Impact of Site of Care, Race, and Hispanic Ethnicity on Medication Use for Childhood Asthma

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ABSTRACT. *Objective.* **To understand the importance of source of care and other factors that influence differences in asthma medication use by race and Hispanic ethnicity.**

Methods. **The Childhood Asthma Severity Study provided 12-month, retrospective, parent-reported questionnaire data on a monthly basis for children ages ≤12 years in a community sample of 1002 children and their families from Connecticut and Massachusetts. Medications considered included cromolyn, β2-agonist, inhaled steroids, anticholinergics, theophylline, and systemic steroids. Information was available on demographics, insurance status, symptom severity, primary care contact, and provider practice types.**

Results. **Black and Hispanic children received fewer β2-agonists, and Hispanic children received fewer inhaled steroids than white children after adjusting for patients' race, age, gender, insurance status, symptom severity, number of primary care visits for asthma, number of urgent visits to the regular provider, family income, maternal education, and site of care. When multivariate analyses were restricted to patients in private practice, the significant association between Hispanic ethnicity and low inhaled steroid use persisted, whereas differences in β2-agonist use by race and ethnicity changed little but became nonsignificant.**

Conclusion. **Even within private practices, patients' race and ethnicity are associated with clinician nonadherence to national guidelines. Programs to eliminate these disparities will need both to focus on site of care and to intervene at the provider and patient levels to be successful.** *Pediatrics* **2002;109(1). URL: http://www.pediatrics.org/cgi/content/full/109/1/e1; *asthma, child, practice guidelines, health insurance, Hispanic Americans.***

ABBREVIATIONS. HMO, health maintenance organization; CHAS, Childhood Asthma Severity Study.

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Asthma is a serious pediatric health concern in the United States. Asthma affects approximately 4.4 million children and accounts for approximately 2.9 million visits to pediatricians each year.[1–3] Moreover, asthma imposes a disproportionate burden on ethnic and racial minorities and poor children.[4,5] Current information suggests that factors other than environmental and household risks are major contributors to the high asthma diagnosis rates and poor asthma control observed among racial minorities.[6–8] Factors that contribute to the differences in asthma rates and control between minority and nonminority children include diagnosing patterns, parental perceptions of asthma, quality of and access to health care, and, most notably, medication utilization.[9–12] Addressing asthma medication utilization disparities is particularly important because it is known that asthma morbidity can be prevented and that emergency department visits and hospitalizations may be reduced by appropriate asthma treatment.[13–15]

The undertreatment of asthma among racial and ethnic minorities is well-documented.[16] Among racial and ethnic minorities in the United States, asthma treatment has 2 consistent and enduring characteristics: 1) lack of access to treatment and 2) health care inconsistent with the guidelines of the National Asthma Education and Prevention Program of the National Heart, Lung, and Blood Institute.[16–20] For example, studies have documented that minority children are more frequent users of reliever medications such as short-acting β-agonists and not control therapies such as inhaled antiinflammatory medications.[17–20] In addition, data from the National Health and Nutrition Examination Survey III, a survey of the US population, reported that young, poor, and Spanish-speaking children were at high risk for inadequate asthma therapy.[21] A cross-sectional study of inner-city children who were from Washington, DC, and Baltimore, Maryland, and had at least mild persistent asthma found that these children were high nebulizer users of β-agonists but low users of inhaled steroids.[22]

Asthma medication utilization disparities have been reported in situations in which racial and ethnic differences in access barriers should be minimized. Joseph et al[23] reported that among children with asthma in a Michigan health maintenance organization (HMO), black children received fewer prescribed medications than white children when seeing

nonspecialists. Finkelstein et al[9] reported that minority children who had been hospitalized for asthma were less likely than their nonminority hospitalized peers to have received effective preventive asthma therapy; however, after adjusting for primary care practice types, race was no longer a significant factor. Children in their study who were seen by private practice physicians were more likely to receive appropriate care based on practice guidelines than those treated in public settings. The notion that practice type is associated with the delivery of care deemed appropriate by national guidelines has also been reported by Flores et al,[24] who found that clinical practice guideline use was more common among pediatricians who practiced in HMOs than in other settings.

