



The association between language proficiency and outcomes of elderly patients with asthma

Juan P. Wisnivesky, MD, DrPH ^{*,†}; Katherine Krauskopf, MD ^{*}; Michael S. Wolf, PhD, MPH [‡]; Elizabeth A.H. Wilson, PhD [‡]; Anastasia Sofianou, MS ^{*}; Melissa Martynenko, MPA, MPH ^{*}; Ethan A. Halm, MD, MPH [§]; Howard Leventhal, PhD ^{||}; and Alex D. Federman, MD, MPH ^{*}

^{*} Division of General Internal Medicine, Mount Sinai School of Medicine, New York, New York

[†] Division of Pulmonary, Critical Care and Sleep Medicine, Mount Sinai School of Medicine, New York, New York

[‡] Division of General Internal Medicine, Feinberg School of Medicine, Northwestern University, Chicago, Illinois

[§] Division of General Internal Medicine, University of Texas Southwestern Medical Center, Dallas, Texas

^{||} Institute of Health, Health Care Policy and Aging Research, Rutgers, The State University of New Jersey, New Brunswick, New Jersey

ARTICLE INFO

Article history:

Received for publication March 28, 2012.

Received in revised form June 15, 2012.

Accepted for publication June 25, 2012.

ABSTRACT

Background: Asthma is a growing cause of morbidity for elderly Americans and is highly prevalent among Hispanic people in the United States. The inability to speak English poses a barrier to patient-provider communication.

Objective: To evaluate associations between limited English proficiency, asthma self-management, and outcomes in elderly Hispanic patients.

Method: Elderly patients with asthma receiving primary care at clinics in New York City and Chicago were studied.

Results: Of 268 patients in the study, 68% were non-Hispanic, 18% English-proficient Hispanic, and 14% Hispanic with limited English proficiency. Unadjusted analyses showed that Hispanic persons with limited English proficiency had worse asthma control ($P = .0007$), increased likelihood of inpatient visits ($P = .002$), and poorer quality of life ($P < .0001$). We also found significant associations between limited English proficiency and poorer medication adherence ($P = .006$). Similar results were obtained in multiple regression analyses adjusting for demographics, asthma history, comorbidities, depression, and health literacy.

Conclusion: Limited English proficiency was associated with poorer self-management and worse outcomes among elderly patients with asthma. Further understanding of mechanisms underlying this relationship is necessary to develop interventions that improve asthma outcomes in this vulnerable population.

© 2012 American College of Allergy, Asthma & Immunology. Published by Elsevier Inc. All rights reserved.

Introduction

The prevalence of asthma in persons aged 60 years or older is 4 to 13%; however, true rates may be underestimated in the elderly, in whom the disease is often under-diagnosed.^{1–4} As the US population ages, the number of older patients with asthma is expected to grow. Furthermore, asthma mortality and morbidity are increased in the elderly, making older patients with asthma a particularly vulnerable population.^{5,6}

According to the 2000 census, 11 million people living in the United States have limited or no English language skills.⁷ Language barriers and having a primary language other than English have been associated with decreased likelihood of having a usual source

of care and of receiving recommended health care, including primary care and preventive screening services.^{8–11} Hispanic people living in inner cities have higher asthma incidence, poorer disease control, and higher mortality.^{12,13} Reasons for these patterns include poor access to care, environmental exposures, and psychosocial and cultural factors.^{11–18} Language barriers have also been cited as an explanation for this increase, specifically in asthma morbidity among US Hispanic people.^{7, 19} Limited English proficiency can compromise patient-provider communication and impede asthma education efforts. These communication challenges may result in decreased patient understanding about asthma and its treatment. Patients require a complex set of self-management behaviors to achieve the best asthma outcomes. The consequences of miscommunication are therefore of particular importance for asthma; however, little is known about the role that language barriers play in determining poorer outcomes among elderly Hispanics with asthma.

The aim of this study was to assess the relationship between limited English proficiency, morbidity, and self-management be-

Reprints: Juan Wisnivesky, MD, DrPH, Department of Medicine, Division of General Internal Medicine, Mount Sinai School of Medicine, One Gustave L. Levy Place, Box 1087, New York, NY 10029; E-mail: Juan.Wisnivesky@mssm.edu.

Disclosures: Authors have nothing to disclose.

Funding Sources: Supported by a grant from the National Heart, Lung and Blood Institute (5R01HL096612-03).

haviors of elderly inner-city asthmatics. We hypothesized that limited English proficiency would be associated with lower rates of medication adherence, worse asthma control, and poorer quality of life.

