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The Association of Health Literacy with Illness and Medication Beliefs Among Older Adults with Asthma

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Abstract

Background—Suboptimal health literacy (HL) and asthma beliefs are associated with poor asthma self-management and outcomes. We tested the hypothesis that low HL is associated with inaccurate beliefs.

Methods—Asthmatics 60 were recruited from hospital and community practices in New York, NY and Chicago, IL (n=420). HL was measured with the Short Test of Functional Health Literacy in Adults; validated instruments derived from the Self Regulation model were used to assess beliefs. The association of beliefs with HL was evaluated with multivariate models.

Results—Thirty-six percent of patients had low HL; 54% believed they only have asthma when symptoms are present, 29% believed they will not always have asthma and 20% believed that their doctor can cure asthma. HL was associated with beliefs of not having asthma all the time and that asthma can be cured (OR: 1.84, 95% CI: 1.2 to 2.82; OR: 2.22, 95% CI: 1.29 to 3.82, respectively). Patients with low HL were also more likely to be concerned about medication use ($\beta = 0.92$, $p = .05$), despite recognizing their necessity ($\beta = -1.36$, $p = .01$).

Conclusions—Older asthmatics with low HL endorse erroneous asthma beliefs.

Practice implications—Health communications for improving self-management behaviors in asthma should employ both health literacy-appropriate strategies and messages to counter illness-related misconceptions.

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1. Introduction

Asthma is a common chronic medical condition in the elderly, affecting up to 9% of adults over age 65 in the United States [1-3], and although it is equally as common among younger adults [4], older asthmatics experience higher rates of mortality and morbidity from the disease [5-8]. Older asthmatics often have difficulty successfully conducting the self-management tasks that are crucial for asthma control [9-11] and such difficulty may contribute to the age-related differences in asthma outcomes that have been observed previously.

Health literacy and health beliefs have emerged as potentially important mediators of successful self-management in asthma [11-19]. For example, patients with low health literacy report lower levels of adherence with asthma controller medications [20] and those with misconceptions about asthma, like believing they only have the disease when symptoms are present (no symptoms no asthma), also have lower levels of adherence [12].

Health literacy levels affect patients' ability to access, process, and effectively utilize health information, including asthma knowledge. By extension, health literacy could influence beliefs about asthma through its impact on information acquisition. However, the connection between health literacy and beliefs has not been previously examined. In this study we test the hypothesis that low health literacy is associated with erroneous asthma beliefs that have been previously linked to poor asthma medication adherence and asthma outcomes.

2. Methods

2.1 Health Literacy

Data for this analysis are taken from the Asthma Beliefs and Literacy in the Elderly (ABLE) study, an ongoing, prospective cohort study of asthma in adults ages 60 years and older. The study began recruiting elderly asthmatics from three inner-city outpatient clinics in New York City, NY and Chicago, IL between December 2009 and August 2012. The New York City practices are based at the Mount Sinai Medical Center located in Manhattan's East Harlem neighborhood, and include the general internal medicine, geriatrics, and pulmonary practices, and an adult primary care practice of the Lutheran Family Health Services network of federally qualified health centers in Brooklyn, NY. The Chicago-based practices include the general internal medicine clinic of Northwestern University Hospital and the Mercy Health Clinic, a federally qualified health center. The study was approved by the Institutional Review Boards of the Mount Sinai School of Medicine, Lutheran Medical Center, and the Northwestern University Feinberg School of Medicine.

Potentially eligible asthmatics were identified by review of the electronic clinic encounter databases at each participating site. We enrolled patients ages 60 years and older who speak English or Spanish, and have persistent asthma based on the definition in the National Heart, Lung and Blood Institute's Expert Panel on Asthma [21]. Individuals with a smoking history of 10 pack-years or a diagnosis of chronic obstructive lung disease or other chronic respiratory illness were excluded.