Data from the Childhood Asthma Severity Study (CHAS), a community-based study of childhood asthma among a racially and ethnically diverse population, offered the opportunity to evaluate racial and ethnic differences in asthma treatment patterns. CHAS provides sufficient information to allow the evaluation of the importance of site of care and other potential explanatory variables for the reported racial and ethnic differences in asthma treatment patterns. We sought to determine whether differences in medication use by site of care and race and ethnicity persist after adjusting for previous patterns of health care use, insurance status, and symptom severity. The goal of this study was to determine whether the well-reported racial/ethnic differences in asthma treatment are mediated by site of care.

METHODS

The methods used in CHAS have been fully described in separate reports.[25,26] In brief, CHAS is an ongoing, prospective study of a socioeconomically and racially diverse community sample of children that aims to investigate the environmental, familial (eg, genetic and household), and health services factors related to childhood asthma severity. Between 1996 and 1998, 1002 families were recruited for study. To be eligible, a family had to have both a newborn infant and a child who was younger than 12 years and had physician-diagnosed asthma. Mothers were approached after delivery at 5 Connecticut hospitals and 1 hospital in southwestern Massachusetts. The following data were collected on the siblings with asthma: health care visits, medication use, and daily symptoms (wheezing, coughing, shortness of breath, and chest tightness) during the preceding 12 months. Although baseline 12-month data were collected on a month-by-month basis, the unit of analysis is the sibling (the data are aggregated across the year) and not patient-month. Siblings were excluded from the current analysis ($n = 24$) if their mothers could not provide at least 9 months' worth of data on health care visits, medications, or symptoms. Thus, 978 siblings with asthma were eligible; however, because of missing data and restricted analyses, the sample sizes for the various analyses range to a low of 700.

Independent Variables

The independent variables were race and ethnicity, age (in years), number of scheduled visits for asthma to the regular provider in the previous year, number of urgent asthma visits to the regular provider, symptom severity (described below), insurance status, family income, maternal education, child's gender, and practice type (described below). Child's race/ethnicity was determined by parental reports and classified as white, black, and Hispanic (93% of the Hispanics reported being of Puerto Rican descent). Family yearly income was categorized as 0 to $19 999 ($n = 274$), $20 000 to $39 999 ($n = 147$), and ≥$40 000 ($n = 507$). Maternal education was classified as less than high school or equivalent ($n = 154$), high school or equivalent ($n = 261$), and more than high school or equivalent ($n = 575$). Child gender was classified as male ($n = 591$) and female ($n = 350$).

The insurance information (private, Medicaid, no insurance) was collected through a supplemental telephone questionnaire. There were 808 respondents to the insurance supplement. Because only 4 participants were reported as not having any health insurance, we restricted the variable to Medicaid ($n = 216$) and private insurance ($n = 588$).

Respondents were asked whether their children had regular sources of care, which everyone answered affirmatively. Respondents were also asked to provide the names and locations of the regular providers. From the respondents' information, we were able to determine practice types by referring to the Folio's Dictionaries for Connecticut and Massachusetts (1998 and 1999).[27] We used the practice type classification provided by the dictionaries. Thirty-five (3%) of the respondents did not provide names or addresses, 247 (25%) provided names but the names and practice information were not located in the dictionaries, and 720 (72%) provided names or addresses that were found in the dictionaries. We were able to determine practice types using the dictionaries when we had the provider name, clinic name, or address. Of the 247 participants who provided names or addresses but the names or addresses were not located in the dictionaries, we were able to classify 153 of them into a practice type on the basis of just the information provided. Thus, we had a total of 873 participants who were categorized into a practice type. Practice types were collapsed into the following 4 categories: ambulatory care center, private arrangement, hospital-based clinic, and unknown.