Methods

This prospective cohort study included elderly (≥ 60 years of age) patients with asthma recruited at 3 inner-city outpatient clinics in New York, NY and Chicago, IL from December 2009 to August 2011. The New York practices were based in the Mount Sinai Medical Center, a large academic medical center located in East Harlem. The Chicago sites included Northwestern University Hospital general internal medicine clinic and the Mercy Health Clinic, a federally qualified health center. The study was approved by the Institutional Review Boards of both institutions.

Potentially eligible patients with asthma were identified by review of electronic clinic encounter databases at each site. We enrolled patients 60 years of age or older who spoke English or Spanish and had a diagnosis of uncontrolled asthma by a medical provider.²⁰ Individuals with a smoking history of 10 or more pack-years or a diagnosis of chronic obstructive lung disease or other chronic respiratory illness were excluded. Additionally, non-Hispanic patients with limited English proficiency ($n = 9$) were excluded from analyses to control for potential cultural differences within the limited English proficiency group.

Trained, bilingual research assistants recruited patients by telephone; eligible patients were invited to provide in-person, written informed consent and subsequently undergo on-site interviews. Standardized English or Spanish interviews were conducted in clinic offices at baseline and at 3 months.

English proficiency was assessed by patients' self-report. Patients with asthma were asked whether their native language was English or Spanish. Patients who indicated that English was not their primary language were then asked, "How would you describe your ability to speak and understand English?" and to choose among the following options: very poor, poor, fair, good, very good, or excellent.^{17, 21} For analyses, Hispanic people who reported speaking English very poorly, poorly, or fairly were classified as having limited English proficiency. All patients were then categorized into three groups—non-Hispanics (all native English speakers), Hispanics proficient in English, and Hispanics with limited English proficiency to evaluate the association between language proficiency and asthma outcomes, while controlling for ethnic-related factors.

Outcome measures were collected at baseline and at 3 months. Asthma control was evaluated using the Asthma Control Questionnaire (ACQ), an instrument validated in English and Spanish that includes items about asthma symptoms, activity limitation, and bronchodilator use.²² All questions were scored on a 7-point Likert scale, with higher scores indicating poorer asthma control; a difference 0.5 units or more has been associated with clinically important asthma control variability.²³ We also collected information about acute asthma-related resource utilization, including the number of exacerbations requiring outpatient (course of oral steroids or unscheduled physician visits) or inpatient (emergency department [ED] or hospitalizations) care.

We used the Mini-Asthma Quality of Life Questionnaire (AQLQ) to measure asthma-related quality of life.²⁴ This is a validated instrument (English and Spanish) that includes 15 items grouped into 4 domains: activity limitations, symptoms, emotional function, and environmental stimuli. Higher scores indicate better quality of life; a 0.5 point difference in AQLQ scores indicates a clinically significant change in quality of life.

Adherence to controller medications is the most important self-management behavior for patients with asthma. We used the Medication Adherence Reporting Scale (MARS) to assess adherence to

inhaled corticosteroids and leukotriene receptor modifiers, a potential mechanism linking low English proficiency with poorer asthma outcomes.²⁵ MARS is a validated, 10-item measure that has been adapted to assess adherence to asthma medications and designed to minimize social desirability bias. Each item is rated on a 5-point Likert scale, with higher scores indicating greater adherence; consistent with prior research, a MARS score of 4.5 or higher was defined as good adherence.^{17, 26}

Covariates included sociodemographic characteristics, asthma history (number of years since diagnosis, history of chronic oral steroid use, history of intubation), comorbid conditions, and symptoms of depression (assessed with the Patient Health Questionnaire).^{27,28}

Health literacy was measured using the Short Test of Functional Health Literacy in Adults (S-TOFHLA), a validated tool, available in English and Spanish.²⁹ Scores range were divided into 2 levels of health literacy: adequate (score ≥ 23) and limited (score < 23).¹⁶

Statistical analysis

Differences in baseline characteristics of non-Hispanic patients, Hispanic patients proficient in English, and Hispanic patients with limited English proficiency were evaluated using the chi-square test, Kruskal-Wallis test, or analysis of variance. Unadjusted associations between English proficiency and ACQ, AQLQ, and MARS scores at baseline and 3-month follow-up were evaluated with generalized estimating equation (GEE) models to incorporate clustering because of repeated measures within participants. We used an identity link and assumed a normally distributed error for analysis using ACQ and AQLQ scores as an outcome; logit link and binomial distribution were used for analysis evaluating adherence.

