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Inadequate Literacy Is a Barrier to Asthma Knowledge and Self-Care*

Mark V. Williams, MD; David W. Baker, MD, MPH; Eric G. Honig, MD; Theodore M. Lee, MD; and Adam Nowlan, MPH

Study objectives: **To determine the relationship of literacy to asthma knowledge and ability to use a metered-dose inhaler (MDI) among patients with asthma.**
Design: **Cross-sectional survey.**
Setting: **Emergency department and asthma clinic at an urban public hospital.**
Patients: **Convenience sample of 273 patients presenting to the emergency department for an asthma exacerbation and 210 patients presenting to a specialized asthma clinic for routine care.**
Interventions: **Measurement of literacy with the Rapid Estimate of Adult Literacy in Medicine, asthma knowledge (20 question oral test), and demonstration of MDI technique (six-item assessment).**
Measurements and results: **Only 27% of patients read at the high-school level, although two thirds reported being high-school graduates; 33% read at the seventh- to eighth-grade level, 27% at the fourth- to sixth-grade level, and 13% at or below the third-grade level. Mean asthma knowledge scores (±SD) were directly related to reading levels: 15.1 ± 2.5, 13.9 ± 2.5, 13.4 ± 2.8, 11.9 ± 2.5, respectively ($p < 0.01$). Patient reading level was the strongest predictor of asthma knowledge score in multivariate analysis. Poor MDI technique (≤3 correct steps) was found in 89% of patients reading at less than the third-grade level compared with 48% of patients reading at the high-school level. In multivariate regression analyses, reading level was the strongest predictor of MDI technique.**
Conclusions: **Inadequate literacy was common and strongly correlated with poorer knowledge of asthma and improper MDI use.** ***(CHEST 1998; 114:1008–1015)***

Abbreviations: AC = asthma clinic; CI = confidence interval; ED = emergency department; MDI = metered-dose inhaler; RA = research assistant; REALM = rapid estimate of adult literacy in medicine

Asthma affects at least 14 to 15 million adults in the United States[1] at an estimated economic impact of >6 billion.[2] Asthma prevalence, emergency department (ED) visits, hospitalizations, and mortality from asthma have been rising[3,4] and disproportionately affect the poor, people of color, and individuals living in urban, inner-city environments.[5,6] Socioeconomic status appears to be a more important determinant of asthma morbidity than race.[7-10] Less education (fewer years of school completed), less knowledge of asthma, inadequate metered-dose inhaler (MDI) technique, and undertreatment have also been associated with increased frequency of ED use.[11-13]

National efforts to reduce asthma morbidity by reducing ED use and hospitalizations have focused on producing guidelines for asthma management that stress improving patient education and self-management.[1] Asthma education programs improve knowledge and self-management skills and decrease morbidity.[14-16] However, traditional patient education relies heavily on printed materials that are often written at too high a level for low-literate patients to read and comprehend essential points.[17-21] Although videotapes and personal demonstrations of MDI use are more effective educational techniques than printed material,[22] inadequate literacy is probably a marker for global problems with written and oral communication.[23,24] Thus, asthma education programs may not adequately reach those patients suffering the greatest morbidity and mortality.

This problem may be more common than many health-care providers realize. Nationally, almost one quarter of the adult population (40 to 44 million

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people) cannot read and understand very basic written materials.[25] We previously documented that 35% of English-speaking patients and 62% of Spanish-speaking patients seeking care at two inner-city public hospitals lack literacy skills adequate to function in health-care settings, *eg*, they struggle to read pill bottles and appointment slips.[26] Our previous research also showed that low-literate patients with diabetes and hypertension have poorer disease knowledge than those with adequate literacy.[24]

If standard education techniques are not effective for asthma patients with inadequate literacy skills, this may result in poorer self-management skills and greater morbidity. To examine this, we surveyed patients with asthma presenting to the ED with an asthma exacerbation or presenting for routine care in a specialized asthma clinic (AC). We measured the reading ability of these patients and evaluated the relationship of patients' literacy skills to their asthma knowledge and MDI skills. Understanding the role of health literacy in asthma management and patient education should enhance efforts to improve patients' knowledge of their disease, adherence to treatment plans, and improve self-management skills.