The validity of our symptom severity measure has been reported elsewhere.[25] The symptom severity measure is a 9-point score constructed using 4 self-reported questionnaire items, each measured using 3 categories of symptom duration (none, 1–29 days in last year, and ≥30 days in the last year) for each of wheezing, coughing, shortness of breath, and chest tightness. For each participant, a symptom severity score was computed by summing across the symptoms using the following point distribution: none, 0 points; 1 to 29 days in last year, 1 point; and ≥30 days in last year, 2 points. The range was 0 to 8 (mean: 3.3; standard deviation: 2.1).

Dependent Variables

The medication use variables were aggregated to limit the potential for misclassification as a result of recall bias. The cutoffs of the categories were based both on the distribution of the data and on preliminary tests of proportional odds that showed no qualitative differences when using similar cutoffs. The variables were categorized as follows: 1) for each cromolyn, β2-agonists, inhaled steroids, and systemic steroids, the categories were "none in the last year," "used 1 to 29 days," and "used ≥30 days"; 2) for both anticholinergics and theophylline, the categories were "none in the last year" and "ever used in the last year."

Analysis

Quantitative differences in the independent variables by race (black, white) and Hispanic ethnicity were determined by χ^2 for categorical and F test for continuous independent variables. We also compared medication use by site of care (ambulatory care center, private arrangement, and hospital-based clinic) and race and ethnicity using χ^2.

Fitting of the multivariate models was based on both conceptual and empirical considerations. Each model was adjusted for race/ethnicity, age, gender, insurance status, symptom severity, number of scheduled visits for asthma to the regular provider in the last year, number of urgent visits for asthma to the regular provider, and practice type.

To test the multivariate effects of race on use of cromolyn, β2-agonists, inhaled steroids, and systemic steroids, we used ordered logistic regression in SAS because the categories of these dependent variables were more than binary.[28] Each model was tested for and satisfied the proportional odds assumption. For anticholinergics, we used unconditional logistic regression for binary-dependent variables because the coding was dichotomous. Because a small number of participants used theophylline, we chose not to analyze that medication in a regression model.

To understand the influence of practice type on racial/ethnic disparities in asthma treatment, we fitted a model for β2-agonists and inhaled steroids for children in private practice. We could not

separately analyze the "other" category of practice type because of the small subsample size.

RESULTS

The study cohort included 549 white (58%), 139 black (15%), and 255 Hispanic (27%) children. The cohort also included 44 children (4%) in ambulatory care centers (including community clinics), 703 children (72%) in private practice, 126 children (12%) in hospital-based clinics, and 105 children (11%) with unknown practice types.

Table 1 lists the summary statistics for sociodemographics, insurance status, practice type, health care visits, and symptom severity by race and ethnicity. White children were more likely to have private insurance, have families that earned ≥$40 000/year, have mothers with more than a high school education, have been seen in private clinics for regular care, have more scheduled asthma care visits to their regular providers, and have fewer urgent care visits than black and Hispanic children. Black and Hispanic children were more likely to be seen in ambulatory care centers or hospital-based clinics than were white children. There were no differences in age, gender, or reported symptoms.

Table 2 shows the impact of practice type on medication use. The only significant difference found was for inhaled steroids. A higher proportion of children in private arrangements (15%) used inhaled steroids for ≥30 days compared with those in ambulatory care centers (7%) or hospital-based clinics (7%). Furthermore, a smaller percentage of children in hospital-based clinics used inhaled steroids for 1 to 29 days than those in ambulatory care centers or private arrangements.

Table 3 shows the differences by race and Hispanic ethnicity for medication use measures. Black and Hispanic children, in general, used less cromolyn, inhaled steroids, anticholinergics, and systemic steroids than did white children. Compared with white children, a higher percentage of black and Hispanic children did not use β2-agonists, and a higher proportion of white children had used β2-agonists for ≥30 days. Overall, a large proportion of children had not used inhaled steroids in the past year: 73% of white children, 88% of black children, and 94% of Hispanic children.

