
Asthma control and future asthma-related morbidity in inner-city asthmatic children

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Background: Asthma guidelines recommend routine evaluation of asthma control, which includes measurements of impairment and risk. It is unclear whether rigorous asthma control changes risk of asthma morbidity.

Objective: To examine whether the degree of asthma control in inner-city asthmatic children results in differential risk reduction of future asthma-related morbidity.

Methods: This retrospective observational study examines 960 inner-city children with asthma who were highly engaged in an asthma-specific disease management program for a minimum of 2 years. Degree of asthma control was determined during the first year of enrollment and was categorized as well controlled ($\geq 80\%$ of visits in control), moderately controlled ($50\%–79\%$ of visits in control), or difficult to control ($<50\%$ of visits in control). Risk and probability of asthma-related morbidity at each visit were determined during the second year of enrollment and included self-reported asthma exacerbations requiring systemic corticosteroid rescue and emergency department visits or hospitalizations.

Results: Increasing the degree of asthma control measured during the first year of enrollment led to statistically significant incremental reductions in risk of acute asthma exacerbations and emergency department visits or hospitalizations during the second year of enrollment.

Conclusions: Achieving and maintaining asthma control in inner-city children with asthma results in significant reductions in asthma-related morbidity. Systematic assessments of asthma control may be useful for predicting future risk in children with asthma.

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INTRODUCTION

The 2007 National Heart, Lung, and Blood Institute Guidelines for the Diagnosis and Management of Asthma recommend routine evaluation of risk in the long-term management

of asthmatic patients. These guidelines, however, state that evaluation of the risk domain is problematic.¹ Measures used to evaluate risk include spirometry, biomarkers such as exhaled nitric oxide, and history of a similar event.^{1,2} It is, however, unclear which of these and similar measures, alone or in combination, best predict future asthma risk. National and international guidelines recommend treating asthmatic patients toward asthma control because this results in improvement of clinical symptoms.^{1,3} If so, then the degree of asthma control may be associated with a differential decrease in the risk of a future asthma exacerbation. Thus, evaluation of the degree of asthma control during a specific period may be useful in predicting future asthma exacerbations.

The purpose of this retrospective observational study was to determine whether the degree of asthma control across 1 year predicts the risk of asthma-related morbidity, specifically, asthma exacerbations and emergency department (ED) visits or hospitalizations during the subsequent year. This study was conducted in a group of highly engaged inner-city pediatric asthmatic patients with regular follow-up in an asthma-specific disease management program (Breathmobile).⁴ The results will provide a rationale for the use of asthma control evaluation as an additional component in the prediction of disease exacerbation in pediatric patients with asthma.

METHODS

Inclusion Criteria

The study population consisted of children followed up in an asthma-specific disease management program (Breathmo-

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bile) using 1 fixed and 4 mobile asthma clinics at Los Angeles County + University of Southern California (LAC + USC) Medical Center. Patients were diagnosed as having asthma by an asthma specialist based on National Asthma Education and Prevention Program (NAEPP) guidelines.^{5,6} Patients who met the following criteria were enrolled: (1) asthmatic patients 3 to 18 years of age engaged in the program 365 days or longer, (2) 2 or more follow-up visits during year 1 with at least 2 visits during the second half of year 1 (182–365 days after entry), (3) at least 1 visit during the first half of the subsequent year (year 2) (366–548 days after entry), (4) at least 1 visit during the second half of year 2 (549–730 days after entry), (5) evaluation of baseline asthma severity, and (6) evaluation of asthma control at all visits during year 1. Patients who did not fulfill all of these criteria were excluded. Patient consent was not required because this was a retrospective analysis of clinical data. This study was reviewed and approved by the institutional review board at LAC + USC Medical Center.

Asthma Treatment

Patients were treated by asthma specialists using 1997 NAEPP guidelines.^{5,6} Patients had unrestricted access to inhaled corticosteroids, long-acting β_2 -agonists, and leukotriene receptor antagonists. The type, dose, and combinations of these agents were left to the discretion of the physician and the patient.

Measures and Data Collection

Data from an electronic medical record system (Asmatrax) for January 3, 1998, to December 23, 2007, were analyzed. During every clinic visit, the frequencies of daytime and nighttime symptoms, bronchodilator use, asthma exacerbations, and ED visits or hospitalizations were recorded. Lung function tests were usually performed at the initial visit and were repeated approximately every 6 months based on the criteria recommended by the American Thoracic Society. Asthma severity was determined during the first visit based on NAEPP guidelines,^{5,6} and asthma disease activity was determined at every follow-up visit.