Materials and Methods

This study was conducted in the ED and AC at Grady Memorial Hospital, an approximately 800-bed urban public hospital in Atlanta, GA. The vast majority of its patients are indigent African-American residents of Fulton and DeKalb counties. Annually, the ED is the site of >100,000 patient visits, about 5% of which are for asthma. The AC has 750 active patients and 2,950 annual appointment visits. The study design and contact forms were approved by the Human Investigations Committee. Patients were enrolled during a 7-month period from November 1995 through May 1996.

A convenience sample of patients was enrolled by one research assistant (RA) from the AC during its usual scheduled appointments on Tuesday, Wednesday, or Thursday between 8 AM and 4 PM. Patients in the AC were recruited while they waited to see a provider. The same RA enrolled patients who presented to the ED after 4 PM on Tuesday, Wednesday, or Thursday, or between 7 AM and 11 PM on other days. Almost all patients presenting to the ED with a chief complaint of asthma are treated in an "asthma room." Patients in the ED were recruited after they were triaged and while waiting to see a physician. Patients in respiratory distress were recruited after completion of initial treatment and stabilization of their medical condition. To diminish selection bias, patients were enrolled sequentially from the medical charts of patients waiting to be seen. We introduced the study to patients by explaining that we wanted to find out about the problems people with asthma face and how much people with asthma know about their disease, with the goal of helping us better care for patients with asthma. Exclusion criteria were prior enrollment in the study, age <18 years, <3-month history of asthma, documented prior diagnosis of COPD, emphysema or chronic bronchitis, intoxication, overt psychiatric illness, lack of cooperation, native language other than English, too ill to participate, and visual acuity worse than 20/100.

After obtaining informed consent, we interviewed patients to collect information about demographics, medication use, self-reported health-care utilization, asthma triggers, recent disease severity,[27,28] regular source of care, health status, health history, self-efficacy,[29] attitude,[29] self-perceived understanding, disease knowledge,[15] compliance,[30] and access barriers. Patients were then asked to demonstrate MDI technique, and lastly reading ability was assessed using the Rapid Estimate of Adult Literacy in Medicine (REALM).[31] The REALM is a rapid, reliable measure of reading ability in the health-care setting. It has high criterion validity, correlating 0.88 with the Wide Range Achievement Test-Revised, 0.97 with the Peabody Individual Achievement Test-Revised, and 0.84 with the Test of Functional Health Literacy in Adults.[32] Test-retest reliability of the REALM is 0.97.[31] Administering the REALM involves having patients read aloud from a 66-item list of medical terms arranged in increasing order of difficulty. The REALM score is a simple count of correctly pronounced words. It requires 1 to 3 min to administer and provides one of four reading grade range estimates: (1) third grade and below, (2) fourth to sixth grade, (3) seventh to eighth grade, and (4) ninth grade and above. Visual acuity was performed using a pocket vision screener (Rosenbaum; Graham-Field Surgical Co Inc; New Hyde Park, NY). The REALM was not administered to patients with vision worse than 20/100.

We measured patients' knowledge of asthma with an orally administered questionnaire modified from one previously validated by Wilson et al.[15] Their questionnaire was decreased from 36 to 20 questions and simplified to read at less than a ninth-grade level. Pilot testing of the questionnaire to ensure patient comprehension resulted in further simplification of some questions. Cronbach's alpha reliability for the knowledge scale was 0.70 indicating adequate internal consistency.[33] Proficiency in the use of an MDI was measured by requesting patients to demonstrate their usual MDI technique of "taking two puffs" in the event of an asthma attack. We developed a six-step scale adapted from a previously reported measure of MDI use[34] to assess patients' ability to correctly (1) remove the MDI cap and shake the inhaler, (2) exhale slowly prior to inhalation, (3) actuate the MDI at onset of inhalation, (4) inhale at less than maximal rate, (5) hold breath after inhalation for at least 5 s, and (6) wait at least 30 s between each MDI actuation. Measures of attitude and self-efficacy were adapted from Wigal et al.[29]