Multivariate Models

Table 4 shows the adjusted effects of the selected independent variables on medication use (cromolyn, β2-agonist, inhaled steroid, and systemic steroid use). Models were adjusted for age, gender, insurance type, symptom severity, number of scheduled visits for asthma to the regular provider, number of urgent visits to the regular provider, family income, maternal education, and practice type. Black children used significantly fewer β2-agonists, and black and Hispanic children used significantly fewer inhaled steroids.

To understand the influence of practice type, we limited the following analyses to the children seen in private practice settings, which in our previous analyses was associated with the highest quality of medication use (Table 5). In this group, the adjusted association between Hispanic ethnicity versus white

TABLE 1. Characteristics of Sample by Race and Hispanic Ethnicity

	Total Sample† (*N* = 943)	White (*n* = 549)	Black (*n* = 139)	Hispanic (*n* = 255)	*P**
Mean child's age (y; SD)	5.3 (2.5)	5.4 (2.5)	5.6 (2.6)	5.2 (2.6)	.28
Child's gender					.88
Male	591 (63%)	346 (63%)	84 (61%)	161 (63%)	
Female	350 (37%)	202 (37%)	54 (39%)	94 (37%)	
Insurance status					<.0001
Private	558 (73%)	459 (92%)	38 (39%)	61 (38%)	
Medicaid	202 (27%)	41 (8%)	60 (61%)	101 (62%)	
Family income					<.0001
0–$19 999	261 (29%)	37 (7%)	68 (52%)	156 (66%)	
$20 000–$39 999	140 (16%)	59 (11%)	35 (27%)	46 (19%)	
≥$40 000	485 (55%)	421 (81%)	29 (22%)	35 (15%)	
Maternal education					<.0001
Less than high school	143 (15%)	22 (4%)	25 (18%)	96 (38%)	
High school or equivalent	246 (26%)	97 (18%)	54 (39%)	95 (37%)	
More than high school or equivalent	554 (59%)	430 (78%)	60 (43%)	64 (25%)	
Practice type					<.0001
Ambulatory care center	41 (4%)	3 (1%)	12 (9%)	26 (10%)	
Private arrangement	669 (72%)	499 (92%)	70 (52%)	100 (40%)	
Hospital-based clinic	118 (12%)	10 (2%)	31 (23%)	77 (31%)	
Information not found	97 (10%)	29 (5%)	22 (16%)	46 (18%)	
Mean number of scheduled visits for asthma to regular provider (SD)	1.2 (2.1)	1.4 (2.2)	0.9 (2.2)	0.9 (1.6)	.001
Mean number of urgent visits for asthma to regular provider (SD)	0.8 (1.6)	0.6 (1.3)	1.0 (2.1)	0.8 (1.5)	.03
Mean asthma symptom severity (SD)	3.3 (2.1)	3.3 (2.1)	3.1 (2.1)	3.2 (2.1)	.53

SD indicates standard deviation.

* χ^2 or F test.

† A total of 943 participants could be classified as white, black, or Hispanic; because of missing data, some variables had fewer than 943 participants.

TABLE 2. Crude Differences in Asthma Medication Use in the Past Year by Practice Type