Asthma control at each visit was rated as controlled if all the following criteria were met: (1) daytime symptoms twice a week or less; (2) nighttime symptoms less than 2 times per month; (3) forced expiratory volume in 1 second of at least 80% of predicted or at least 80% of optimum for the patient; (4) rescue β_2 -agonist use (independent of exercise prophylaxis or exercise-induced symptoms) twice a week or less during the daytime and less than twice a month at night; (5) no acute asthma exacerbations (self-reported), defined as a severe asthma exacerbation requiring systemic corticosteroid rescue since the last visit; and (6) no ED visits or hospitalizations (self-reported) since the last visit. Daytime and nighttime symptoms and β_2 -agonist use were based on 4-week recall.

The degree of asthma control was determined using data from the first year of program enrollment. Patients were

stratified into 3 asthma control categories: well controlled ($\geq 80\%$ of visits in control), moderately controlled (50%–79% of visits in control), and difficult to control ($< 50\%$ of visits in control). Asthma control during year 1 was evaluated independently of self-reported morbidity during year 2.

The primary outcome was whether the degree of asthma control during year 1 resulted in a reduced likelihood of asthma morbidity (asthma exacerbations requiring systemic corticosteroid rescue or ED visits or hospitalizations) during the second year of enrollment. Secondary independent points of interest included the impact of age, sex, ethnicity (African American vs Hispanic), underlying asthma severity, and the potential clustering effect of site of care on the aforementioned morbidities.

Statistical Analysis

Logistic regression analysis was applied to evaluate whether patients with well-controlled asthma have a decreased likelihood of a future asthma exacerbation. The effect of asthma control during year 1 on time to an acute exacerbation was examined by conducting Cox regression analyses within each age group (3–5, 6–11, and 12–18 years). Owing to the small number of patients requiring an ED visit or hospitalization during year 2, the stratified analysis was not used in the examination of time to this outcome. The TIES=EXACT approach was specified in the SAS model statement for the survival analysis (PHREG) procedure to account for tied event times that have a true but unknown order (ie, construct of time as an interval although multiple patients may have reported events at the same discrete time points [visit numbers] during year 2).

Potential confounding factors investigated in each analysis included age (≤ 5 , 6–11, and 12–18 years), sex, ethnicity (Hispanic, African American, white, and other), and baseline asthma severity (intermittent, mild persistent, moderate persistent, and severe persistent). Analyses were adjusted for the potential clustering effect of site of care. The likelihood of a future morbidity event in relation to year 1 asthma control was evaluated using SPSS version 11.0 (SPSS Inc, Chicago, Illinois). The cumulative probability of no asthma exacerbations across year 2 follow-up visits was analyzed using SAS version 9.1 (SAS Institute Inc, Cary, North Carolina).

RESULTS

Study Population

Of the 960 patients enrolled, most were Hispanic ($> 80\%$) (Table 1). Approximately 60% of the patients were 6 to 11 years of age and male. During the first year, more than 40% of all the patients had well-controlled asthma ($\geq 80\%$ of visits in control), approximately one-third had moderately controlled asthma (50%–79% of visits in control), and approximately 20% had difficult-to-control asthma ($< 50\%$ of visits in control). During years 1 and 2, the mean period from the first to the last visit was 321 and 347 days, respectively. The mean number of return visits was 5 during each year.

Table 1. Characteristics of the 960 Study Patients

Characteristic	Value
Age at entry, %	
2–5 y	19.3
6–11 y	60.4
12–18 y	20.3
Sex, M/F, %	61.5/38.5
Ethnicity, %	
Hispanic	81.3
African American	8.5
White	2.4
Other	7.8
Visits during year 1, mean (SD), No.	5 (1.6)
Visits during year 2 mean (SD), No.	5 (1.7)
Underlying asthma severity, %	
Mild intermittent	26.6
Mild persistent	21.9
Moderate persistent	31.0
Severe persistent	20.5
Asthma control during year 1, %	
Difficult to control	20.6
Moderate control	35.5
Well controlled	43.8

Distribution of Asthma Control During Year 1

The distribution of asthma control during year 1 differed by underlying disease severity established during the first visit (baseline) ($P < .05$) (Fig 1). Median percentages of year 1 follow-up visits in which asthma was rated as controlled for patients who were evaluated at baseline to have mild intermittent, mild persistent, moderate persistent, and severe persistent asthma severity were 100%, 80%, 75%, and 67%, respectively. Patients in each underlying severity group exhibited difficult-to-control, moderately controlled, and well-controlled asthma during year 1. In general, patients with less severe disease evaluated at the first visit maintained a higher degree of asthma control during year 1, although some patients with mild disease exhibited a low percentage of visits with asthma rated as controlled, and some patients with severe disease maintained good asthma control during this period (Fig 1).

