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Current Asthma Guidelines May Not Identify Young Children Who Have Experienced Significant Morbidity

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ABSTRACT

BACKGROUND. The current guideline for classifying asthma severity, the National Asthma Education Prevention Program (NAEPP) 2002, is not evidence-based. We had the opportunity to validate this guideline in an untreated inner-city population, both in those ≤ 5 and those > 5 years of age. The basis for this retrospective validation model was to determine how well the NAEPP severity classification based on symptom-frequency criteria alone identified patients in those age groups demonstrating significant morbidity the previous year and thus the potential need for controller therapy.

METHODS. Using a mobile asthma van (Breathmobile) at the school site, children not receiving controller medication were evaluated by an asthma specialist for severity according to NAEPP guideline clinical criteria. Validation was determined by the relationship of guideline severity to ≥ 2 emergency department (ED) visits, any hospitalization, health care utilization (any ED visit, hospitalization), number of exacerbations, and school absenteeism resulting from asthma the prior year.

RESULTS. Eight hundred twenty-six asthmatic children were evaluated; 89 (10.8%) were ≤ 2 years, 222 (26.9%) were 3 to 5 years, and 515 (62.3%) were > 5 years of age; 60.5% were male, and 80.9% were Hispanic. Classification of asthma severity included 34.4% with mild intermittent, 10.2% with mild persistent, 31.5% with moderate persistent, and 24.0% with severe persistent asthma categories. There were significantly more Hispanic children and children ≤ 5 years classified as having mild intermittent asthma. Morbidity was clearly related to severity in the overall population. However, although the health care utilization was significantly related to severity, it was borderline in those 3 to 5 years and nonsignificant in children ≤ 2 years.

CONCLUSIONS. The NAEPP guidelines 2002, based on symptom-frequency criteria as assessed in this study, seem to offer a valid basis for classifying asthma severity in those > 5 years of age but may underclassify younger children. Our data suggest that morbidity experienced in the prior year may provide a useful additional criterion for classifying asthma severity, particularly in those children ≤ 5 years of age.

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Key Words

asthma, inner city, asthma control, asthma exacerbation, guidelines

Abbreviations

HC—health care
NAEPP—National Asthma Education Prevention Program
CHOC—Children's Hospital of Orange County
ED—emergency department
FVC—forced vital capacity
MI—mild intermittent
MIP—mild persistent
MOP—moderate persistent
SP—severe persistent

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BRONCHIAL ASTHMA in childhood poses a huge health burden in terms of prevalence, morbidity, and cost.¹⁻³ This is particularly true in young children who may be at particular risk of underdiagnosis and treatment resulting in increased morbidity.¹ Martinez et al⁴ have suggested that loss of lung function may occur in the first 3 to 5 years of life. Several studies have established that the use of inhaled corticosteroids is effective in reducing symptoms, exacerbations, health care (HC) use, and improving pulmonary function in children if started early in the inflammatory process.⁵⁻⁸ Furthermore, beneficial results have been seen even in those considered to have "mild" asthma.^{9,10} Despite these observations, studies have shown underuse of controller medication in children, particularly in the "inner-city" population, where the risk of morbidity may even be higher.^{11,12}

To improve diagnosis and therapy, the National Asthma Education Prevention Program (NAEPP) devised guidelines that provide recommendations for therapy based on classification of severity. First published in 1991,¹³ there have been revisions in 1997¹⁴ and 2002.¹⁵ According to the 2002 classifications, severity is based on daytime and nighttime symptom frequency in those both ≤ 5 years and those > 5 years of age and pulmonary function in those > 5 years of age. These recommendations are based on a consensus of experts and are not evidence based. However, included in the most recent report are new recommendations, not necessarily guidelines, for the initiation of inhaled corticosteroids in infants and young children who experience exacerbations, particularly if they also demonstrate risk factors for allergy and asthma.¹⁵ This is based on the Tucson Study Clinical Index, which defines the risk of developing persistent asthma in this population.¹⁶ Several studies report poor acceptance of these guidelines by primary care physicians, at least in part because they are not evidence based.^{17,18} Furthermore, there is evidence that even those assumed by guideline criteria to have mild asthma can have considerable morbidity and even mortality.^{9,10,19,20} Thus, there clearly needs to be a more comprehensive approach, as suggested by Fuhlbrigge et al,²¹ to detecting children at risk for asthma morbidity.