Trained, bilingual research assistants recruited patients by telephone. After obtaining verbal consent, the research assistants administered a brief screening assessment to determine final eligibility for the study. Eligible patients were then invited to an in-person baseline interview in English or Spanish followed by a phone interview at 3 months and a second in-person interview at 12 months.

2.2 Health Literacy

Health literacy was assessed at baseline and 12-months, and was measured using the Short Test of Functional Health Literacy in Adults (S-TOFHLA). The S-TOFHLA is composed of a 36-item reading comprehension section and a 4-item numeracy exercise. The reading comprehension section is presented as two timed (7-minute) clinically oriented reading passages that are designed to omit key words and phrases from every line. Four multiple choice answers are provided under each missing section of the text and the participant is required to choose the response which contextually fits into the blank. The numeracy section assesses the patient's ability to read and interpret the information encountered when navigating the healthcare system, by presenting appointment slips and instructions for medication use, and requesting the participant to respond to related questions. The reading comprehension items are multiplied by 2 for a total score range of 0-72 and the numeracy items are multiplied by 7 for a range of 0-28. These items are then summed for a total S-TOFHLA score of 0-100, where higher scores represent higher health literacy. In this analysis scores were divided into two levels of health literacy: adequate (score ≥ 67) and marginal and low (score <67) [22]. The S-TOFHLA has been validated for use in both English and Spanish [23].

2.3 Asthma Disease and Medication Beliefs

Asthma perceptions and beliefs were collected at baseline and at 12 months. The measures were based on the Common Sense Model of Self-Regulation (CSM) [24-25], which describes how people's mental models or representations of illnesses provide the frameworks within they make decisions to seek health care and adopt treatments and at home procedures for disease management [12]. The five domains or content areas of illness representation—identity, timeline, cause, control, and consequences—are based to a substantial degree on patients' lifetime experience with acute conditions. The CSM has been used to examine the mechanisms underlying patient behaviors for a wide range of chronic illnesses, including asthma [12, 26-27]. For this analysis, we examined beliefs which have been linked to medication non-adherence as well as poor asthma outcomes [12, 26-27]. Specifically, we focused on the identity, timeline, and control domains of the CSM and three beliefs representative of these domains. We have previously found lesser and non-significant associations between measures in the cause and consequence domains and health outcomes [12, 26-27] and therefore excluded them from analysis in this study.

Identity refers to the symptoms that asthmatics use as indicators of disease activity, for example wheezing. The no symptoms no asthma belief, wherein the patient believes that their asthma is present only when they have asthma symptoms, is a perceptual belief based on a prior experience with acute conditions and is strongly associated with asthma controller medication adherence [12]. The timeline domain reflects beliefs about the duration of asthma, specifically, whether it is acute or chronic. The belief that a patient may not always have asthma, a characteristic of acute and episodic conditions, is a second timeline belief that is also associated with adherence. Control encompasses beliefs and expectations that symptoms and illness can be cured [12]. The belief that a physician can cure asthma rather than simply control it is an example of a control domain belief.

2.4 Medication Beliefs

To assess asthma controller medication beliefs, we used the Beliefs about Medications Questionnaire (BMQ) [28]. The BMQ assesses whether the patient believes that taking their asthma medications is necessary or whether they are concerned about the side effects. Responses are summed for a total score ranging 5-25. Higher scores indicate more negative beliefs, specifically, that the patient believes less strongly in the necessity of taking their

medication and has more concerns about the negative consequences of taking their medications.

2.5 Covariates

Other covariates included in our analyses were the socioeconomic indicators age, sex, race, education, and income, and asthma history (number of years since diagnosis, history of chronic use of oral steroids, and history of intubation).