Asthma Control and the Likelihood of Acute Asthma Exacerbations (Primary Outcome)

Increasing the degree of asthma control during year 1 was associated with differential risk reduction of asthma exacerbation during the subsequent year (Table 2). Compared with patients whose asthma was difficult to control during year 1, patients with moderately controlled and well-controlled asthma were 26% and 53%, respectively, less likely to experience an asthma exacerbation the following year, although only patients with well-controlled asthma achieved significance ($P < .01$). Patients with a higher degree of asthma control during year 1 had a longer time to first asthma exacerbation during year 2. The cumulative probability of not having an exacerbation during each visit during year 2 was

higher in patients whose asthma was well controlled during year 1 compared with patients whose asthma was not well controlled during the same period (Fig 2). This was consistent in the analysis of the entire study group and when adjusted for demographic factors, baseline asthma severity, and the potential clustering effect of site of care.

After adjustment for demographic factors, baseline asthma severity, and the potential clustering effect of site of care, well-controlled asthma during year 1 was the most significant factor contributing to the reduced likelihood of an exacerbation during year 2. Maintaining moderate levels of asthma control showed substantial benefit across age groups, although significant protection against future attacks was detectable only in patients with well-controlled asthma ($P < .05$) (Table 2 and Fig 2).

Age, Sex, Ethnicity, and Underlying Asthma Severity and the Likelihood of Asthma Exacerbations (Secondary Outcomes)

Patients who were older, female, and Hispanic compared with African American were less likely to have asthma exacerbations during year 2 when adjusted for other variables, including asthma control (Table 2). Less severe baseline asthma severity was associated with a reduced likelihood of asthma exacerbations in the unadjusted but not the adjusted study population.

Asthma Control and the Likelihood of ED Visits or Hospitalizations (Primary Outcome)

Increasing the degree of asthma control during year 1 was associated with differential risk reduction of ED visits or hospitalizations during the subsequent year (Table 3). Patients with a higher degree of asthma control during year 1 had longer times to the first ED visit or hospitalization during year 2. The cumulative probability of not requiring an ED visit or hospitalization during each visit during year 2 was higher in patients whose asthma was well controlled during year 1 compared with patients whose asthma was not well controlled during the same period (Fig 3). Compared with patients whose asthma was difficult to control during year 1, patients with moderately controlled and well-controlled asthma were 4% and 53%, respectively, less likely to require ED visits or hospitalizations the following year, although only patients with well-controlled asthma achieved significance ($P < .01$). This was consistent in the analysis of the entire study group and when adjusted for demographic factors, baseline asthma severity, and the potential clustering effect of site of care.

Age, Sex, Ethnicity, and Underlying Asthma Severity and the Likelihood of ED Visits or Hospitalizations (Secondary Outcomes)

Patients who were older, who were Hispanic vs African American, and who had baseline asthma severity of mild intermittent (compared with patients with baseline asthma severity of severe persistent) were less likely to have ED