The GEE models were also used to assess whether English proficiency was associated with the ACQ scores, resource utilization measures, and AQLQ scores at baseline and follow-up after adjusting for covariates (sex, age, income, asthma medication use, duration of asthma diagnosis, history of intubation for asthma, and depression). In a subsequent step, we also adjusted for health literacy, a potential confounder of the association between English proficiency and asthma outcomes. Similarly, a GEE model was used to compare adherence at baseline and at 3-month follow-up across the 3 study groups. All GEE models were manually built using 2-sided *P*-values with SAS statistical software (SAS Institute, Cary, North Carolina).

Sample size calculations showed that the study had a 92% and 87% power to detect a clinically significant difference of 0.5 units in ACQ and AQLQ scores, respectively. The study also had a 79% power to identify a 25% difference in the proportion of participants adherent to asthma controller medications according to English proficiency level, and 86% power to detect a 20% difference in inpatient and outpatient resource utilization.

Results

Between December 2009 and September 2011, 1,175 patients with asthma were identified from the electronic clinic encounter databases at participating sites. Of these, 165 were unreachable or deceased (14%), 244 refused participation (21%), and 399 were excluded because of: no history of asthma (46%), chronic obstructive pulmonary disease or other chronic lung diseases (11%), smoking history (15%), cognitive impairment (2%), and other reasons (26%). Eight dropped out of the study ($< 1\%$), leaving a cohort of 359 elderly patients with asthma identified as eligible for the study. At the time of this analysis, 277 of these patients had completed baseline assessments and were included in the study. Eighty-two participants had consented to participate but had not yet completed their baseline assessment. Nine non-Hispanic patients with limited English proficiency were excluded, resulting in a final co-

Table 1
Baseline characteristics of asthma patients by race/english proficiency

Characteristic	Total (n = 268)	Non-Hispanics (n = 181)	Hispanics		P-value
			English proficient (n = 49)	Limited english proficiency (n = 38)	
Age, years (%)					
60–64	44	41	53	42	.41
65–69	24	23	25	29	
≥70	32	36	22	29	
Sex (%)					
Male	17	17	16	16	.96
Race (%)					
White	47	51	37	37	
Black	32	44	6	10	
Other	21	5	57	53	
Country of origin (%)					
Mainland United States	66	91	25	0	<.0001
Puerto Rico	22	1	61	68	
Other	12	8	14	32	
Yearly income (%)					
≤\$16,200	46	31	60	95	<.0001
Education (%)					
Elementary—some high school	25	11	37	76	<.0001
High school graduate	16	14	23	16	
Some college	23	26	24	5	
College graduate or higher	36	49	16	3	
Years in United States (mean ± SD)	64 (10)	66 (9)	57 (9)	51 (9)	<.0001
Asthma history					
Ever Intubated (%)	9	8	8	16	.28
Steroid dependant (%)	30	29	33	30	.90
Years with asthma (mean ± SD)	31 (21)	32 (22)	31 (19)	27 (19)	.42
Asthma management (%)					
Prescribed an inhaled corticosteroid	74	75	73	74	.98
Prescribed a leukotriene modifier	23	22	22	29	.61
Has a peak flow meter	45	42	55	47	.22
Has an asthma action plan	24	30	13	11	.01
Pack-years (mean ± SD)	3 (3)	3 (3)	4 (4)	2 (2)	.34
Self-reported chronic conditions (%)					
Allergy	68	70	69	55	.20
Eczema	16	18	12	8	.22
Sinusitis	37	40	29	32	.24
Gastroesophageal reflux disease	57	54	65	61	.34
Diabetes	25	20	33	39	.02
Hypertension	70	66	80	76	.09
Congestive heart failure	11	8	10	21	.06
Osteoporosis	31	28	29	47	.05
Depression symptoms (%)^a	17	11	25	38	<.0001
Inadequate health literacy (%)	27	18	29	68	<.0001

^aParticipants with a score of ≥10 were classified as having active depression symptoms.

hort of 268 patients with asthma. The 3-month follow-up rate was 83%.

Approximately one fourth of patients were 65 to 69 years old, and 32% were 70 years or older (Table 1). Consistent with other inner-city elderly asthma cohorts, our population predominantly consisted of women (83%), and nearly 50% were below the federal poverty line. Overall, 68% of patients were classified as non-Hispanic, 18% as Hispanic proficient in English, and 14% as Hispanic with limited English proficiency. Most Hispanic patients (>60%), with and without limited English proficiency, were from Puerto Rico.