Medications	Total Sample† (N = 873)	Ambulatory Care Center (n = 44)	Private Arrangement (n = 703)	Hospital-Based Clinic (n = 126)	P*
Cromolyn					.05
None in the past year	700 (81%)	38 (90%)	556 (79%)	106 (89%)	
Used 1–29 d	50 (6%)	2 (5%)	43 (6%)	5 (4%)	
Used ≥30 d	112 (13%)	2 (5%)	102 (15%)	8 (7%)	
β2-agonists					.82
None in the past year	168 (20%)	8 (20%)	132 (19%)	28 (24%)	
Used 1–29 d	405 (47%)	19 (46%)	331 (47%)	55 (46%)	
Used ≥30 d	286 (33%)	14 (34%)	236 (34%)	36 (30%)	
Inhaled steroids					.01
None in the past year	682 (79%)	36 (86%)	537 (77%)	109 (91%)	
Used 1–29 d	63 (7%)	3 (7%)	57 (8%)	3 (3%)	
Used ≥30 d	119 (14%)	3 (7%)	108 (15%)	8 (7%)	
Anticholinergics					.22
None in the past year	842 (97%)	42 (100%)	681 (97%)	119 (99%)	
Ever used	22 (3%)	0 (0%)	21 (3%)	1 (1%)	
Theophylline					.14
None in the past year	860 (99%)	41 (98%)	699 (100%)	120 (100%)	
Ever used	4 (1%)	1 (2%)	3 (<1%)	0 (0%)	
Systemic steroids					.05
None in the past year	636 (74%)	35 (83%)	502 (72%)	99 (83%)	
Used 1–9 d	120 (14%)	2 (5%)	106 (15%)	12 (10%)	
Used ≥10 d	107 (12%)	5 (12%)	93 (13%)	9 (8%)	

* χ^2 or F test.
† We had practice type information for 873 participants; because of missing data, some variables had fewer than 873 participants.

TABLE 3. Differences in Asthma Medication Use in the Past Year by Race/Ethnicity (N = 943)*

Medications	White (n = 549)	Black (n = 139)	Hispanic (n = 255)	P†
Cromolyn				.001
None in the past year	418 (76%)	123 (88%)	225 (89%)	
Used 1–29 d	40 (7%)	9 (6%)	9 (4%)	
Used ≥30 d	90 (16%)	7 (5%)	20 (8%)	
β2-agonists				.02
None in the past year	96 (18%)	37 (27%)	55 (22%)	
Used 1–29 d	252 (46%)	68 (49%)	124 (49%)	
Used ≥30 d	198 (36%)	33 (24%)	75 (30%)	
Inhaled steroids				.001
None in the past year	398 (73%)	122 (88%)	239 (94%)	
Used 1–29 d	51 (9%)	9 (6%)	5 (2%)	
Used ≥30 d	100 (18%)	8 (6%)	10 (4%)	
Anticholinergics				.04
None in the past year	531 (97%)	138 (99%)	253 (99%)	
Ever used	18 (3%)	1 (1%)	2 (1%)	
Theophylline				.13
None in the past year	548 (100%)	137 (99%)	254 (100%)	
Ever used	1 (<1%)	2 (1%)	1 (<1%)	
Systemic steroids				.001
None in the past year	382 (70%)	111 (80%)	209 (82%)	
Used 1–9 d	93 (17%)	10 (7%)	26 (10%)	
Used ≥10 d	73 (13%)	17 (12%)	20 (8%)	

* Analyses only included the 943 participants whom we were able to classify as white, black, or Hispanic.
† χ^2 or F test.

race and low use of inhaled steroids remained. The association between low use of β2-agonists and black race versus white race became nonsignificant, although the effect estimate remained essentially unchanged. Lack of precision as a result of small ethnic/racial subsamples is the likely explanation for the widened confidence intervals and nonsignificant results for β2-agonists.

DISCUSSION

Both racial/ethnic disparities and site-of-care differences in asthma medication utilization were found in CHAS. These differences were not the result of differences in previous patterns of health care usage, symptomatology, insurance status, or other confounding factors. The persistence of these racial/ethnic differences in private practices is an important finding that helps us to understand the diversity of the factors that contribute to racial/ethnic differences in asthma medication use. Ethnic differences were found only for inhaled steroid use, but limited sample sizes in the racial/ethnic strata within the private practice group limited the precision of the effect estimates for β2-agonists. Given that the magnitude of the effect estimates did not change substantially for β2-agonists while the confidence intervals wid-

TABLE 4. Adjusted Odds Ratios for Race/Ethnicity and Medication Use in the Past Year: Logistic Regression* ($N = 804$)