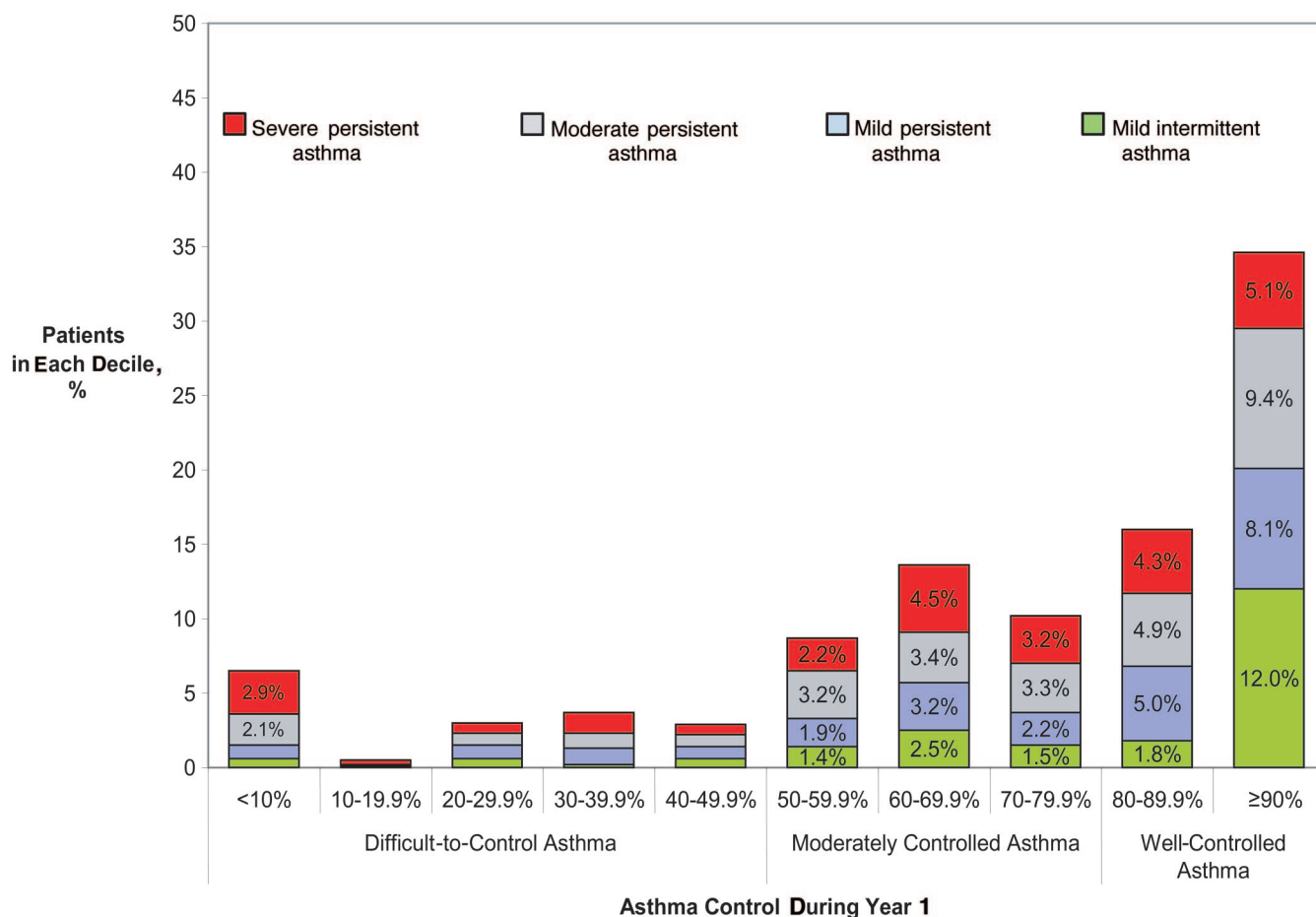


Figure 1. There was a wide range (0%–100%) in the degree of asthma control (percentage of follow-up visits in control) during year 1. A less severe disease rating at the first visit (baseline) was generally associated with an increased degree of asthma control. The medians (25th–75th percentiles) for each severity group were as follows: mild intermittent, 100% (66.7%–100%); mild persistent, 80% (60%–100%); moderate persistent, 75% (50%–100%); and severe persistent, 67% (50%–83%).

visits or hospitalizations during year 2 when adjusted for other variables, including asthma control (Table 3 and Fig 3).

DISCUSSION

This retrospective observational study demonstrates that increasing the degree of asthma control is associated with differential risk reduction of acute asthma exacerbations and ED visits or hospitalizations in inner-city asthmatic children who are highly engaged in an asthma treatment program. Well-controlled asthma (maintaining asthma control for $\geq 80\%$ of visits) for 1 year had a highly significant protective effect against these asthma-related morbidities during the following year (year 2). Patients who did not achieve the stringent criteria of well-controlled asthma but maintained a moderate degree of control (50%–79% of visits with asthma controlled) still had a strong trend toward a reduced likelihood of asthma exacerbations and ED visits or hospitalizations compared with those who had difficult-to-control

asthma (<50% of visits in control). The results validate positions taken by asthma guidelines advocating disease control in the long-term treatment of asthma and support the use of systematic evaluation of asthma control as a useful instrument for predicting future morbidity in asthmatic children.^{1,3,5,6}

In patients with persistent asthma, the likelihood of asthma morbidity was statistically similar regardless of baseline severity if asthma control was not maintained (Tables 2 and 3). This supports clinical observations that initial asthma severity evaluated at a single time point may not be a strong predictor of future asthma morbidity.^{1,7,8} Mild intermittent asthma activity was protective against ED visits or hospitalizations. Patients with mild intermittent asthma as a group may represent a different asthma phenotype compared with those with persistent disease. This may be due to the presence of persistent inflammation and aberrant airway responsiveness in persistent vs inter-

Table 2. Asthma Control During Year 1, Age, Sex, Ethnicity, and Underlying Asthma Severity in Relation to Future Morbidity (Acute Attacks) During Year 2