In univariate analysis, there were no significant differences in the distribution of age ($P = .41$) or sex ($P = .96$) between study groups. Hispanics with limited English proficiency were more likely to report fewer years of education and had lower income ($P < .0001$ for both comparisons). The number of years with a diagnosis of asthma ($P = .42$) and the percentage of patients who received chronic oral steroids ($P = .90$) were not different between groups. Similarly, no significant differences were seen in the proportion of patients prescribed an inhaled corticosteroid ($P = .98$) or a leukotriene modifier ($P = .61$). Most medical comorbidities were similarly distributed across the 3 groups; only diabetes was more com-

monly reported by Hispanic patients with and without limited English proficiency ($P = .02$). Hispanic patients were also more likely to report symptoms of depression ($P < .0001$). Limited English proficiency was significantly associated with inadequate health literacy ($P < .0001$).

Unadjusted analysis

Unadjusted analyses showed that Hispanic patients with limited English proficiency overall had the highest ACQ scores, indicating poorest asthma control ($P = .0007$, Table 2). Compared with non-Hispanic patients, the mean difference in ACQ scores for Hispanic patients with limited English proficiency was 0.81 (95% CI: 0.40–1.23), and for Hispanic patients proficient in English 0.36 (95% CI: –0.01–0.73). The frequency of exacerbations requiring outpatient treatment were similar across all study groups ($P = .98$). However, Hispanic patients with limited English proficiency had the highest odds of experiencing an exacerbation requiring inpatient care (OR: 3.5; 95% CI: 1.6–7.7) compared with non-Hispanic patients. English-proficient Hispanic patients also had higher odds of an asthma exacerbation requiring inpatient care compared with non-Hispanic patients (OR: 2.5; 95% CI: 1.2–5.3). Asthma-related quality of life scores were lowest overall for non-English-proficient

Table 2
Unadjusted associations between asthma outcomes, adherence, and english proficiency

Outcome	Hispanic, english proficient ^a Mean score difference (95% CI)	Hispanic, limited english proficiency ^a Mean score difference (95% CI)	P-value
Asthma control ^b	0.36 (−0.01 to 0.73)	0.81 (0.40 to 1.23)	.0007
Quality of life ^c	−0.70 (−1.1 to −0.30)	−1.3 (−1.7 to −0.86)	<.0001
Outcome	OR (95% CI)	OR (95% CI)	
Outpatient exacerbations	1.1 (0.57 to 2.0)	1.1 (0.52 to 2.1)	.98
Inpatient exacerbations	2.5 (1.2 to 5.3)	3.5 (1.6 to 7.7)	.002
Adherence ^d	0.60 (0.32 to 1.13)	0.30 (0.14 to 0.65)	.006

Abbreviations: OR, odds ratio; CI, confidence interval.

^aThe reference category was non-Hispanic.^bAsthma control was assessed using the Asthma Control Questionnaire (ACQ). Higher ACQ scores indicate worse asthma control.^cAsthma quality of life was assessed using the Mini-Asthma Quality of Life Questionnaire (AQLQ). Higher AQLQ scores indicate better quality of life.^dAdherence was assessed using the Medication Adherence Reporting Scale (MARS).

Hispanic patients ($P < .0001$). Compared with non-Hispanic patients, quality of life was significantly lower among Hispanic patients with limited English proficiency (mean score difference -1.3 ; 95% CI: -1.7 to -0.86). The mean difference in AQLQ scores for English-proficient Hispanic patients compared with non-Hispanic patients was -0.70 (95% CI: -1.1 to -0.30). Adherence was also lowest overall for Hispanic patients with limited English proficiency ($P = .006$). The proportion of participants adherent to controller medications was 50% among non-Hispanic patients, 32% among English-proficient Hispanic patients, and 19% among Hispanic patients with limited English proficiency. Compared with non-Hispanic patients, non-English proficient Hispanic patients reported significantly lower odds of adherence to asthma medications (OR: 0.30; 95% CI: 0.14–0.65).

Adjusted analyses

Our base model adjusted for sex, age, income, asthma medication use, duration of asthma diagnosis, history of intubation for asthma, and depression. Analyses with this model showed that ACQ scores were not significantly different between study groups ($P = .56$, Table 3). Similar results were obtained in analyses additionally adjusting for health literacy (adequate as defined by Short Test of Functional Health Literacy in Adults score ≥ 23).

In analysis with our base adjusted model, Hispanic patients with limited English proficiency had similar odds of asthma exacerbation requiring outpatient treatment (OR: 0.92, 95% CI: 0.38–2.2) compared with non-Hispanic patients. However, the adjusted odds of experiencing an exacerbation requiring inpatient care was 3.2 times greater (95% CI: 1.2–8.6) among Hispanic patients with limited English proficiency compared with non-Hispanic patients. The association between English proficiency and exacerbations requiring inpatient care became attenuated after additionally adjusting for differences in health literacy (OR: 2.2; 95% CI: 0.78–6.1). No significant differences in either inpatient (OR: 2.3; 95% CI: 1.0–5.3) or outpatient (OR: 0.99, 95% CI: 0.49–2.0) resource utilization were found among Hispanic patients with adequate English proficiency and non-Hispanic patients in base model analysis; results did not vary when additionally adjusting for health literacy.