Race/Ethnicity	Dependent Variables			
	Cromolyn Use	β2-Agonists	Inhaled Steroids	Systemic Steroids
White	Referent	Referent	Referent	Referent
Black	0.5 (0.3, 1.0)	0.6 (0.4, 0.9)	0.4 (0.2, 0.8)	0.9 (0.5, 1.6)
Hispanic	0.6 (0.4, 1.1)	0.8 (0.5, 1.2)	0.3 (0.1, 0.5)	0.8 (0.5, 1.4)

* Adjusted for child's age, gender, insurance status, asthma symptom severity, number of scheduled visits for asthma to the regular provider, number of urgent visits for asthma to the regular provider, family income, maternal education, and practice type.

TABLE 5. Adjusted Odds Ratios for β2-Agonist and Inhaled Steroid Use in the Past Year by Sample Characteristics Among Children in Private Practice: Logistic Regression* ($N = 700$)

Race/Ethnicity	Dependent Variables	
	β2-Agonists	Inhaled Steroids
White	Referent	Referent
Black	0.6 (0.3, 1.1)	0.5 (0.2, 1.1)
Hispanic	0.7 (0.4, 1.2)	0.3 (0.1, 0.7)

* Adjusted for child's age, gender, insurance status, asthma symptom severity, number of scheduled visits for asthma to the regular provider, number of urgent visits for asthma to the regular provider, family income, and maternal education.

ened (leading to nonsignificant results), future studies might find racial/ethnic associations with larger racial subsamples.

The influence of site of care on medication use is a well-reported phenomenon and can operate through a number of pathways. Rust et al[29] reported that community health centers are generally unable to provide quality asthma care to traditionally underserved populations because of a lack of adequate resources. Flores et al[24] reported that adherence to practice guidelines was more common in HMOs than in other settings. Other studies have identified provider factors such as imperfect pediatric conformity to clinical practice guidelines, particularly in community- or hospital-based clinics.[17,30,31]

Our findings add to the previous work by Finkelstein et al,[9] who reported that among hospitalized minority children, attendance at nonprivate practice sites of care explained the undertreatment noted in these children before their hospitalization. In the CHAS community sample, nonprivate practice sites were associated with less optimal care, as shown by the lower use of inhaled steroids in the current analyses (Table 2). However, attendance at a private practice site did not ensure that a minority child would receive treatment equivalent to that of a white child.

Our analyses suggest that the relationship between race/ethnicity and asthma medication utilization is mediated through a number of pathways. Simply upgrading the quality of asthma practice patterns at community clinics and hospital outpatient departments will not solve the problem. The association between race and ethnicity and asthma medication utilization will require additional exploration of the patient–physician interaction. In particular, it would be useful to explore the links among the provider, the family, and the system factors associated with disparities in medication use between minorities and nonminorities. A recent article by Mansour et al[32] provided some guidance in this regard. The authors reported that among children who had asthma and living in urban areas, the most commonly cited barriers to care were related to patient and family characteristics, health beliefs, and social and physical environments, in contrast to access to health care, health insurance, or continuity of health care.[32] Our findings support and extend the findings of Mansour et al because we found that after controlling for primary care contacts, disparities in asthma medication use still exist. Thus, future studies should consider going beyond studying issues of access and focus on parental perceptions and motivators for health care use. Recent studies have also shown that family/maternal factors such as life stressors and poor maternal mental health are associated with poor asthma morbidity and underuse of asthma medications.[33,34] Thus, the extent to which poor asthma medication adherence could also be attributable to family stressors should also be explored.

Particular strengths of this study include use of a community sample (rather than a hospital-based sample) of healthy children; consideration of a sociodemographically diverse population of children; and access to a range of questions that deal with not only race and medication use but also primary care contacts, symptomatology, practice types, and insurance status. The limitations of this study should also be acknowledged. A limitation of our approach is that it did not identify the differences that might exist in medications according to income level and mothers' education within the black and Hispanic groups in private arrangements. Our multivariate model adjusted for this across all categories, ignoring the question of possible differences between groups. Our decision to include these factors in the multivariate models reflects our desire to remove their potential confounding effects in those analyses. For understanding the influence of income and education within the private practice, additional analyses, which would involve dividing up the small minority sample within the private practice group into even smaller groups, must be performed. Given the sizes of our stratified samples, it is not possible to perform these required analyses and obtain reliable/precise results. This was confirmed when we fitted separate models that examined the independent effects of income and maternal education on medication use within the black and Hispanic strata. The analyses were underpowered, which was indicated by very wide confidence intervals.