In this report, we introduce a novel outreach program using a mobile asthma van, the Breathmobile²² at the school site where > 800 children, $\sim 80\%$ Hispanic, were evaluated between April 2002 and April 2005. In evaluating these children, it was initially observed that the severity classification by the asthma specialist based on NAEPP guidelines seemed to reflect their morbidity the previous year. We felt this presented an ideal opportunity to explore the question of whether this classification system based primarily on daytime and nighttime symptom frequency and spirometry, in those previously untreated with controller medication, provided a valid measure for severity based on asthma-related morbidity

in the previous 12 months. The assumption that this retrospective analysis was valid was based on the notion that those experiencing previous morbidity can be at increased risk for future morbidity, as suggested by others.²³⁻²⁷ In addition, once evaluated in our program, patients with persistent asthma criteria were given controller medication and, thus, were no longer controller-naïve. Several previous models have been used to validate NAEPP severity guidelines at baseline.²⁸⁻³² Morbidity as an outcome, both retrospectively³⁰ and prospectively,^{31,32} has generally been shown to correlate well with guideline criteria. However, because the NAEPP guidelines apply only to previously untreated patients, studies may have been confounded, because patients had been on controller medication at baseline.^{30,32} Furthermore, only 1 morbidity study evaluated a pediatric population.³⁰ In our population, $\sim 80\%$ of the patients had been previously untreated with controller medication for ≥ 6 to 8 weeks before baseline evaluation, making these patients suitable for evaluation of the NAEPP guidelines. The specific goal of this retrospective study was to determine whether asthma severity based on guideline-specific symptom frequency criteria alone could identify children who had experienced morbidity the previous year including those ≤ 5 years of age. In a separate report, we more fully explore the value of spirometry in classifying severity, because recent studies suggest a lack of association between detection of airway obstruction and asthma severity based on clinical assessment in children.³³

METHODS

The Orange County Breathmobile is a mobile asthma clinic based on the delivery of a HC program developed by the Southern California chapter of Asthma and Allergy Foundation of America Breathmobile based at the Los Angeles County/University of Southern California Medical Center.²² The Orange County Breathmobile is affiliated with Children's Hospital of Orange County (CHOC) and provides care for children up to age 18 at > 20 low-income public school and preschool sites throughout Orange County, California. CHOC waived review of this study, because data acquisition and analysis was not directly linked to individual patients.

Study Population

The study population sampled was preschool- and school-aged children from low-income cities in Orange County who had been diagnosed previously with asthma or were suspected to have asthma based on symptoms of cough, chest tightness, dyspnea, and wheezing primarily by school and preschool personnel. Children who had younger siblings of the target population were also included, as the only exclusion criterion was age > 18 years because of CHOC policy. The majority of our patient population reflected a high percentage of Latino

children with low socioeconomic status found in these inner-city schools.

Study Staff

The staff on board the Breathmobile included a board certified allergy specialist, registered nurse, driver, and a community health advocate from Latino Health Access. All of the staff members were bilingual in Spanish and English to minimize language barriers.

Procedure

We selected school and preschool sites based on geographic distribution to maximize the area of coverage, location, and areas of low income. This was based on >85% of children in a school qualifying for free or reduced lunch programs, an economic index related to the federal gross income poverty lines. We recruited children by referral from school nurses and public health clinics, responses to advertisements from health fairs at schools, an asthma case detection questionnaire,^{22,34} and posthospitalization or emergency department (ED) visits. Referrals were based on the review of health records where asthma was indicated as a medical condition, use of β agonist in the nurse's office, history of frequent prolonged school absences because of respiratory infection, and reports or observation of asthma symptoms (cough, wheezing, or dyspnea) by the school staff. The families of children identified were given information about the Breathmobile program directly and invited to call for an appointment. Initial patient appointments generally were made on a self-referral process with no referral or prior authorization required from primary care providers to enter the Breathmobile program. Each new patient visit began with determination of demographic data, insurance information, and consent for treatment.