	Acute attack(s) in year 2 (%)			OR (95% CI)	
	0	1	≥2	Unadjusted	Adjusted ^a
Overall (N = 960)	72.9	18.4	8.6		
Asthma control during year 1 ^b				<i>P</i> < .001	<i>P</i> = .001
Difficult to control (n = 163)	62.0	22.7	15.3	1 [Reference]	1 [Reference]
Moderate control (n = 312)	69.2	21.5	9.3	0.72 (0.5–1.1)	0.74 (0.5–1.1)
Well controlled (n = 485)	79.0	15.1	6.0	0.43 (0.3–0.6) ^c	0.47 (0.3–0.7) ^c
Age at entry, y				<i>P</i> = .01	<i>P</i> = .01
3–5 (n = 190)	66.3	19.5	14.2	1 [Reference]	1 [Reference]
6–11 (n = 587)	72.7	19.9	7.3	0.74 (0.5–1.1)	0.67 (0.5–1.0) ^d
12–18 (n = 183)	80.3	12.6	7.1	0.48 (0.3–0.8) ^c	0.47 (0.3–0.8) ^c
Sex				<i>P</i> = .03	<i>P</i> = .045
M (n = 572)	70.3	20.6	9.1	1 [Reference]	1 [Reference]
F (n = 388)	76.8	15.2	8.0	0.71 (0.5–1.0) ^d	0.73 (0.5–1.0) ^d
Ethnicity				<i>P</i> = .02	<i>P</i> = .035
Hispanic (n = 835)	74.6	17.6	7.8	1 [Reference]	1 [Reference]
African American (n = 46)	56.5	23.9	19.6	2.26 (1.2–4.1) ^c	2.03 (1.1–3.9) ^d
White (n = 31)	64.5	19.4	16.1	1.62 (0.8–3.4)	1.85 (0.8–4.1)
Other (n = 48)	64.6	27.1	8.3	1.61 (0.9–3.0)	1.80 (0.9–3.4)
Underlying asthma severity				<i>P</i> < .001	<i>P</i> = .06
Mild intermittent (n = 255)	84.8	10.8	4.4	0.31 (0.2–0.5) ^c	0.61 (0.4–1.0)
Mild persistent (n = 210)	71.4	21.8	6.8	0.69 (0.5–1.0)	1.20 (0.8–1.9)
Moderate persistent (n = 298)	73.8	18.3	7.9	0.61 (0.4–0.9) ^c	1.02 (0.7–1.6)
Severe persistent (n = 197)	63.4	21.8	14.8	1 [Reference]	1 [Reference]

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

^a Adjusted for other factors (listed in column 1) and the potential clustering effect of treatment site.

^b Asthma control during year 1 based on the percentage of follow-up visits within 365 days of entry that the patient's asthma was in control: difficult to control, less than 50%; moderate control, 50% to 79%; and well controlled, 80% or more.

^c *P* ≤ .01.

^d *P* ≤ .05.

mittent asthmatic patients. Significant numbers of patients were controller naïve when first seen by us (data not shown), and the mild intermittent symptoms of some patients may reflect the mild intermittent nature of their disease and not disease activity suppressed by controller agents.

Other factors that affected risk of acute exacerbations and ED visits or hospitalizations independent of asthma control included young age and African American race. Female patients had a decreased risk of acute exacerbations, and patients with mild intermittent asthma severity had significantly fewer ED visits or hospitalizations independent of asthma control (Tables 2 and 3). The significantly higher risk of ED visits or hospitalizations in the small population of African American compared with Hispanic patients in this study supports current evidence that asthma phenotype may be different in different ethnic populations. Reasons for this may include access to care, compliance, and differential response to asthma medications associated with genetic polymorphisms. Further study into these factors in this study population may help explain the increased risk of asthma exacerbations in African American patients.^{9–12}

Congruent with published observations,^{13,14} these data show that younger children may experience more severe

exacerbations compared with older ones. Children aged 3 to 5 years were 4 and 2 times more likely to require ED visits or hospitalizations and to experience acute asthma exacerbations, respectively, than children 12 years and older. In the aforementioned high-risk groups, however, maintaining asthma control (year 1) results in a decreased likelihood of future asthma-related morbidity (year 2). For example, maintaining well-controlled asthma in 3- to 5-year-olds resulted in a 3-fold reduction in risk of acute asthma exacerbations and increased time to first attack compared with similar patients with difficult-to-control asthma (Table 2 and Fig 2). Similarly, time to first ED visit or hospitalization was increased in African American patients with well-controlled vs difficult-to-control asthma (Fig 3). Achieving and maintaining asthma control, therefore, seems to provide a protective effect against asthma-related morbidity regardless of other high-risk factors.

