4)	<0.001
Black	78 (32.2)	49 (35.5)	29 (27.9)	
Hispanic	72 (29.7)	52 (37.7)	20 (19.2)	
Other	25 (10.3)	11 (8.0)	14 (13.5)	
Limited English Proficiency	42 (17.4)	33 (23.9)	9 (8.7)	0.002
Household Income < \$1,350/mon [†]	117 (49.2)	78 (57.8)	39 (37.9)	0.002
Education				
Some high school	67 (27.7)	48 (34.8)	19 (18.3)	<0.001
High school	39 (16.1)	27 (19.6)	12 (11.5)	
Some college	57 (23.6)	33 (23.9)	24 (23.1)	
College or higher	79 (32.6)	30 (21.7)	49 (47.1)	
Asthma history [‡]				
Years with asthma, mean (SD)	30.4 (19.7)	30.9 (19.7)	29.9 (19.8)	0.71
Ever intubated	24 (10.4)	16 (12.0)	8 (8.2)	0.34
Asthma ED visit in last year	159 (68.8)	98 (73.7)	61 (62.2)	0.06
Asthma hospital visit in last year	92 (39.8)	59 (44.4)	33 (33.7)	0.1
Asthma medication use				
Inhaled corticosteroid (ICS)	163 (67.4)	101 (73.2)	62 (59.6)	0.08
Leukotrine inhibitor (LTI)	14 (5.8)	6 (4.4)	8 (7.7)	
Both LTI and ICS	65 (26.9)	31 (22.5)	34 (32.7)	
Co-morbid conditions*				
Allergy	165 (68.2)	89 (64.5)	76 (73.1)	0.16
Sinus	88 (36.4)	47 (34.1)	41 (39.4)	0.39
Diabetes	68 (28.1)	48 (34.8)	20 (19.2)	0.01
Hypertension	171 (70.7)	105 (76.1)	66 (63.5)	0.03
Congestive heart failure	22 (9.1)	18 (13.0)	4 (3.90)	0.01
Depression	88 (36.4)	60 (43.5)	28 (26.9)	0.008
Anxiety	64 (26.5)	46 (33.3)	18 (17.3)	0.005
Osteoporosis	80 (33.1)	48 (34.8)	32 (30.8)	0.51
Arthritis	173 (71.5)	99 (71.7)	74 (71.2)	0.92

*Co-morbid conditions are assessed through self-report; [†]Four participants did not report income Denominators are—total: 238; poor adherence: 135; adequate adherence: 103 [‡]ED denotes emergency department; SD, standard deviation

poor adherence were more likely to have limited English skills (23.9 % vs. 8.7 %, $p=0.002$) and monthly household incomes below \$1,350 (57.8 % vs. 37.9 %, $p=0.002$) than individuals reporting good adherence. Other

variables associated with poor self-reported adherence were black race and Hispanic ethnicity, lower education, and chronic illnesses (diabetes, hypertension, congestive heart failure, anxiety and depression).

Table 2. Bivariate Associations Between Asthma Beliefs and Medication Adherence

	holds belief	All n (%)	Poor Adherence n (%)	Adequate Adherence n (%)	p
		242	138 (57.0)	104 (43.0)	
Asthma Illness Beliefs n (%)					
No symptoms, no asthma	yes	114 (47.1)	81 (58.7)	33 (31.7)	<0.0001
	no	128 (52.9)	57 (41.3)	71 (68.3)	
I will not always have asthma	yes	61 (25.2)	48 (34.8)	13 (12.5)	<0.0001
	no	181 (74.8)	90 (65.2)	91 (87.5)	
Doctor can cure my asthma	yes	40 (16.5)	30 (21.7)	10 (9.6)	0.01
	no	202 (83.5)	108 (78.3)	94 (90.4)	
Asthma Treatment Beliefs*					
Treatment benefit median (IQR) [†]		0 (2)	0 (2)	0 (1)	<0.001
Treatment necessity mean(SD)		13 (4.5)	13.9 (4.7)	11.8 (4.1)	<0.001
Treatment concerns mean(SD)		13.1 (4.2)	13.9 (4.2)	12.0 (4.1)	<0.001

*Treatment beliefs are scaled so that higher responses indicate more negative beliefs towards treatment benefit, necessity, and consequences of its use