Baseline Asthma Evaluation

History

We performed a detailed medical history, obtained from the patient and/or parent, including age of onset, duration of asthma, morbidity in the previous year including number of hospitalizations, ED visits, exacerbations, and school absenteeism because of asthma. Asthma exacerbations for this study were defined as a severe asthma attack with respiratory distress in the previous year, which would ordinarily require increased inhaled bronchodilator use and systemic steroids. Medication criteria were not required, because this was a largely untreated and previously undiagnosed population. In addition, we recorded frequency of day and night symptoms conforming to NAEPP guidelines, and medication history included controller and β agonist use in the 6 to 8 weeks before the visit. A controller-naïve patient was defined

as one who had not received controller medication in the 6 to 8 weeks before the initial evaluation.

Physical Examination

We performed a physical examination, which included the usual examination performed for patients suspected of a diagnosis of asthma and allergy.

Laboratory Tests

Skin Testing

We selected the following allergens for prick-puncture skin testing: cat, dog, feathers, cockroach, house dust mite, mold mix, tree mix, weed mix, and grass mix. Allergens were provided by Hollister Stier Laboratories LLC (Spokane, WA). Results will be described in a separate report.

Spirometry

We attempted spirometry testing for all of the children ≥ 4 years of age. Spirometric results were included in the analysis if the child completed ≥ 3 forced vital capacity (FVC) maneuvers that met the acceptability criteria of the American Thoracic Society from a maximum of 6 attempts.³⁵ The best spirometric measurements of ≥ 3 attempts were recorded for analysis, including FVC, forced expiratory volume in 1 second, forced expiratory volume in 1 second/FVC%, and forced expiratory flow. Spirometry measures were compared in Knudsen/Intermountain Thoracic Society normal predictive values and adjusted for ethnic values based on parent reports of ethnicity/race.³⁶ Spirometry equipment was purchased from Creative Biometrics International, Inc (Win Dx 1.00.54).

Criteria for the Diagnosis of Asthma and Asthma Severity

The diagnosis of asthma was determined by the history of recurrent coughing, wheezing, or shortness of breath at rest or with exercise, symptomatic improvement following bronchodilator use, and exclusion of other diagnoses as suggested previously.¹⁵ The NAEPP classification of asthma severity was made by selecting the most severe category based on daytime/nighttime symptom frequency.¹⁵

Validation of NAEPP Asthma Severity Classification

Validation of this instrument was based on comparison of severity classification to morbidity for the previous 12 months. The morbidities evaluated included ≥ 2 ED visits, any hospitalization, HC use (any ED visits or hospitalization), number of exacerbations, and school absenteeism experienced in the previous year. Data acquisition used a standardized form, which we constructed to reflect what an asthma specialist would use in an outpatient/office setting.

Data Entry

We input all of the patient data in the standardized form using the Asma trax System, a computer-based data entry program developed and trademarked by Dr Loran Clement of the Los Angeles County/University of Southern California Breathmobile program.²¹