A single experienced RA, used to collect all data, underwent 24 h of training, which included explanation of the study rationale and design, and interviewing techniques. We provided additional training in procedures for REALM administration and assessment of MDI use. To ensure precision in MDI assessment, both the RA and one of the investigators (M.V.W.) evaluated 20 asthma patients. Patients were asked to demonstrate their MDI technique using a placebo or their own inhaler and were observed for appropriate technique. Kappa values were 0.76, 0.62, 0.79, 0.29, 0.77, and 1.0 for each of the six steps above, respectively. Cronbach's alpha reliability for the MDI scale was 0.51. Because of the low kappa value for the fourth step, inhale at less than maximal rate, additional training with the RA was undertaken to ensure consistency. All six steps of the MDI scale were used in data analysis; results of the study were unchanged if the one step with initially low kappa, inhale at less than maximal rate, was excluded.

Categorical variables were analyzed using unadjusted χ^2 tests. Differences in normally distributed continuous variables (*eg*, asthma knowledge scores) were compared with two-sided Student's *t* test, analysis of variance, and Pearson correlation coefficient. Bonferroni's correction was used to adjust p values for multiple comparisons. Ordinal variables (*eg*, MDI skills) were analyzed using Wilcoxon rank-sum or the Kruskal-Wallis test. To adjust for confounding factors that could affect asthma knowl-

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edge (*eg*, duration of disease and location of care), we used multiple linear regression. Although the six-point MDI skill score is an ordinal variable, the frequency distribution of the scores was approximately normally distributed. We therefore used multiple linear regression to examine the association between literacy and MDI skills after adjustment for possible confounders. In addition, we performed a similar analysis using ordinal logistic regression to confirm the validity of the findings from the linear regression. The results were similar, so only the linear regression results are presented. A final p value of 0.05 for any variable or any group of categorical variables was used to determine statistical significance in the models. All data analyses were performed using statistical software (STATA; Stata Corp; College Station, TX).[35]

Results

A total of 653 patients were approached: 398 in the ED and 255 in the AC. Of the 398 patients approached in the ED, 25 (6%) were excluded. Of the 373 eligible for the study, 57 (15%) refused and 48 (13%) initiated but failed to complete the survey due to required medical care or delayed refusal, leaving 293 (79%) who completed the survey. Of the 255 patients approached in the AC, 16 (6%) were excluded leaving 239 eligible for the study. Twelve (5%) refused and 10 (4%) initiated but failed to complete the questionnaire, leaving 217 (90%) who completed the survey. Of the 510 who completed the survey, 17 patients had vision worse than 20/100, and 10 others refused reading skill assessment with the REALM, leaving 483 who completed the REALM. Comparisons of REALM level and MDI skills were possible in 469 patients, as 14 refused MDI assessment.

Characteristics of patients enrolled in the study are presented according to site in Table 1. Most participants at both sites were African-American and female, reflecting the populations seen in these clinics. Patients in the AC were older, more likely to be female, and more likely to report having a regular source of care and insurance. There was no significant difference in the average duration of asthma ($p = 0.24$), pack-years of smoking ($p = 0.52$), or average REALM score, 43 vs 46 ($p = 0.16$) in the AC compared with the ED.

Despite about two thirds of the sample reporting at least a high-school education, only 27% read at the ninth-grade level or better. A third of high-school graduates had marginal reading skills reading at a seventh- to eighth-grade level. Twenty-seven percent of all patients read at the fourth- to sixth-grade level and 13% were essentially illiterate, reading at less than the third-grade level. Reading ability was strongly associated with age ($p < 0.0001$); 75% of patients >60 years read at or below the sixth-grade level compared with 25% of those ≤25 years.