Adjusted analysis with our base model showed that quality of life scores were lowest among Hispanic patients with limited English proficiency ($P = .01$) and that AQLQ scores in this group were significantly lower compared with non-Hispanic patients (mean difference, -0.67 ; 95% CI: -1.14 to -0.20), indicating poorer quality of life. Quality of life scores in our adjusted base model were also lower among Hispanic patients with adequate English proficiency compared with non-Hispanic patients (mean difference, -0.35 ;

Table 3
Adjusted associations between asthma outcomes, adherence, and english proficiency

Outcome	Hispanic, english proficient ^a Mean score difference (95% CI)	Hispanic, limited english proficiency ^a Mean score difference (95% CI)	P-value
Asthma control^b			
Base model	0.09 (−0.24 to 0.42)	0.23 (−0.20 to 0.66)	.56
Adjusted for health literacy	0.08 (−0.25 to 0.40)	0.17 (−0.25 to 0.60)	.70
Quality of Life^c			
Base Model	−0.35 (−0.70 to −0.002)	−0.67 (−1.14 to −0.20)	.01
Adjusted for Health Literacy	−0.34 (−0.69 to 0.01)	−0.60 (−1.1 to −0.13)	.02
Outcome	OR (95% CI)	OR (95% CI)	
Outpatient visits			
Base model	0.99 (0.49 to 2.0)	0.92 (0.38 to 2.2)	.98
Adjusted for health literacy	1.0 (0.49 to 2.0)	0.80 (0.32 to 1.99)	.88
Inpatient visits			
Base model	2.3 (1.0 to 5.3)	3.2 (1.2 to 8.6)	.03
Adjusted for health literacy	2.1 (0.93 to 4.95)	2.2 (0.78 to 6.1)	.13
Adherence^d			
Base model	0.72 (0.36 to 1.46)	0.35 (0.14 to 0.87)	.08
Adjusted for health literacy	0.69 (0.34 to 1.39)	0.32 (0.13 to 0.81)	.05

Abbreviations: OR, odds ratio; CI, confidence interval.

Base model adjusts for: age, sex, income ($\leq 16,200$ /year), inhaled corticosteroid use, leukotriene modifier use, years with asthma, ever intubated, and depression. Model adjusted for Health Literacy consists of covariates included in base model as well as health literacy (low health literacy: reading comprehension score < 23).^aThe reference category was non-Hispanic.^bAsthma control was assessed using the Asthma Control Questionnaire (ACQ). Higher ACQ scores indicate worse asthma control.^cAsthma quality of life was assessed using the Mini-Asthma Quality of Life Questionnaire (AQLQ). Higher AQLQ scores indicate better quality of life.^dAdherence was assessed using the Medication Adherence Reporting Scale (MARS).

95% CI: -0.70 to -0.002). Associations remained unchanged after additionally adjusting for health literacy.

Hispanic patients with limited English proficiency were less likely than non-Hispanic patients to be adherent to asthma medications (OR: 0.33; 95% CI: 0.13–0.81), whereas adherence was not significantly different between English-proficient Hispanic patients and non-Hispanic patients (OR: 0.72; 95% CI: 0.36–1.46) in analysis with our base model. The association between limited English proficiency and lower adherence remained significant after additionally adjusting for health literacy (OR: 0.32; 95% CI: 0.13–0.81).

Discussion

Elderly Hispanic patients in inner cities have high rates of poorly controlled asthma.^{10,11} As the population ages, the burden of asthma is expected to increase in these patients. Language barriers are associated with poorer medical outcomes, as well as with higher health resource utilization in a number of conditions.^{30–32} In this prospective study of elderly, inner-city patients, limited English proficiency was associated with increased asthma-related morbidity and poorer quality of life, an effect that may be mediated by asthma medication adherence, regardless of degree of health literacy. These findings suggest it would be important to develop targeted Spanish-language adherence interventions as well as improved access to trained interpreters or Spanish-proficient providers for elderly patients with asthma who are not proficient in English.