2.6 Statistical Analysis

We first compared characteristics of the study sample by health literacy level (adequate vs. marginal or low) using the chi-square test, student's t-test or Wilcoxon rank-sum test, as indicated. We then fitted generalized estimating equation (GEE) models to test the hypothesis that health literacy is associated with asthma beliefs at baseline and 12-month follow-up while account for clustering by repeated measures within participants. Models were fitted with an exchangeable correlation structure and the sandwich estimator to obtain robust standard errors. Analyses were performed with SAS statistical software (SAS Institute, Cary, NC), using two-sided p-values.

3. Results

1,560 people were identified from the hospital databases between January 2010 and September 2012. From this initial pool, 519 (33.1%) were ineligible, 456 (29.2%) declined to participate, 12 (0.77%) were deceased, and we were unable to reach 97 (6.3%) leaving an enrolled sample of 476. Of this enrolled sample, 5 (1.1%) withdrew before their scheduled baseline interview, and 30 (6.3%) were screened but had not yet completed baseline interviews, resulting in a dataset of 441 observations at the time of this analysis. From the final sample, 113 (26%) participants elected to be interviewed in Spanish. Patients who did not complete the S-TOFHLA at baseline, either due to refusal (n=10) not having reading glasses (n=6), or other vision problems (n=3), and those with missing responses to all three health belief questions (n=2) were excluded for a final analytic sample of 420 patients. The mean and standard deviation (SD) of age of study participants was 60 (SD ± 6.8) and 31% of the sample was 70 or older. Most study participants were female (84%) and 23% were non-Hispanic white, 31% black, 38% Hispanic, and 9% were of other race and ethnicities. The median number of years since asthma diagnosis was 29, more than three-quarters used an asthma controller medication (79%), and 9% had a prior history of intubation.

3.1 Health Literacy

Overall, 36.0% of study patients had marginal or low health literacy. Individuals with marginal or low health literacy were older ($p=0.003$), and more likely to be non-white, of low income ($p<0.0001$), less educated ($p<0.0001$), and to have a prior history of intubation ($p=0.001$) (Table 1).

3.2 Asthma Health and Medication Beliefs

At baseline, more than half of patients (54%) believed they have asthma only when symptoms are present (Table 2), while 29% believed that asthma is not a chronic condition (will not always have asthma) that can be cured (20%). At 12-month follow-up, all three of these beliefs were somewhat less common at month 12 (no symptoms no asthma, 45%; will not always have asthma, 19%; and doctor can cure my asthma, 13%). The difference in adherence to the no symptoms no asthma and doctor can cure my asthma beliefs was statistically significant amongst those 256 patients completing both baseline and 12 month follow-up (Table 2). With regard to medication beliefs, the mean and standard deviation

scores for the BMQ necessity and concern assessments were 12.9 (4.5) and 13.5 (4.2), respectively, at baseline. These values were slightly lower at 12-month follow-up (Table 2), and significantly different for the necessity beliefs (Table 2).

3.3 Associations of Health Literacy and Asthma Health Beliefs

In unadjusted analyses incorporating data from baseline and 12-month data, health literacy was strongly associated with asthma beliefs (Table 3). Those with low or marginal health literacy were more likely to have the no symptoms no asthma belief (odds ratio [OR]: 1.94, 95% confidence interval [CI]: 1.35-2.79) and had more than twice the odds of believing they would not always have asthma (OR: 2.59, 95% CI: 1.76-3.81) or that a doctor could cure their asthma (OR: 3.51, 95% CI: 2.22-5.58) than those with adequate health literacy.

Adjustment of these models for age, sex, race/ethnicity, and asthma history modestly diminished the relationships between health literacy and the timeline belief (OR: 1.84, 95% CI: 1.2 to 2.82) and curability belief (OR: 2.22, 95% CI: 1.29 to 3.82) but they remained statistically significant (Table 3). However, adjustment rendered the association of health literacy with the no symptoms no asthma belief non-significant (OR: 1.27, 95% CI: 0.83 to 1.95).