[†]IQR denotes interquartile range, a number which denotes the spread of the middle fifty percent of the data, calculated as the distance between the 75th percentile from the 25th percentile

Bivariate Results

Endorsement of the asthma health and treatment beliefs varied (Table 2). Nearly half of respondents held the “no symptoms, no asthma” belief (47.1 %), one-quarter (25.2 %) believed that they would not always have asthma, and 16.5 % thought the doctor could cure their asthma. In bivariate analyses, all three beliefs were significantly associated with self-reported adherence. Poor self-reported adherence was more common among individuals who held the “no symptoms, no asthma” belief (58.7 % vs. 31.7 %, $p < 0.0001$), those who believed that asthma is not a chronic disease (34.8 % vs. 12.5 %, $p < 0.0001$), and those who thought that a doctor could cure their asthma (21.7 % vs. 9.6 %, $p = 0.01$).

Treatment beliefs were also associated with self-reported adherence (Table 2). Poor adherence was reported more commonly among patients with a weaker tendency to believe in the ability of asthma medications to control their asthma (mean treatment benefit score non-adherers, 1.23, standard deviation [SD] 1.6 vs. adherers, 0.60, SD 1.18, $p < 0.001$), and among those who believed less strongly in the necessity of asthma medications (mean necessity score non-adherers, 13.9, SD 4.7 vs. adherers, 11.8, SD 4.1, $p < 0.001$). Individuals who were more concerned about side effects and other problems associated with using asthma medications were more likely to report poor medication adherence (mean concern score non-adherers, 13.9, SD 4.2 vs. adherers, 12.0, SD 4.1, $p < 0.001$).

Adjusted Results

In multivariate models, we measured the association of all three illness beliefs with self-reported adherence and sequentially adjusted for this association with the addition of treatment beliefs and demographic factors. In the model of adherence and illness beliefs alone, patients with the “no symptoms, no asthma” belief had significantly lower adjusted odds of reporting good adherence than those without this belief (odds ratio [OR] 0.45, 95 % confidence interval [CI] 0.25-0.80, $p = 0.01$) (Model 1, Table 3). A similar association

was observed for those who believed they would not always have asthma (OR 0.40, 95 % CI 0.19-0.84). After controlling for both illness and treatment beliefs (Model 2), all three treatment beliefs were significantly associated with self-reported adherence, and the prior observed associations between the “no symptoms, no asthma” and “not always have asthma” did not change. Finally, the addition of demographic characteristics (age, gender, race and ethnicity, income and education) (Model 3) had a nominal impact on the associations observed in Model 2, resulting in the timeline (will not always have asthma) and treatment concern beliefs narrowly losing statistical significance.

CONCLUSIONS

Discussion

A considerable imbalance in the disease burden faced by older asthmatics necessitates further research on asthma in older populations.⁵ Exploring the impact of sub-optimal health beliefs on self-management behaviors in this subgroup is essential to the development of targeted interventions that address asthma-related health disparities experienced by older patients.

Over half of our study population had poor self-reported adherence to their controller medication. The significance of our findings is underscored by the fact that the majority of our patients had longstanding asthma and multiple chronic conditions that require daily attention and medication use (Table 1). These factors should have provided our patients with adequate exposure to healthcare providers, as well as multiple opportunities to learn, and practice, appropriate self-management behaviors. As a proven effective method of asthma control, the correct and consistent use of controller medications is essential to reducing adverse asthma outcomes in this vulnerable subgroup.

Both illness and treatment beliefs were significantly, and strongly, associated with self-reported adherence to controller medications in this older asthmatic population. Specifically,

Table 3. Adjusted Associations Between Good Medication Adherence and Illness and Treatment Beliefs*

	Model 1 OR (95 % CI)	p	Model 2 OR (95 % CI)	p	Model 3 OR (95 % CI)	p
Asthma Illness Beliefs						
Identity						
No symptoms, no asthma	0.45 (0.25-0.80)	0.01	0.42 (0.23-0.79)	0.01	0.45 (0.23-0.86)	0.02
Timeline						
I will not always have asthma	0.40 (0.19-0.84)	0.01	0.39 (0.18-0.86)	0.02	0.46 (0.19-1.07)	0.07
Control						
Doctor can cure my asthma	0.63 (0.28-1.45)	0.28	0.80 (0.33-1.97)	0.63	0.96 (0.35-2.67)	0.94
Asthma Treatment Beliefs						
Treatment benefit	-		0.74 (0.59-0.94)	0.01	0.73 (0.57-0.94)	0.02
Treatment necessity	-		0.91 (0.85-0.97)	0.01	0.89 (0.83-0.96)	0.003
Treatment concerns	-		0.91 (0.85-0.98)	0.02	0.94 (0.86-1.02)	0.15