Prior studies demonstrate that language barriers negatively affect access to quality health care, contribute to lack of understanding about disease processes, and are associated with poorer adherence in a variety of medical conditions.^{33–35} Work specifically related to asthma in Hispanic children and adolescents showed an association between language barriers and poorer adherence.¹⁸ Language barriers have also been shown to negatively impact outcomes for adult patients with asthma. A retrospective chart review of 96 patients with asthma conducted by Manson et al³⁶ found that Spanish-speaking patients with language-discordant physicians were significantly more likely to miss outpatient appointments. A study of inner-city adult patients with asthma, primarily younger than age 65, demonstrated associations between limited English proficiency, poorer asthma control, and poorer quality of life.¹⁷ In this study, we found similar patterns among a relatively large cohort of inner-city elderly patients with asthma. Moreover, we demonstrated that the association between limited English proficiency and poorer outcomes is not explained completely by lower health literacy, a potential mechanism underlying this association. These findings add to our understanding of how language barriers may contribute to ongoing ethnic disparities in asthma outcomes in the United States.

Self-management is central to successful asthma control.²⁰ Physicians are often the key players involved in educating patients with asthma about their disease management. Patients with limited English proficiency have been shown to have an increased risk for nonadherence, in part because of decreased understanding about their prescriptions.¹¹ Discrepant language may interfere with effective communication between providers and patients about self-management and thus may lead to worse asthma outcomes. Collaborative relationships between patients and providers can be hindered by language barriers even in circumstances in which interpreters are available. Our study suggests that miscommunication about proper medication adherence may be a factor underlying the association between English proficiency and asthma outcomes. In particular, prior work has shown that inner-city patients with asthma with limited English proficiency were more likely to report that asthma is an acute, episodic illness than a chronic disease, a belief associated with non-adherence.^{17,37} Lan-

guage barriers also may alter both a physician's ability to describe and a patient's ability to understand the difference between short-acting rescue medications and chronic controller medications and may interfere with a provider's ability to address the nuances of a patient's asthma health beliefs and dispel inaccuracies. Participatory decision-making is likely to be compromised in this context, thus limiting patient involvement in treatment choices and planning.^{35,38} Finally, language barriers may interfere with a patient's ability to interact with community resources available to promote adherence and self-management, such as pharmacists, support groups, and public health campaigns.

Associations between health literacy and asthma have been demonstrated previously.¹⁶ Because elderly patients and ethnic minorities have higher rates of low health literacy, an association between limited English proficiency, low health literacy, and asthma outcomes might be presumed.^{39,40} However, with the exception of attenuating the association between English proficiency and risk of asthma exacerbations requiring inpatient care, health literacy did not mediate outcomes in our study.

Several limitations of this study merit comment. Subjects were clinic-attending patients enrolled from 3 hospital-based clinics in New York and Chicago. As such, patients without a regular place of care were not represented in the study, and our results may not apply to patients in other settings. In addition, not all ethnic Hispanic groups were represented in our study; thus, results may not be generalizable to other Hispanic populations.

Acculturation is difficult to disentangle from language barriers as a factor in health-related outcomes for US Hispanic patients.⁴¹ Although the mean number of years living in the United States for Hispanics with limited English proficiency was 51 in this cohort, our study does not account for the effects that lack of acculturation might have had on asthma self-management and related asthma outcomes.

Unadjusted analyses showed that English-proficient Hispanic patients also reported worse asthma quality of life than did non-Hispanic patients. However, Hispanic patients with limited English proficiency had the worst outcomes, and most adjusted analyses showed no significant differences between English-proficient Hispanic patients and non-Hispanic patients. Thus, our results do not appear to be explained by ethnicity-related factors.

Most medical providers in a similar inner-city practice did not feel they could provide adequate medical care in Spanish.⁴² Our study did not include observations of patient-physician interactions during clinic visits, and we did not collect additional data on physicians' language skills. We could not, therefore, directly evaluate which aspects of clinical interactions were most likely affected by language barriers. Although some Hispanic patients with limited English proficiency may have received care from Spanish-speaking providers, these cases would have biased our results toward the null.

Finally, our study design is observational, and as such, allows for conclusions to be drawn only as associations. Thus, we cannot conclude a direct causal relationship between English language proficiency among elderly Hispanic patients with asthma and their asthma outcomes.

In summary, this prospective study of elderly patients with asthma demonstrates several associations between limited English proficiency and increased asthma morbidity. Non-adherence to inhaled corticosteroids was also significantly associated with low English proficiency and may mediate the relationship between language barriers and lack of asthma control. Further research is needed to understand the underlying mechanism for these effects of limited English proficiency if health outcomes are to be optimized for elderly inner-city patients with asthma. Future work should examine interventions to improve the Spanish language capacity of our existing health care work force, to foster a greater

number of bilingual medical providers, and to facilitate asthma-related communication for Spanish-speaking patients. In addition, providing Spanish language resources for patients with limited English proficiency that focus on proper asthma medication adherence may lead to improvements in asthma outcomes for this population.