In the subgroup of individuals on asthma controller medications (n=331 at baseline), health literacy was significantly associated with both beliefs about the necessity for and concerns about these medications in unadjusted analyses (Table 4). Individuals with low health literacy reported stronger beliefs about the necessity of asthma controller medications but greater concern about using them. The association of low health literacy with the necessity beliefs remained significant in the adjusted analysis (β : -1.36, standard error [SE]: 0.52, $p = 0.01$), whereas the association with concern beliefs were of borderline significance (β : 0.92, SE: 0.47, $p = 0.05$).

3.4 Associations of Other Variables with Asthma Beliefs

Race and ethnicity were significantly associated with the three asthma health beliefs in the fully adjusted models, whereas no other variables had consistent associations across the three analyses (data not shown). Hispanics and blacks had greater odds of holding the no symptoms no asthma belief (OR: 4.52, 95% CI: 2.61 to 7.83; and OR: 2.96, 95% CI: 1.76 to 4.99, respectively). They were also more likely to believe that asthma is not a chronic illness (OR: 3.60, 95% CI: 1.82 to 7.10; and OR: 3.53, 95% CI: 1.79 to 6.95, respectively) and is curable (OR: 11.20, 95% CI: 4.29 to 29.6; and OR: 3.58, 95% CI: 1.30 to 9.91, respectively). Hispanic ethnicity and black race were also significantly associated with having greater concerns about asthma controller medications in adjusted analyses (β : 3.1, SE: 0.6, $p < 0.0001$, and β : 2.2, SE: 0.6, $p < 0.0001$, respectively), but not with beliefs about the necessity of these medications.

4. Discussion and conclusion

4.1 Discussion

In this longitudinal, multicenter study of older adults with asthma, we found that low health literacy is associated with asthma-related beliefs that have been shown to predict poor asthma medication adherence and outcomes. Specifically, individuals with low health literacy were less likely to believe that asthma is a chronic illness and more likely to believe that a physician could cure it. They were also more likely to have concerns about the use of asthma controller medications, yet more likely to believe that such medications are necessary.

The association of low health literacy with greater belief in the necessity of asthma controller medications was somewhat unexpected given patients' concerns about use of controller medications. The conflict may reflect concerns about long-term use of controller medications, like side effects or addiction that are expressed by one-third to nearly half of asthmatic patients [29]. Asthmatics with low literacy, experiencing poorer asthma outcomes, may view their medications as necessary to maintain the stability of their illness, but further research is needed to clarify how patients reconcile beliefs about the potential harmful effects of their medications with beliefs about their benefits, and what impact this ultimately has on self-management.

In addition to health literacy, we found that Black and Hispanic patients were consistently more likely than white patients to hold the beliefs about illness identity, timeline, and control we studied, even after accounting for health literacy and other correlates of asthma illness beliefs. Blacks and Hispanics have more than twice the odds of whites to hold the no asthma no symptoms beliefs, suggesting an underlying acute model of illness that has been associated with non-adherence. These findings highlight the importance of race and ethnicity in asthma-related beliefs.

Finally, we found that at 12 months fewer individuals held some of the health beliefs we measured than at baseline. It is possible that there was a learning effect related to measurement of beliefs and that this influenced responses at 12 months. Alternatively, the differences may have occurred as a result of natural variation in responses or secular trends relating to knowledge about asthma and the medications used to treat it. The stability of health beliefs over time should be examined in future studies.

4.2 Conclusions

This study fills an important gap in the existing literature on the relationship between health literacy and asthma outcomes because the association of health literacy with disease beliefs that have established in our work may explain in part the poor asthma outcomes described in patients with low health literacy [11, 30]. Other studies support this conclusion. Mancuso et al [11, 30], for example, showed that adult asthmatics with low health literacy had poor asthma-related quality of life, worse general health and functional status, and were more likely to receive asthma treatment in the emergency department, after adjusting for asthma severity and self-efficacy. Low health literacy may impact patients' knowledge of asthma and its self-management as well as their ability to follow written or verbal instructions for asthma self-care thereby affecting their self-management skills [31]. The study by Mancuso et al. found, in fact, that asthma knowledge mitigated the effect of health literacy on health outcomes in adjusted models.