*Model 1: Good adherence = Identity + Timeline + Control

Model 2: Good adherence = Model 1 + Treatment benefit + Treatment necessity + Treatment Concerns

Model 3: Good adherence = Model 2 + Age + Sex + Race + Income + Education

older asthmatic patients who endorsed the “no symptoms, no asthma” belief had double the risk of reporting poor adherence as those without this belief. This is a particularly notable finding, given that nearly half of our population held this erroneous belief. Similarly, diminished beliefs in the benefit and necessity of treatment corresponded to decreased odds of reporting good adherence. The “no symptoms, no asthma” and treatment beliefs maintained strong associations with self-reported adherence when analyzed in aggregate and controlled for demographic characteristics that are also associated with medication use. Beliefs about the chronicity and curability of asthma, as well as the potential problems with asthma treatments, were also associated with poor self-reported adherence, but did not retain their statistical significance in the multivariate analysis.

The results of this study suggest that illness and treatment beliefs have a strong influence on self-reported controller medication adherence in older asthmatics. Importantly, unlike many of the barriers to good disease self-management in older adults such as cognitive impairment, frailty, and limited financial resources, health beliefs represent modifiable risk factors that can be targeted in interventions to improve medication adherence. Our findings mirror those of other studies that have examined beliefs related to the CSM and self-management in younger asthmatics.^{17–21} Taken together, the literature demonstrates consistency across a broad spectrum of ages of negative health beliefs and the association of such beliefs with poor medication adherence. Consequently, these results highlight the importance of routine and basic illness and treatment education not just in asthmatic children and young adults, but also in older patients. Clinicians, healthcare providers, health coaches, educators should assess patient views on illness and medications and carefully discuss those that may conflict with optimal asthma self-care.

Additional research is needed to determine whether the relative association of illness and treatment beliefs with adherence is similar between older and younger adults, or between those with more and less complicated healthcare needs. Further longitudinal research is also needed to establish a temporal understanding of when in a patient's lifetime erroneous beliefs are generated.

Limitations

A direct causal link between self-reported adherence and the asthma beliefs we examined cannot be assumed since this was a cross-sectional, observational cohort study. The treatment beliefs, in particular, may be subject to reverse causality since experiences like treatment failure or unpleasant side effects could have caused patients to discontinue use of the medications. Reverse causality is not likely, however, with the illness beliefs. Moreover, the selection of illness and treatment beliefs is firmly grounded in established

theory,^{23,24} and is consistent with findings in studies of health beliefs and medication adherence for other diseases.^{30–}

³³ Our study is also limited by use a self-reported assessment of medication adherence, where responses could be influenced by social desirability and recall bias. Nevertheless, MARS correlates strongly with objective measure of adherence, such as electronically recorded ICS use in asthmatics.²⁷ Our enrollment relies on ICD-9 codes rather than the use of a cognitive screener to detect dementia, so it is possible that our enrolled participants may have cognitive impairments that were not captured through hospital based records. Finally, although the BMQ and BIPQ have been validated in older populations, no study that we know of to date has assessed their performance on adults >80 years old, so there is a possibility that responses of patients >80 years of age may not have the same meaning as those of younger participants.

In Conclusion

This study expands established literature on health beliefs and medication adherence in asthmatics. As reported on younger cohorts, we find that certain health beliefs, such as the notion that asthma is only present with symptoms, and notions that medication is not needed or beneficial, are strongly associated with poor self-reported medication adherence in older asthmatics. Our findings have clear implications for health practitioners who can work with older asthmatic patients to modify beliefs that stand in the way of effective chronic illness self- management.

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Corresponding Author: Alex D. Federman, MD, MPH; Division of General Internal Medicine, Mount Sinai School of Medicine, One Gustave L. Levy Place, Box 1087, New York, NY 10029, USA (e-mail: alex.federman@mountsinai.org).

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