Although asthma controller agents often improve symptoms and reduce exacerbations, it was previously unclear whether strict asthma control is required to achieve these benefits given the potential adverse effects of inhaled corticosteroid treatment.^{1,3,15,16} Bateman et al¹⁷ demonstrated asthma control in a large number of adult patients with persistent asthma using inhaled corticosteroids alone and

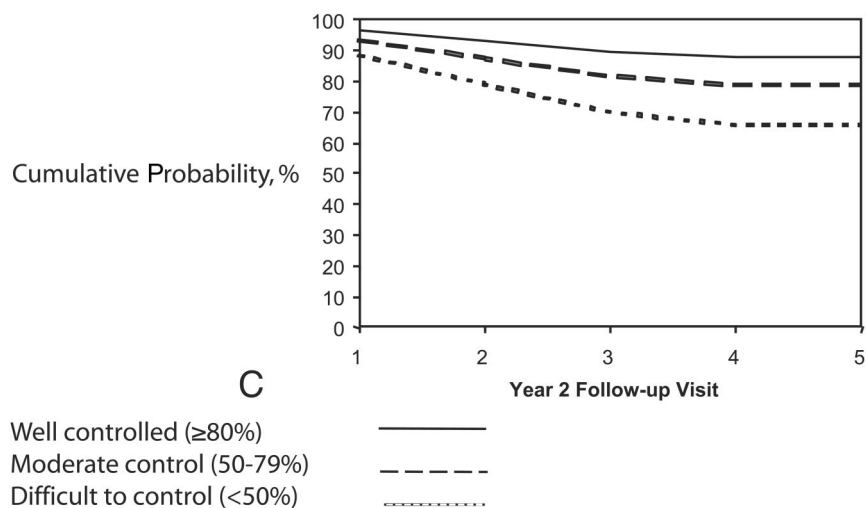
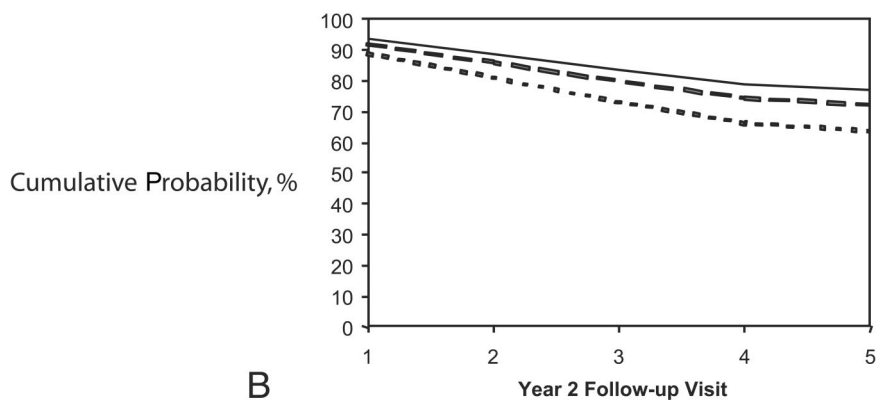
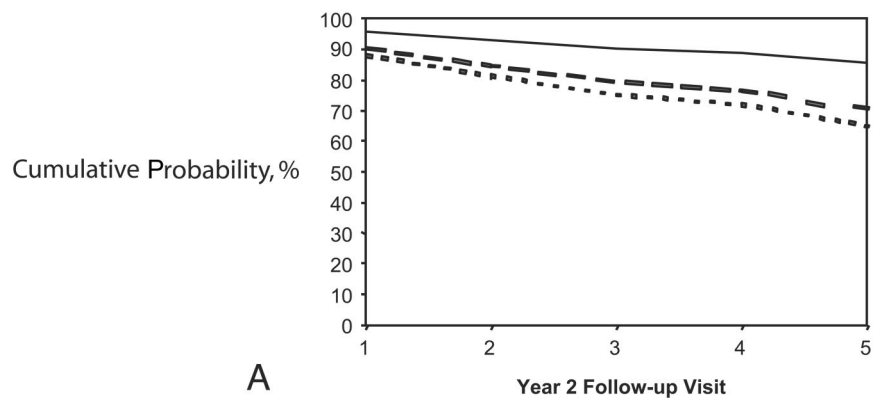


Figure 2. Year 1 asthma control and time elapsed with no acute exacerbations during year 2 in patients aged 3 to 5 years (A), 6 to 11 years (B), and 12 to 18 years (C). The cumulative probability of the patient's asthma being maintained with no acute exacerbations during year 2 at each consecutive follow-up visit (y-axis) was affected by the degree of asthma control during year 1 across age groups ($P < .05$) when controlled for the potential clustering effect of site of care (Cox regression analysis). Because ethnicity factored into the model for 12- to 18-year-olds, probability estimates shown are for non-African American patients (primarily the Hispanic group). Estimates are plotted for mobile unit 2 (mode for site of care).