We specifically examined the association of health literacy and asthma beliefs in older adults with asthma. Our study is unique for its focus on older adults with asthma and its longitudinal perspective, and the generalizability of our findings to urban patients is supported by collection of data from multiple clinical centers in New York City and Chicago, Illinois. However, some limitations deserve mention. Our study was performed at two urban sites and our results may not be generalizable to other settings. Nonetheless, inner-city minority populations are a group at higher risk for poor asthma outcomes and therefore merit the focus. Finally, we excluded from our evaluation two domains of the Common Sense Model of Health Beliefs, cause and consequences. Given that we have previously found only weak nor non-significant associations between measures in these domains and outcomes, like asthma medication adherence, exclusion of these measures is unlikely to have any meaningful impact on the translation of our findings to clinical practice or basic understanding of the relationship between health literacy and health beliefs.

4.3 Practice implications

In our investigation we found that health literacy is associated with some of the same asthma health and medication beliefs that predict poor self-management behaviors and outcomes in older adults. Our work has important practice implications for two reasons. First, Asthma in older adults has received far less attention than in younger populations and little is known about whether interventions to promote better asthma self-management and outcomes should be tailored differently for older patients [32]. Several observations also suggest that older adults might benefit from asthma education strategies specifically targeting them. These include the decline of cognitive function with age and a related decline in health literacy [15] as well as age-related changes in the lung that may influence perceptions of airflow restriction [33-34] and subsequent understanding of asthma severity and the response to medications. Health related beliefs also differ across age groups as shown elsewhere [35]. As there are both theoretical reasons and empirical data suggesting that these experience-based beliefs are changeable, asthma education support targeted to older adults warrant further exploration.

Second, Several studies have demonstrated a strong link between health literacy and asthma self-management and outcomes, for example lower asthma knowledge [11, 17, 31], poorer skill with inhaler technique [9], and other asthma outcomes like emergency department use and quality of life [11]. Yet, health literacy incompletely explains asthma self-management behaviors and outcomes, and thus, as noted elsewhere [36], interventions that focus simply on delivering low-literacy asthma education may generate only modest benefits [37]. The Common Sense Model of Self-Regulation, on which this work is based, predicts that the patient's experience and understanding of their asthma will influence their perception of its severity and their susceptibility to it, as well as the benefits of treatment. By extension, health literacy may mitigate beliefs through its impact on the patient's ability to integrate factual information about asthma into their adaptive responses to the disease, which in turn, affects how they experience the disease and their response to its treatment. Self-management support interventions for older adults should therefore not aim simply to educate patients with factual, low-literacy information [38], but should also explicitly counter common misconceptions about the nature of asthma and medications used to treat it. Our results also showed that the messages conveyed in asthma education and self-management interventions should align with the cultural perspectives of the intended population, and particular attention should be given to understand the cultural perspectives of Blacks and Hispanics during intervention design[39]. Our study was performed at two urban sites and our results may not be generalizable to other settings.

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Table 1

Baseline Demographic Characteristics, Stratified by Health Literacy Level (N=420)