Statistical Analysis

χ^2 test statistics were calculated to assess the significance of distributional differences in gender, ethnicity, and severity by age groups (≤ 2 , 3–5, and > 5 years), presented in Table 1. Furthermore, the significance of association between categorical outcome measures of morbidity (ED visits, hospitalizations, and HC use) as a function of our independent variables of interest, severity, and age made use of this statistic. Distributions for morbidity outcomes, school days missed and number of exacerbations, were positively skewed. Transformations were applied in an attempt to normalize the data, but the resulting distributions still exhibited significant departures from the reference range. Describing average number of school days missed and exacerbations by calculation of means would not have provided an accurate reflection of the patient experience. Therefore, average values were evaluated across symptom severity groups by medians. Distributions were further described by providing the lower and upper end of the range between which 50% of patients had corresponding values (25th and 75th percentiles). The Kruskal-Wallis test was applied to assess the significance of observed differences in average school days missed and the number of exacerbations between severity groups. Significance of age differences in the average number of exacerbations was examined using the same methodology. Differences in the percentage of patients reporting HC use (past year) across severity groups for each age stratum (see Fig 1) were evaluated for significance by the χ^2 test statistic. All of the analyses were performed by using SPSS 12.0 (SPSS Inc, Chicago, IL).

RESULTS

Characteristics of Patient Population by Underlying Asthma Severity (Table 1)

Shown in Table 1 are the overall and age-specific demographic characteristics of 826 controller-naïve children who were seen during the first 3 years of operation. There were 89 (10.8%) ≤ 2 years, 222 (26.9%) 3 to 5 years, and 515 (62.3%) > 5 years of age; 60.5% were male, and 80.9% were Hispanic. In terms of severity classification, 34.4% were thought to be mild intermittent (MI), 10.2% mild persistent (MIP), 31.5% moderate persistent (MOP), and 24.0% severe persistent (SP) disease. There were significant differences ($P = .001$) for Hispanic ethnicity and severity classification when comparing those ≤ 5 years to those > 5 years of age. Particularly striking was the comparison of MI disease for those ≤ 2 years and 3 to 5 years, ~41% compared with those > 5 years (30.5%).

Relationship Between NAEPP-Assessed Severity and Morbidity the Previous Year (Table 2)

In the total population, morbidity was significantly related to severity including ED visits ($P < .001$) and hospitalization ($P = .014$), HC use ($P < .001$), number of exacerbations ($P < .001$), and school absenteeism ($P < .001$).

Relationship Between Patient Age at Program Entry and Morbidity the Previous Year (Table 3)

There was a trend for more morbidity in those ≤ 2 years compared with those > 5 years of age. ED visits (28.1% vs 19.6%), hospitalization (20.2% vs 12.4%), HC use (43.8% vs 35.9%), and exacerbations with median (25% and 75%) of 1 (0, 3) compared with 0 (0, 3).

Relationship Among HC Use, Age, and Asthma Severity

In Fig 1, we show the relationship of HC use to both severity and age. There was no statistically significant relationship between HC use and severity in those ≤ 2 years ($P = .257$), borderline significance in those 3 to 5 years,

TABLE 1 Description of Controller-Naïve Patient Population

Characteristic, %	Overall (n = 826)	Age ≤ 2 y (n = 89)	Age 3–5 y (n = 222)	Age > 5 y (n = 515)	χ^2 Test P^a
Male	60.5	60.7	59.5	60.9	.934
Female	39.5	39.3	40.5	39.1	
Hispanic	80.9	91.0	85.6	77.1	.001
Non-Hispanic	19.1	9.0	14.4	22.9	
NAEPP severity					
MI	34.4	41.6	41.0	30.3	.001
MIP	10.2	4.5	12.6	10.1	
MOP	31.5	22.5	24.3	36.1	
SP	24.0	31.5	22.1	23.5	

^a The χ^2 test was applied to evaluate significance of distributional differences in gender, ethnicity, and severity by age.