Acknowledgments

We thank Fernando Caday, Diego Chiluisa, Rachel O'Connor, and Annie Boyd for their efforts recruiting and interviewing study subjects.

References

- [1] Enright PL, McClelland RL, Newman AB, Gottlieb DJ, Lebowitz MD. Underdiagnosis and undertreatment of asthma in the elderly. Cardiovascular Health Study Research Group. *Chest*. 1999;116:603–613.
- [2] Burrows B, Barbee RA, Cline MG, Knudson RJ, Lebowitz MD. Characteristics of asthma among elderly adults in a sample of the general population. *Chest*. 1991;100:935–942.
- [3] McHugh MK, Symanski E, Pompeii LA, Delclos GL. Prevalence of asthma among adult females and males in the United States: results from the National Health and Nutrition Examination Survey (NHANES), 2001–2004. *J Asthma*. 2009;46:759–766.
- [4] Parameswaran K, Hildreth AJ, Chadha D, Keaney NP, Taylor IK, Bansal SK. Asthma in the elderly: underperceived, underdiagnosed and undertreated; a community survey. *Respir Med*. 1998;92:573–577.
- [5] Robin ED. Death from bronchial asthma. *Chest*. 1988;93:614–618.
- [6] Diette GB KJ DFea. Why do older adults have higher rates of hospitalization for asthma than younger adults? American Thoracic Society International Conference. Toronto, Canada; 2000.
- [7] Shin HB, Bruno R. Language use and English speaking ability: 2000 Census. U.S. Census Bureau. Available at: <http://www.census.gov/prod/2003pubs/c2kbr-29.pdf>. Accessed June 11, 2012.
- [8] Cheng EM, Chen A, Cunningham W. Primary language and receipt of recommended health care among Hispanics in the United States. *J Gen Intern Med*. 2007;22(Suppl 2):283–288.
- [9] Woloshin S, Schwartz LM, Katz SJ, Welch HG. Is language a barrier to the use of preventive services? *J Gen Intern Med*. 1997;12:472–477.
- [10] Jacobs EA, Karavolos K, Rathouz PJ, Ferris TG, Powell LH. Limited English proficiency and breast and cervical cancer screening in a multiethnic population. *Am J Public Health*. 2005;95:1410–1416.
- [11] Chan KS, Keeler E, Schonlau M, Rosen M, Mangione-Smith R. How do ethnicity and primary language spoken at home affect management practices and outcomes in children and adolescents with asthma? *Arch Pediatr Adolesc Med*. 2005;159:283–289.
- [12] Wisnivesky JP, Leventhal H, Halm EA. Predictors of asthma-related health care utilization and quality of life among inner-city patients with asthma. *J Allergy Clin Immunol*. 2005;116:636–642.
- [13] American Lung Association Epidemiology and Statistics Unit Research and Program Services Unit. Trends in Asthma Morbidity and Mortality. Available at <http://www.lungusa.org/finding-cures/our-research/trend-reports/asthma-trend-reportpdf>. Accessed October 24, 2011.
- [14] Murray CS, Simpson A, Custovic A. Allergens, viruses, and asthma exacerbations. *Proc Am Thorac Soc*. 2004;1:99–104.
- [15] Eisner MD, Katz PP, Yelin EH, Shiboski SC, Blanc PD. Risk factors for hospitalization among adults with asthma: the influence of sociodemographic factors and asthma severity. *Respir Res*. 2001;2:53–60.
- [16] Pesola GR, Xu F, Ahsan H, Sternfels P, Meyer IH, Ford JG. Predicting asthma morbidity in Harlem emergency department patients. *Acad Emerg Med*. 2004;11:944–950.
- [17] Halm EA, Wisnivesky JP, Leventhal H. Quality and access to care among a cohort of inner-city adults with asthma: who gets guideline concordant care? *Chest*. 2005;128:1943–1950.
- [18] Federman AD, Wisnivesky JP, Wolf MS, Leventhal H, Halm EA. Inadequate health literacy is associated with suboptimal health beliefs in older asthmatics. *J Asthma*. 2010;47:620–626.
- [19] Wisnivesky JP, Kattan M, Evans D, et al. Assessing the relationship between language proficiency and asthma morbidity among inner-city asthmatics. *Med Care*. 2009;47:243–249.
- [20] National Heart, Lung and Blood Institute. National Asthma Education and Prevention Program Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma Full Report 2007. Available at: <http://www.nhlbi.nih.gov/guidelines/asthma/asthgdlnp.pdf>. Accessed October 24, 2011.