Characteristic	Total (n=420) %	Health Literacy		P
		Low (n=151) %	Adequate (n=269) %	
Age				
60-64	44.5	33.8	50.6	0.003
65-69	24.5	26.5	23.4	
70	31.0	39.7	26.0	
Female	84.1	84.1	84.0	0.98
Race				
White	22.6	3.3	33.5	<0.0001
Black	30.5	32.5	29.4	
Hispanic	38.1	58.3	26.8	
Other	8.8	6.0	10.4	
Monthly Income				
\$0-\$750	23.9	36.1	17.1	<0.0001
\$751-1350	29.8	44.2	21.7	
\$1351-3000	24.2	17.7	27.8	
>\$3000	22.2	2.0	33.5	
Education				
Less than 12 years	32.5	66.7	13.8	<0.0001
High-school/GED	17.0	16.7	17.1	
1-3 Years of College	20.3	12.0	24.9	
College degree, or higher	30.1	4.7	44.2	
Years since Asthma diagnosis (<i>median, IQR</i>)	29.0 (35)	31 (32)	27.5 (36.0)	0.53
Asthma Controller Medication Use				
Any	78.8	75.5	80.7	0.21
Inhaled corticosteroids	73.8	70.2	75.8	0.21
Leukotriene receptor antagonist	26.4	25.2	27.4	0.66
Ever Intubated	9.1	15.3	5.6	0.001

Table 2

Asthma Illness and Medication Beliefs at Baseline and 12-Months

Illness Beliefs - n (%)	Total Sample at Baseline (n=420)	Subset of Patients with Who Completed 12-Month Survey		
		Baseline (n=256)	12 Months (n=256)	p [‡]
No symptoms no asthma	225 (53.6)	132 (51.2)	114 (44.7)	0.04
Will not always have asthma	121 (28.8)	61 (23.8)	49 (19.1)	0.15
Doctor can cure my asthma	85 (20.2)	46 (18.0)	33 (13.0)	0.04
Beliefs about Medications Scores - mean (sd)				p[‡]
Necessity score	12.9 (4.5)	13.1 (4.5)	12.6 (4.5)	0.04
Concern score	13.5 (4.2)	12.3 (3.9)	12.6 (3.8)	0.39

[‡]McNemar's test

[‡]Paired t-test

Table 3

Association of Health Literacy with Asthma Health Beliefs [‡]

Health Beliefs	Health Literacy			P	Unadjusted OR (95%CI)	P	Adjusted [‡] OR (95%CI)	P
	Low %	Adequate %	P					
No symptoms no asthma	64.2	47.6	.001	1.94 (1.35-2.79)	.0003	1.27 (0.83-1.95)	0.28	
Will not always have asthma	41.1	21.9	<.0001	2.59 (1.76-3.81)	<.0001	1.84 (1.20-2.82)	0.005	
Doctor can cure my asthma	32.5	13.4	<.0001	3.51 (2.22-5.58)	<.0001	2.22 (1.29-3.82)	0.004	

OR denotes odds ratio; CI, confidence interval.

[‡]Generalized estimating equation models; include data from baseline and 12-month assessments.

[‡]Models estimate odds of having the asthma health belief. The association of health literacy with the belief is adjusted for age, sex, race/ethnicity, and asthma history (years since diagnosis, history of intubation, use of controller medications).

Table 4

Association of Health Literacy with Asthma Controller Medication Beliefs[‡]

Asthma Controller Medication Beliefs (Outcomes) [‡]	Health Literacy						
	Low	Adequate	Mean BMQ Score (SD)	P	Unadjusted β (SE)	Adjusted [‡] β (SE)	P
BMQ necessity	12.1 (4.2)	13.3 (4.6)	13.3 (4.6)	0.02	-1.12 (0.47)	-1.36 (0.52)	0.01
BMQ concerns	14.8 (4.2)	12.9 (4.1)	12.9 (4.1)	<.0001	1.81 (0.44)	0.92 (0.47)	0.05

BMQ denotes Beliefs about Medications Questionnaire; SD, standard deviation; SE, standard error.

[‡] Generalized estimating equation models; include data from baseline and 12-month assessments.

[‡] Models estimate the continuous scores for BMQ necessity and BMQ concerns scales (range 0-25 each). The association of health literacy with the belief score is adjusted for age, sex, race/ethnicity, and asthma history (years since diagnosis, history of intubation, and use of controller medications).

[‡] Higher BMQ scores indicate endorsement of the negative belief (stronger belief that medications are not necessary and, greater concerns about taking the medications).