Patients with poor reading skills were less likely than literate patients to answer knowledge questions correctly. Table 2 shows examples of questions asked of patients and proportions answering correctly according to reading grade level as measured by the REALM and site of study entry. For example, only 31% of all patients reading at third-grade level or less, compared with 90% of those reading at the high-school level, knew that they need to see their physician even when not having an asthma attack. Many patients with poor reading skills also did not understand when to take "as needed" asthma medications and did not realize the importance of using an inhaler properly. Fewer than half of the patients reading at a third-grade level or less answered these questions correctly. About twice as many literate patients knew this information, 84% and 95% correct, respectively. Also, as reading ability increased with each level of REALM score, the proportion of patients answering questions correctly also increased (test for trend, $p < 0.01$).

Mean knowledge scores (range, 0 to 20) directly correlated with reading level, correlation coefficient $r = 0.36$. Patients reading at a high-school level had a mean score (±SD) of 15.1 ± 2.5 compared with 11.9 ± 2.5 for those reading at a third-grade level or

Table 1—*Patient Characteristics*

	ED	AC
N (%)	273 (57)	210 (43)
Age, yr (mean ± SD)*	37.3 ± 13.6	46.7 ± 14.9
Gender, female*	160 (59)	170 (81)
Race, %		
Black	259 (95)	187 (89)
White	14 (5)	23 (11)
Years of asthma		
≤1	8 (3)	18 (8)
2 to 5	30 (11)	48 (23)
6 to 10	37 (13)	30 (14)
11 to 20	57 (21)	35 (17)
>20	141 (52)	79 (38)
Years of schooling		
≤6	9 (3)	11 (5)
7-11	78 (29)	64 (30)
12	109 (40)	71 (34)
>12	77 (28)	64 (30)
Reading level by REALM		
≤3rd (0-18)	36 (13)	29 (14)
4th to 6th (19-44)	60 (22)	70 (33)
7th to 8th (45-60)	102 (37)	55 (26)
High school (61-66)	75 (28)	56 (27)
Regular source of care*		
Yes	83 (30)	157 (75)
No	190 (70)	53 (25)
Insurance†		
Yes	104 (38)	113 (54)
No	169 (62)	97 (46)

*$p \leq 0.001$.
†$p < 0.05$.

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Table 2—*Proportion of Patients Correctly Answering Selected Asthma Knowledge Questions (True-T, False-F) According to REALM Reading Grade Level (Score)*

Test Question	≤ 3rd (0-18) n = 65	4-6th (19-44) n = 130	7-8th (45-60) n = 157	High School (61-66) n = 131	p Value*
It is possible to die from having an asthma attack. (T)	88	95	97	100	0.001
Someone with asthma only needs to see a doctor about asthma when he or she is having an attack. (F)	31	63	80	93	<0.001
If someone takes asthma medicine every day, they do not have to stay away from things that they are allergic to. (F)	45	59	77	89	<0.001
Asthma medicines have no side effects. (F)	42	67	78	90	<0.001
It is best to wait and see whether asthma symptoms go away on their own before taking "as needed" asthma medications. (F)	45	71	79	84	<0.001
It doesn't really matter how an asthmatic uses their puffer. It will still deliver a useful dose of medicine. (F)	43	68	82	95	<0.001

*Test for trend.

less (Fig 1). Higher mean asthma knowledge score was associated with more years of schooling ($p < 0.001$), self-perceived better understanding of asthma and how to treat or prevent an attack ($p \leq 0.004$), and reporting a regular source of care ($p < 0.001$), but not patients' age, duration of asthma, health status, insurance status, or site of study entry in univariate analysis. After adjusting for these factors, patient reading level remained the strongest predictor of asthma knowledge in multivariate analysis (Table 3). The adjusted difference in knowledge score between patients reading at a high-school level and those reading at a third-grade level or less was 2.7 points (95% confidence interval [CI], 1.9 to 3.5).