Table 3. Asthma Control During Year 1, Age, Sex, Ethnicity, and Underlying Asthma Severity in Relation to Future Morbidity (ED Visits or Hospitalizations) During Year 2

	ED visits or hospitalizations in year 2 (%)		OR (95% CI)	
	0	≥1	Unadjusted	Adjusted ^a
Overall (N = 960)	92.0	8.0		
Asthma control during year 1 ^b			<i>P</i> = .003	<i>P</i> = .03
Difficult to control (n = 163)	87.1	12.9	1 [Reference]	1 [Reference]
Moderate control (n = 312)	90.1	9.9	0.75 (0.4–1.3)	0.96 (0.5–1.8)
Well controlled (n = 485)	94.8	5.2	0.37 (0.2–0.7) ^c	0.47 (0.2–0.9) ^d
Age at entry, y			<i>P</i> = .003	<i>P</i> = .006
3–5 (n = 190)	86.8	13.2	1 [Reference]	1 [Reference]
6–11 (n = 587)	92.2	7.8	0.56 (0.4–0.9) ^d	0.62 (0.4–1.1)
12–18 (n = 183)	96.7	3.3	0.22 (0.1–0.6) ^c	0.21 (0.1–0.5) ^c
Sex			<i>P</i> = .03	<i>P</i> = .10
M (n = 572)	90.4	9.6	1 [Reference]	1 [Reference]
F (n = 388)	94.3	5.7	0.57 (0.3–0.9) ^d	0.63 (0.4–1.1)
Ethnicity			<i>P</i> < .001	<i>P</i> = .004
Hispanic (n = 835)	93.5	6.5	1 [Reference]	1 [Reference]
African American (n = 46)	73.9	26.1	5.11 (2.5–10.4) ^c	4.12 (1.8–9.5) ^c
White (n = 31)	90.3	9.7	1.55 (0.5–5.3)	1.86 (0.5–6.8)
Other (n = 48)	83.3	16.7	2.89 (1.3,6.5) ^c	2.25 (0.9–5.4)
Underlying asthma severity			<i>P</i> = .04	<i>P</i> = .03
Mild intermittent (n = 204)	97.1	2.9	0.30 (0.1–0.8) ^d	0.20 (0.1–0.6) ^c
Mild persistent (n = 167)	91.0	9.0	0.99 (0.5–1.9)	0.59 (0.3–1.3)
Moderate persistent (n = 206)	90.0	10.0	1.12 (0.6–2.0)	0.58 (0.3–1.2)
Severe persistent (n = 154)	90.9	9.1	1 [Reference]	1 [Reference]

Abbreviations: CI, confidence interval; ED, emergency department; OR, odds ratio.

^a Adjusted for other factors (listed in column 1) and the potential clustering effect of treatment site.

^b Asthma control during year 1 based on the percentage of follow-up visits within 365 days of entry that the patient's asthma was in control: difficult to control, less than 50%; moderate control, 50% to 79%; and well controlled, 80% or more.

^c *P* ≤ .01.

^d *P* ≤ .05.

combined with long-acting β_2 -agonists. Patients who achieved asthma control had reduced urgent care visits, although no statistical analysis was reported for this end point.¹⁷ This study, for the first time, to our knowledge, shows that a high degree of asthma control confers clinically important benefits (reduced risk of asthma exacerbations and ED visits or hospitalizations) in asthmatic children. This will aid in weighing benefits and adverse effects of controller agents when treating these patients.

The results of this study must be interpreted with several caveats in mind. This was a retrospective observational study, and analysis was performed only in patients who were highly compliant with the program. The ED and hospital visits were based on patient recall and not on administrative data. Follow-up visits were more frequent than recommended by guidelines,¹ and increased interaction with providers may have been a factor resulting in reduced morbidity compared with less engaged patients. Interpretations involving African American patients must be taken with caution owing to the small numbers of these patients. Finally, asthma control was determined using a composite measurement, including mor-

bidity since the last visit.^{1,3} Because history of exacerbations has been shown to predict similar future events, it is possible that day-to-day control of asthma symptoms and lung function may not be as important as the elimination of asthma exacerbations during year 1 that results in a reduction in asthma morbidity in year 2.² A documented history of asthma morbidity, however, may not be readily available in certain clinical settings, and considerable burden is placed on patient recall. Furthermore, asthmatic patients often underestimate the severity of their disease, and it is conceivable that patients with more mild baseline disease may underestimate previous asthma exacerbations, although this has not been rigorously studied.^{1,18} Following the degree of asthma control in real time has the advantage of minimizing errors due to patient recall. Therefore, used prospectively, systematic tracking of the degree of asthma control may be an accurate and useful predictor of future asthma risk.