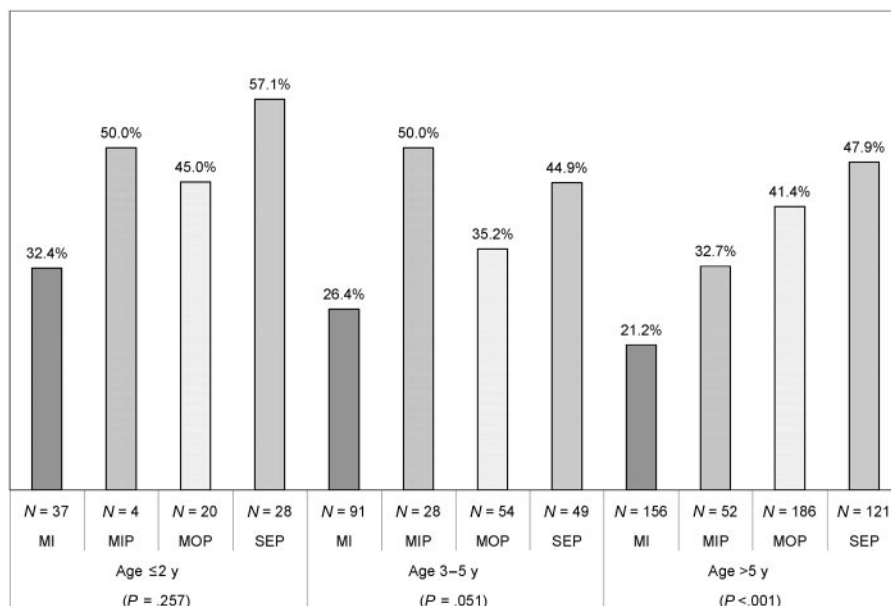


FIGURE 1
Distribution of percentage of patients reporting HC use (past year) evaluated by patient age and asthma severity (P based on χ^2 test statistic). SEP indicates severe persistent.

TABLE 2 Relationship Between NAEPP Assessed Severity and Morbidity Experience

NAEPP Severity	N	Morbidity Experience (Past Year)				
		ED, %	Hospitalized, %	HC, %	Exacerbations Median (25th, 75th Percentiles)	School Absenteeism Caused by Respiratory Symptoms (d) Median (25th, 75th Percentiles)
MI	284	12.3	8.5	24.3	0 (0, 1)	0 (0, 6)
MIP	84	21.4	17.9	39.3	1 (0, 3)	2.5 (0, 10)
MOP	260	20.4	16.2	40.4	0 (0, 3)	3 (0, 10)
SP	198	31.3	16.7	48.5	2 (0, 5)	6 (0, 20)
P^a		<.001	.014	<.001	<.001	<.001

ED indicates ≥ 2 ED visits; hospitalized, ≥ 1 hospitalizations; HC, ≥ 1 ED visit or ≥ 1 hospitalization.

^a Significance of between-severity-group differences in morbidity experience (ED, hospitalization, and HC, χ^2 test); exacerbations and school absenteeism, median value (Kruskal-Wallis test).

TABLE 3 Relationship Between Patient Age at Program Entry and Morbidity Experience

Age	N	Morbidity Experience (Past Year)			
		ED, %	Hospitalized, %	HC, %	Exacerbations Median (25th, 75th Percentiles)
≤2 y	89	28.1	20.2	43.8	1 (0, 3)
3-5 y	222	18.9	14.4	35.6	1 (0, 2)
>5 y	515	19.6	12.4	35.9	0 (0, 3)
P^a		.154	.137	.334	.187

ED indicates ≥ 2 ED visits; hospitalized, ≥ 1 hospitalizations; HC, ≥ 1 ED visit or ≥ 1 hospitalization.

^a Significance of between-age-group differences in morbidity experience (ED, hospitalization, and HC, χ^2 test); exacerbations, median value (Kruskal-Wallis test).

and a highly significant relationship in those >5 years of age ($P < .001$).

DISCUSSION

Berg and Moy,¹⁸ commenting on the 1991 NAEPP guidelines, after detailed review, suggested that "The guidelines offer clinicians a handy summary of a sample of current expert opinion, but had not advanced the level

of certainty of our diagnosis and care for this common and chronic condition." Although the updated 2002 guideline emphasizes evidence basis for therapeutic questions, the parameters for classification of asthma severity have not yet been validated and seem somewhat lacking, particularly in young children. In fact, with each new addition, the guideline parameters have been reduced and now entail only daytime and night-

time symptom frequency in the recent past, presumably 4 to 8 weeks, although not specified, and spirometry, which often is in the reference range, particularly in children regardless of the severity based on clinical parameters.³³ The importance of validating these guidelines cannot be overemphasized, because critical, long-term therapeutic decisions are based on these severity classifications.