Other limitations include the following. First, it is

unknown in this study whether the children who did not take medications did so because they were not prescribed, their families could not afford them, or they were prescribed and affordable but the family failed to fill the prescriptions. Second, the use of retrospective baseline data reported on a month-to-month basis could introduce recall bias; however, our utilization measures were categorized to limit the potential for misclassification as a result of recall bias. Third, our sampling frame at both the hospital and patient level is a convenient one, but with respect to our variables of interest, there is little reason to suspect sampling bias, because we accessed our sample through the birth of a sibling. Fourth, because of limited sample sizes, we were unable to analyze medication use in practice types other than private. Fifth, we had very limited measures on perceived or actual access to care. Thus, we do not know the extent to which the children could not access needed services.

Ending racial/ethnic disparities in asthma treatment will not be simple. Broad-based changes will be needed. Structural changes, which upgrade the resources and practice patterns of community health clinics and hospital outpatient departments, are a necessary start. However, these initiatives alone will reduce but not eliminate the disparities. More work needs to be done to understand the cultural differences that influence how asthma is perceived, acceptance of treatment, and communication with providers. Finally, providers must be better trained to deal with the changing challenges of their increasingly diverse practices.

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REFERENCES

1. Adams PF, Hendershot GE, Marano MA. Current estimates from the National Health Interview Survey, 1996. National Center for Health Statistics. *Vital Health Stat 10*. 1999;200
2. Schappert SM, Nelson C. National Ambulatory Medical Care Survey: 1995–96 summary. National Center for Health Statistics. *Vital Health Stat 13*. 1999;142:i-vi, 1–122
3. Eggleston PA. Asthma. In: McMillan JA, DeAngelis CD, Feigin RD, Warshaw JB, eds. *Oski's Pediatrics: Principles and Practice*. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 1999:2041–2049
4. Beckett WS, Belanger K, Gent JF, et al. Asthma among Puerto Rican Hispanics: a multi-ethnic comparison study of risk factors. *Am J Respir Crit Care*. 1996;154:894–899
5. Evans D, Mellins R, Lobach K, et al. Improving care for minority children with asthma: professional education in public health clinics. *Pediatrics*. 1997;99:157–164
6. Ali S, Osberg JS. Differences in follow-up visits between African American and white Medicaid children hospitalized with asthma. *J Health Care Poor Underserved*. 1997;8:83–98
7. Gaskin DJ, Hoffman C. Racial differences in preventable hospitalizations across 10 states. *Med Care Res Rev*. 2000;57(suppl 1):85–107
8. Lozano P, Connell FA, Koepsell TD. Use of health services by African American children with asthma on Medicaid. *JAMA*. 1995;274:469–473
9. Finkelstein JA, Brown RW, Schneider LC, et al. Quality of care for preschool children with asthma: the role of social factors and practice setting. *Pediatrics*. 1995;95:389–394
10. Goodman DC, Lozano P, Stukel TA, et al. Has asthma medication use in children become more frequent, more appropriate, or both? *Pediatrics*. 1999;104:187–194
11. Kattan M, Mitchell H, Eggleston P, et al. Characteristics of inner-city children with asthma: the National Cooperative Inner-City Asthma Study. *Pediatr Pulmonol*. 1997;24:253–262