- [21] Lasater LM, Davidson AJ, Steiner JF, Mehler PS. Glycemic control in English- vs Spanish-speaking Hispanic patients with type 2 diabetes mellitus. *Arch Intern Med*. 2001;161:77–82.
- [22] Juniper EF, O'Byrne PM, Guyatt GH, Ferrie PJ, King DR. Development and validation of a questionnaire to measure asthma control. *Eur Respir J*. 1999;14:902–907.
- [23] Juniper EF, Svensson K, Mork AC, Stahl E. Measurement properties and interpretation of three shortened versions of the asthma control questionnaire. *Respir Med*. 2005;99:553–558.
- [24] Juniper EF, Guyatt GH, Cox FM, Ferrie PJ, King DR. Development and validation of the Mini Asthma Quality of Life Questionnaire. *Eur Respir J*. 1999;14:32–38.
- [25] Cohen JL, Mann DM, Wisnivesky JP, et al. Assessing the validity of self-reported medication adherence among inner-city asthmatic adults: the Medication Adherence Report Scale for Asthma. *Ann Allergy Asthma Immunol*. 2009;103:325–331.
- [26] Roy A, Lurslurchachai L, Halm EA, Li X-M, Leventhal H, Wisnivesky JP. Use of herbal remedies and adherence to inhaled corticosteroids among inner-city asthmatic patients. *Ann Allergy Asthma Immunol*. 2010;104:132–138.
- [27] Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16:606–613.
- [28] Kroenke K, Spitzer RL. The PHQ-9: A new depression diagnostic and severity measure. *Psychiat Ann*. 2002;32:509–515.
- [29] Baker DW, Williams MV, Parker RM, Gazmararian JA, Nurss J. Development of a brief test to measure functional health literacy. *Patient Educ Couns*. 1999;38:33–42.
- [30] Timmins CL. The impact of language barriers on the health care of Latinos in the United States: a review of the literature and guidelines for practice. *J Midwifery Womens Health*. 2002;47:80–96.
- [31] Hampers LC, Cha S, Gutglass DJ, Binns HJ, Krug SE. Language barriers and resource utilization in a pediatric emergency department. *Pediatrics*. 1999;103(6 Pt 1):1253–1256.
- [32] Flores G. Language barriers to health care in the United States. *N Engl J Med*. 2006;355:229–231.
- [33] Murphy DA, Roberts KJ, Hoffman D, Molina A, Lu MC. Barriers and successful strategies to antiretroviral adherence among HIV-infected monolingual Spanish-speaking patients. *AIDS Care*. 2003;15:217–230.
- [34] Adams RJ, Smith BJ, Ruffin RE. Impact of the physician's participatory style in asthma outcomes and patient satisfaction. *Ann Allergy Asthma Immunol*. 2001;86:263–271.
- [35] Smedley B, Stith Y, Nelson AR (eds). *Unequal Treatment. Confronting Racial and Ethnic Disparities in Care*. Washington, DC: The National Academies Press; 2002.
- [36] Manson A. Language concordance as a determinant of patient compliance and emergency room use in patients with asthma. *Med Care*. 1988 Dec;26(12):1119–28.
- [37] Halm EA, Mora P, Leventhal H. No symptoms, no asthma: the acute episodic disease belief is associated with poor self-management among inner-city adults with persistent asthma. *Chest*. 2006;129:573–580.
- [38] Adams RJ, Appleton S, Wilson DH, Ruffin RE. Participatory decision making, asthma action plans, and use of asthma medication: a population survey. *J Asthma*. 2005;42:673–678.
- [39] Paasche-Orlow MK, Parker RM, Gazmararian JA, Nielsen-Bohlman LT, Rudd RR. The prevalence of limited health literacy. *J Gen Intern Med*. 2005;20:175–184.
- [40] Davidson E, Liu JJ, Sheikh A. The impact of ethnicity on asthma care. *Prim Care Respir J*. 2010;19:202–208.
- [41] Lara M, Gamboa C, Kahramanian MI, Morales LS, Bautista DEH. Acculturation and Latino health in the United States: a review of the literature and its sociopolitical context. *Annu Rev Public Health*. 2005;26:367–397.
- [42] Wisnivesky JP, Lorenzo J, Lyn-Cook R, et al. Barriers to adherence to asthma management guidelines among inner-city primary care providers. *Ann Allergy Asthma Immunol*. 2008;101:264–270.