The question we have addressed in this retrospective analysis is whether these guidelines can identify those children, particularly those ≤ 5 years of age, who have experienced significant morbidity in the past year and who may be at increased risk for future morbidity.^{23–27} In addition to age and severity, we evaluated the relationship between prior morbidity and those classified as mild, particularly with MI disease, because this group is often untreated despite showing a good response to low-dose inhaled corticosteroids.³⁷

In this study we have found that the NAEPP classification system based on symptom frequency criteria alone works well if judged by the observation that prior morbidity, including >2 ED visits, any hospitalization, HC use, exacerbations, and school absenteeism, is significantly related ($P < .001$) in the overall population to asthma severity (Table 2) and in those >5 years of age (Fig 1). However, in contrast, the relationship is only borderline ($P = .051$) in those 3 to 5 years and nonsignificant ($P = .257$) in children ≤ 2 years (Fig 1). In addition, even those thought by guideline criteria to have MI asthma had considerable morbidity, with 12.3% requiring >2 ED visits, 8.5% hospitalization, 24.3% HC use, and 11.4% with >10 missed days of school in the previous year. The situation was particularly problematic in those ≤ 2 years compared with >5 years of age where a larger percentage were classified as MI, 41.6% compared with 30.6%, and a greater percentage, 32.4% vs 21.2%, had prior HC use (Fig 1).

Of 6 previous reports that attempted to validate the NAEPP guidelines,^{28–32} the study by Warman et al³⁰ is closest to the model and population used in our study. That retrospective study, in the inner-city child, evaluated asthmatics, ages 2 to 12 years, who had been hospitalized previously, and found that the 1997 NAEPP severity classification correlated significantly with prior ED visits and exacerbations and showed a trend toward hospitalization rate. However, they were not able to differentiate MI asthma from MIP asthma or MOP from SP asthma, and a number of patients were on controller medication. Furthermore, all of the patients on entry had been hospitalized previously, and only 17% were classified as MI, suggesting a more severe population at higher risk in general than reported in our article. Furthermore, they did not stratify their results according to age, although 35% were 2 to 4 years old. An additional consideration is whether symptom frequency criteria alone represent the total asthma burden and need for

therapy. Fuhlbrigge et al²¹ have suggested recently that short-term (previous 4 weeks) parameters of day and nocturnal asthmatic symptoms alone may not accurately reflect the total asthma burden in those ≥ 16 years of age. They propose the concept of global burden, which includes, in addition to short-term considerations, functional limitations and long-term manifestations, including exacerbations in the previous year. Using the global burden shifted the severity classification of MI asthma from 43.7% by short-term criteria to 7.3% and MOP/SP from 35.9% to 77.3%. This concept may be particularly relevant in those ≤ 5 years of age.

The current guidelines recognize the limitations in accurately assessing children ≤ 5 years of age who often do not have symptom frequency criteria and are too young for office spirometry, yet experience morbidity to a greater degree than older children.¹ In an attempt to reconcile this dilemma, the 2002 NAEPP guideline report recognizes exacerbations as a risk factor for developing persistent asthma in young children.¹⁵ Although not a guideline, it recommends controller therapy in infants and preschoolers who have had ≥ 4 exacerbations in the prior year associated with identifiable risk factors for asthma and allergy or after episodes of severe exacerbations if these episodes occurred <6 weeks apart.¹⁵ These recommendations are based on a clinical index that predicts young patients at risk for development of persistent asthma rather than transient wheezing.¹⁶ More recently, Martinez and Godfrey³⁷ have developed an algorithm for treating this young population who are symptomatic but do not meet the NAEPP 2002 recommendation for controller therapy. They recommend inhaled corticosteroids for a 2- to 3-month trial, depending on exacerbation frequency and either atopic background in those <2 years of age or with a history of previous wheezing in the first 2 years of life in those 2 to 6 years of age. These recommendations for inhaled corticosteroid use, based on exacerbations as a major risk factor for identifying the child who may develop persistent asthma,¹⁶ are consistent with our own observation that exacerbations, particularly ≥ 2 in the previous year, were consistently associated with HC use ($P < .05$; data not shown).