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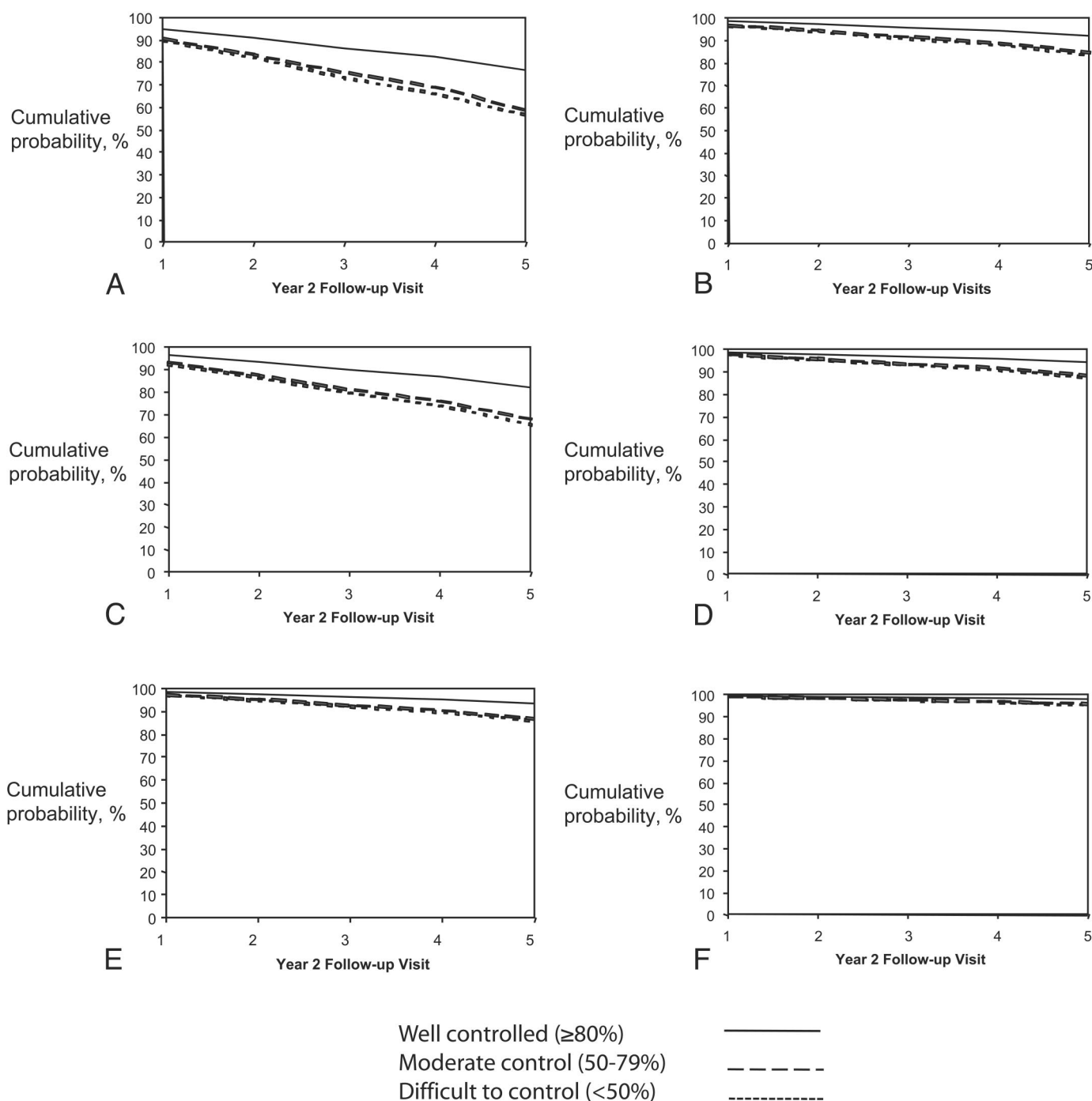


Figure 3. Year 1 asthma control and time elapsed with no emergency department visits or hospitalizations during year 2 in African American patients aged 3 to 5 years (A), 6 to 11 years (C), and 12 to 18 years (E) and in Hispanic patients aged 3 to 5 years (B), 6 to 11 years (D), and 12 to 18 years (F). The cumulative probability of the patient's asthma being maintained with no emergency department visits or hospitalizations during year 2 at each consecutive follow-up visit (y-axis) was affected by the degree of asthma control during year 1 ($P = .02$), African American ethnicity ($P = .001$), and patient age ($P = .02$) when controlled for the potential clustering effect of site of care. Estimates are plotted for mobile unit 2 (mode for site of care).

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