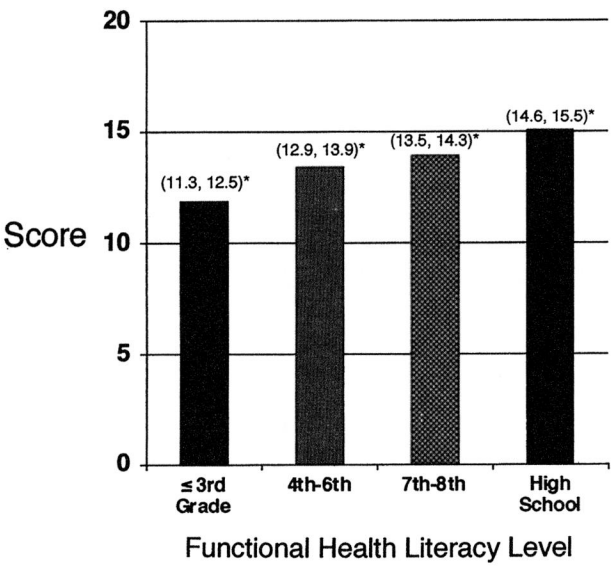

FIGURE 1. Mean asthma knowledge scores (95% CI) according to REALM reading level. Asterisk: 95% CIs; scores ranged from 6-20 out of possible 20 questions. $p < 0.01$ by Kruskal-Wallis and test for trend.

To better understand how patients' literacy affects their self-management of disease, we assessed MDI skills. The mean number of correct steps (range, 0 to 6) strongly correlated with reading level, test for trend $p < 0.01$ (Table 4). ED patients who read at a third-grade level or less performed a mean of only 1.6 steps out of six correctly compared with 3.3 correct steps among those reading at a high-school level. However, many literate patients were not using their inhaler properly. Among patients reading at the high-school level, 48% performed three or fewer steps correctly. For those reading at a third-grade level or less, 88% performed three or fewer correct steps.

Table 3—*Independent Effect of Factors Decreasing Asthma Knowledge Score in Multivariate Analysis*

Independent Variable	Coefficient	95% CI	p Value
Reading ≤3rd-grade level	−2.8	−3.6, −2.0	<0.001
Reading 4th- to 6th-grade level	−1.5	−2.1, −0.9	<0.001
Reading 7th- to 8th-grade level	−1.1	−1.7, −0.5	<0.001
No regular source of care	−0.9	−1.4, −0.4	<0.001
Asthma for <1 yr	−1.1	−2.1, −0.1	0.04
Age >60 yr	−0.9	−1.6, −0.2	0.02

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Table 4—*Proportion (%) of Patients Correctly Performing Step in Proper MDI Technique According to REALM Reading Grade Level**

MDI Step	≤3rd (0-18) n = 64	4-6th (19-44) n = 126	7-8th (45-60) n = 149	High School (61-66) n = 130	p Value†
Remove the cap and shake the inhaler	64	69	79	82	0.013
Exhale to functional residual capacity	19	29	31	44	0.003
Activate the MDI at the start of inhalation	33	52	67	71	<0.001
Inhale slowly	66	83	89	92	<0.001
Hold breath for at least 5 s	14	23	34	39	0.001
Take one puff at a time and wait for at least 30 s before the next puff	8	12	18	16	0.18

*Fourteen patients declined to perform MDI technique, thus analysis is on 469 patients.
†Test for trend.

Better MDI skills were also associated with more years of school ($p = 0.0007$), reporting a regular source of care ($p = 0.02$), and AC as site of study entry ($p < 0.02$). Self-perceived understanding of asthma care, age, duration of asthma, or health status were not associated with MDI skills. After adjusting for the number of years of school and regular source of care, patient reading level remained the strongest predictor of MDI skills (Table 5). The adjusted difference in number of correct MDI steps between patients reading at a high-school level and those reading at a third-grade level or less was 1.3 steps (95% CI, 0.9 to 1.7). Analysis using ordinal logistic regression yielded similar results (data not shown).

Despite the association of literacy and asthma knowledge and MDI skills with poor reading skills, patients' attitudes about their asthma were similar regardless of reading level. More than 80% considered it important not to miss any medications, and >80% said it was "very" important to learn about asthma, to learn how to prevent attacks, and to take medications exactly as prescribed. However, patients' perceived self-efficacy in managing their asthma did correlate with reading skills. While 31% of patients reading at the high-school level reported they usually need to go to the ED when they have an asthma attack, 54% of all patients reading at a sixth-grade level or less said they usually do ($p < 0.001$). Forty percent of patients reading at a third-grade level or less reported there is nothing they can do to keep from getting an attack compared with 26% of those reading at the high-school level ($p = 0.02$).