The population we studied was inner city, predominantly Hispanic, which may not be applicable to other ethnic or socioeconomic populations. Furthermore, our data for classification based on symptom frequency in the previous 6 to 8 weeks and morbidity during the previous year were self-reported. However, we were able to review hospital records of 25 self-reported cases of hospitalization and confirmed 18, or 72%, of all cases. In addition, there is evidence suggesting that recall for ED visits and hospitalization may be accurate.³⁸ Because bias applies to both symptom and morbidity reporting, we would have expected underreporting of symptoms, as well as morbidity and medication usage in this pop-

ulation and not in a manner whereby morbidity was closely related to asthma severity. Using ED visits as a morbidity could also be misleading, because many of these children receive their usual care in the ED. Thus, we included only those experiencing ≥ 2 ED visits for asthma in the previous year as stand-alone criteria for morbidity. Absenteeism because of asthma was also self-reported, because records from the school were difficult to obtain.

Another limitation was using the criterion of no medication for 6 to 8 weeks before baseline for the controller-naïve population. This period was chosen based on the notion that beyond this period accuracy would be much less reliable, particularly in this population, and the fact that a 6- to 8-week controller washout is considered adequate in pharmacological studies requiring a controller-naïve population.^{39,40} In addition, if some patients had received controller medication before the 6- to 8-week criteria, one would expect the bias to result in less, rather than more prior morbidity compared with those who were truly controller-naïve. It is also very unlikely that this population, particularly the younger children, would have consistently received controller medication in the prior year.

In our study, we define an asthma exacerbation as a severe asthma attack characterized by respiratory distress, which would ordinarily require an inhaled β agonist and systemic corticosteroids. Although there is no generally accepted definition, an asthma exacerbation can generally be regarded as a significant worsening of the patient's condition that is acute in onset and requires a change in regular medication, usually a short-term bronchodilator and systemic corticosteroid therapy.⁴¹ Our patients experiencing exacerbations certainly had significant worsening of their asthma with respiratory distress, but for many reasons, including lack of prior diagnosis or appropriate or insufficient accessibility to adequate care, did not always receive care or an appropriate change in their therapy as recommended by the guidelines.¹⁵ Therefore, exacerbations were defined by the severity of their symptoms rather than the treatment they received.

Finally, the primary outcome measure to assess guideline validity was prior morbidity, which required a retrospective analysis. The major reason for this was that once we assessed the patient at baseline, we were obligated to treat appropriately, often with controller medication. Therefore, we could not assess the relationship of guidelines to future morbidity in an untreated population prospectively. As discussed previously, several studies report that prior morbidities, such as hospitalization and ED visits, substantially increase the risk of similar morbidities in the future.^{23–27} This is particularly true in those <5 years of age for hospital readmissions.^{25,26}

CONCLUSIONS

We have provided an evidence basis for concluding that the NAEPP 2002 guideline criteria classification based on short-term symptom frequency criteria is a valid measure of severity, because it correlates well with morbidity the prior year in children >5 years of age. However, the relationship is borderline in those 3 to 5 years and nonsignificant in children ≤ 2 years of age. Furthermore, even those children classified as MI have considerable morbidity, and this is magnified in those ≤ 2 years who are more often classified as MI and have more morbidity in this category than older children. To better identify children ≤ 5 years who may benefit from controller medication, a more “global” approach, which encompasses morbidity, including HC use and exacerbations the previous year, may be a useful addition to current short-term guideline criteria based on symptom frequency.

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