12. Gergen P. Social class and asthma—distinguishing between the disease and the diagnosis. *Am J Public Health*. 1996;86:1361–1362
13. Donahue JG, Weiss ST, Livingston JM, et al. Inhaled steroids and the risk of hospitalization for asthma. *JAMA*. 1997;277:887–891
14. Suissa S, Ernst P, Benayoun S, et al. Low-dose inhaled corticosteroids and the prevention of death from asthma. *N Engl J Med*. 2000;343:332–336
15. Adams RJ, Fuhlbrigge A, Finkelstein JA, et al. Impact of inhaled anti-inflammatory therapy on hospitalization and emergency department visits for children with asthma. *Pediatrics*. 2001;107:706–711
16. Ortega AN, Calderon JG. Pediatric asthma among minority populations. *Curr Opin Pediatr*. 2000;12:579–583
17. Finkelstein JA, Lozano P, Shulruff R, et al. Self-reported physician practices for children with asthma: are national guidelines followed? *Pediatrics*. 2000;106:886–896
18. Diaz T, Sturm T, Matte T, et al. Medication use among children with asthma in East Harlem. *Pediatrics*. 2000;105:1188–1193
19. Warman KL, Silver J, McCourt MP, Stein REK. How does home management of asthma exacerbations by parents of inner-city children differ from NHLBI guideline recommendations? *Pediatrics*. 1999;103:422–427
20. National Asthma Education and Prevention Program (NAEPP). *Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma*. Bethesda, MD: National Heart, Lung, and Blood Institute; 1997. NIH Publ. No. 97-4051
21. Halterman JS, Aligne CA, Auinger P, et al. Inadequate therapy for asthma among children in the United States. *Pediatrics*. 2000;105:272–276
22. Butz AM, Eggleston P, Huss K, et al. Nebulizer use in inner-city children with asthma. *Arch Pediatr Adolesc Med*. 2000;154:984–990
23. Joseph CLM, Havstad SL, Ownby DR, et al. Racial differences in emergency department use persist despite allergist visits and prescriptions filled for anti-inflammatory medications. *J Allergy Clin Immunol*. 1998;101:484–490
24. Flores G, Lee M, Bauchner H, et al. Pediatricians' attitudes, beliefs, and practices regarding clinical practice guidelines: a national survey. *Pediatrics*. 2000;105:496–501
25. Ortega AN, Belanger KD, Leaderer BP, Bracken MB. A childhood asthma severity scale: symptoms, medications, and health care visits. *Ann Allergy Asthma Immunol*. 2001;86:405–413
26. Ortega AN, Belanger KD, Paltiel AD, Horwitz SM, Bracken MB, Leaderer BP. Use of health services by insurance status among children with asthma. *Med Care*. 2001;39:1065–1074
27. *Folio's Medical Dictionaries for Connecticut/Massachusetts 1998, 1999*. Hyannis, MA: Folio Associates; 1998, 1999
28. Allison PD. *Logistic Regression Using the SAS System: Theory and Application*. Cary, NC: SAS Institute; 1999:134–148
29. Rust GS, Murray V, Octaviani H, et al. Asthma care in community health centers: A study by the Southwest Regional Clinicians' Network. *J Natl Med Assoc*. 1999;91:398–403
30. Werk LN, Steinbach S, Adams WG, et al. Beliefs about diagnosing asthma in young children. *Pediatrics*. 2000;105:585–590
31. Cabana MD, Ebel BE, Cooper-Patrick L, et al. Barriers pediatricians face when using asthma practice guidelines. *Arch Pediatr Adolesc Med*. 2000;154:685–693
32. Mansour ME, Lanphear BP, DeWitt TG. Barriers to asthma care in urban children: parent perspectives. *Pediatrics*. 2000;106:512–519
33. Shalowitz MU, Berry CA, Quinn KA, Wolf RL. The relationship of life stressors and maternal depression to pediatric asthma morbidity in a subspecialty practice. *Ambul Pediatr*. 2001;1:185–193
34. Weil CM, Wade SL, Bauman LJ, et al. The relationship between psychosocial factors and asthma morbidity in inner-city children with asthma. *Pediatrics*. 1999;104:1274–1280

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