Table 5—*Independent Effect of Factors Decreasing MDI Skills in Multivariate Analysis*

Independent Variable	Coefficient	95% CI	p Value
Reading ≤3rd-grade level	−1.3	−1.7, −0.9	<0.001
Reading 4th- to 6th-grade level	−0.7	−1.0, −0.4	<0.001
Reading 7th- to 8th-grade level	−0.2	−0.6, −0.1	0.13
No regular source of care	−0.3	−0.5, −0.04	0.02
Asthma for <1 yr	−0.5	−1.0, −0.02	0.06

Discussion

Patient education has been described as "critically important in the successful treatment of asthma,"[36] and the National Asthma Education Program emphasizes patient education to achieve the goal of improved asthma care outcomes.[1] Recent evidence indicates the need to consider patients' literacy skills when providing asthma care.[37] The importance of addressing the educational needs of low-literate patients has been recognized for some time among patients with other chronic diseases such as hypertension and diabetes.[38-40] We previously showed that low-literate patients with diabetes or hypertension have poorer knowledge of disease and self-management skills than those with adequate literacy.[24] This study confirms these findings among patients with asthma. This is the first study, to our knowledge, that also shows that self-management skills (*eg*, MDI ability), not just knowledge, are poorer among patients with limited reading skills.

As in previous reports,[24,26] many patients had inadequate literacy skills. Almost half, 46%, of the patients in the AC and 33% of patients in the ED read at the sixth-grade level or lower (Table 1). Patients with poor reading skills had significantly less asthma knowledge (Table 2 and Fig 1) and poorer MDI skills (Table 3 and Fig 2). In multivariate analysis, patients' reading level was the strongest predictor of asthma knowledge and MDI skills. Although MDI skills were better among more literate patients, they were still inadequate (Fig 2). Others have also shown that patients,[34,41,42] and even physicians,[34,43-45] have inadequate MDI skills. A previous study demonstrated that knowledge of the correct inhaler maneuvers, a history of additional

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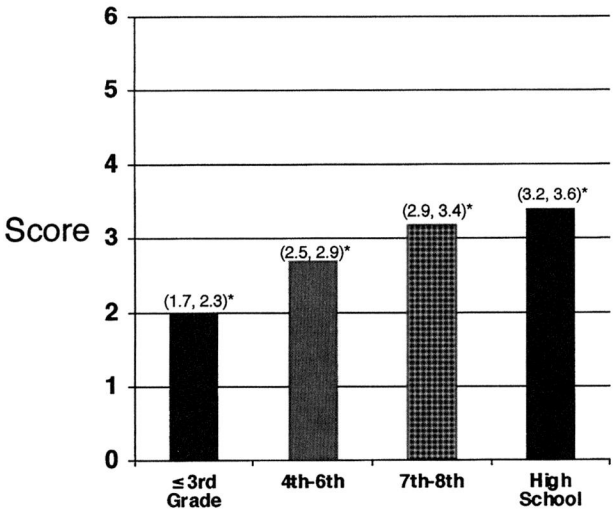

FIGURE 2. Mean MDI score, 0 to 6 (95% CI) according to REALM reading level (score). Asterisk: 95% CIs; scores ranged from 0 to 6 out of possible 6 steps. Analysis was of 469 patients, because 16 refused MDI testing.

instruction about proper technique, and the patient's perception of whether it is important to use an inhaler all predicted correct MDI use.[42] Correcting MDI skill deficits may be especially difficult among asthma patients with poor reading skills as current educational strategies clearly do not reach a large number of them. Attendance in a specialized asthma clinic did not decrease the negative effects of literacy on asthma knowledge, and slightly mitigated the negative effect on MDI skills in this study.

Although disease knowledge may not be correlated with health behaviors and disease outcomes,[46,47] responses to specific questions provide insight into patients' understanding of proper health behaviors and self-management skills (Table 2). Patients with poor reading skills were far less likely to know they should take their medications for symptoms and of the need to stay away from allergens. Poor reading skills also correlated with lack of awareness that an MDI must be used properly to deliver a useful dose and were the strongest predictor of poor MDI technique in multivariate regression. Patients with poor MDI skills may be unable to adequately treat asthma exacerbations at home and require ED visits for treatment.[12] Correcting such knowledge and health behavior deficits through asthma instructional programs has been shown to be cost-effective[48-50] and to reduce physician visits and hospitalizations.[51-53] Failure to tailor educational efforts to patients with poor reading skills might explain why current asthma education programs may not always improve outcomes.[54]

There are several potential limitations to our study. First, less literate patients may not be less knowledgeable, but simply worse at taking tests. We attempted to overcome this by administering the test orally and directly assessing disease management skills by evaluating MDI technique. Second, we do not know the generalizability of our findings as the study was conducted at an urban hospital caring for predominantly indigent patients. Yet, inadequate literacy pervades our society,[25] especially among the elderly, and this study provides additional evidence that patients' reading skills must be considered in their health education.[24,55] Finally, though we measured patients' knowledge of disease and management skills, we were unable to physiologically measure severity of disease or assess patient morbidity and use of services. However, other studies suggest that poorer knowledge[13] and MDI skills[12] result in high use of health-care services.

The results of this study confirm that patients with poor reading skills do not fully comprehend medical instruction using standard patient education methods.[56] Fortunately, such patients recognize they have less ability to prevent and treat attacks; more than half of patients reading at a sixth-grade level or less report they go to the ED when they have an attack compared with less than a third of literate patients. Reliance on the ED for crisis-oriented care by underprivileged patients has been considered as a sign of increased asthma morbidity.[57,58] However, this pattern may be completely appropriate for low-literate patients with inadequate self-management skills. The prevalence of poor reading skills may also partly explain the worse health outcomes after hospital discharge of asthma patients with lower socioeconomic status.[59] Less than one third of patients with the poorest reading skills knew they should see a physician when their asthma was not symptomatic compared with 90% of literate patients. Not seeing a regular provider may result in underuse of inhaled steroids, a factor found to be closely associated with lower educational attainment.[37]

Physicians, other health-care providers, and health educators should consider several factors when caring for patients with limited literacy.[60] Before beginning an educational program for any chronic disease, patients with just a high-school education or less should undergo some assessment of literacy skills. Patients are unlikely to volunteer that they are illiterate due to associated shame,[61] or because they do not recognize they have deficient literacy skills.[25] Educational efforts can then be tailored to the patient.[23] Because of the high prevalence of inadequate literacy among the elderly,[24,26,62] in whom asthma is common,[63] this group should be particularly targeted for screening and special educational strategies for low-literate patients.[64]

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Health-care providers should not ignore the problem of educating patients with poor reading skills. National efforts focus on improving health through education and accrediting agencies require documentation. Healthy People 2000: National Health Promotion and Disease Prevention Objectives set goals of having no more than 10% of people with asthma experience activity limitation and decreasing asthma morbidity by reducing hospitalizations.[65] The Joint Commission on Accreditation of Healthcare Organizations mandates that hospitals and other health-care organizations provide instruction understandable to patients, assess their knowledge, and document such educational efforts.[66] The National Committee on Quality Assurance also requires providers to ensure patients understand medical information provided to them.[67] Patients' health literacy must be considered when attempting to reach these goals.

Indigent patients face many barriers to obtaining health care.[68,69] Our results indicate poor reading skills are another significant barrier to optimal asthma care. New education strategies to improve the self-management skills of this truly disadvantaged population are needed to achieve the goals of the National Asthma Education Program.[1] Education of indigent asthma patients in the ED has shown success,[70] but most ED staff lack even rudimentary skills with MDI devices.[45] Use of church-based programs,[71] practice assistants,[72] and pharmacists[53,70,73] have been tried with varying success, but not all have been specifically targeted toward low-literate patients. Such patients should be involved in developing educational materials to empower them to improve their health while ensuring effective educational content.[74] Successful education programs that reduce morbidity and mortality of those most affected by asthma must consider patients' literacy skills.

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