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Journal of Asthma

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713597262>

Urban Minority Children with Asthma: Substantial Morbidity, Compromised Quality and Access to Specialists, and the Importance of Poverty and Specialty Care

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Online Publication Date: 01 May 2009

To cite this Article Flores, Glenn, Snowden-Bridon, Christina, Torres, Sylvia, Perez, Ruth, Walter, Tim, Brotanek, Jane, Lin, Hua and Tomany-Korman, Sandy(2009)'Urban Minority Children with Asthma: Substantial Morbidity, Compromised Quality and Access to Specialists, and the Importance of Poverty and Specialty Care',Journal of Asthma,46:4,392 — 398

To link to this Article: DOI: 10.1080/02770900802712971

URL: <http://dx.doi.org/10.1080/02770900802712971>

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ORIGINAL ARTICLE

Urban Minority Children with Asthma: Substantial Morbidity, Compromised Quality and Access to Specialists, and the Importance of Poverty and Specialty Care

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Background. Asthma disproportionately affects minorities, but not enough is known about morbidity and specialist access in asthmatic minority children. **Objective.** To examine asthma morbidity and access to specialty care in urban minority children. **Methods.** A consecutive series was recruited in 2004–2007 of urban minority children 2 to 18 years old seen for asthma in four emergency departments (EDs) or admitted to a children's hospital. Outcomes assessed included asthma symptom and attack frequency; missed school and parental work; asthma ED visits and hospitalizations; severity of illness; and asthma specialty care. **Results.** Of 648 children assessed, 220 were eligible. The mean age was 7 years; 68% were poor, 83% had Medicaid, 84% were African-American, and 16% were Latino. Sixty-eight percent of children were not in excellent/very good health, 73% had persistent asthma (moderate/severe = 52%), and only 44% had asthma care plans. The mean number of asthma attacks in the past year was 12, and of monthly daytime and nighttime asthma symptoms, is 12 and 12, respectively. The mean annual number of asthma doctor visits was 6; of ED asthma visits, 3; hospitalizations, 1; missed school days, 7; and missed parent work days, 6. Eighty-three percent of children have no asthma specialist, and 62% use EDs as the usual asthma care source. Poor children were less likely than the non-poor to have asthma specialists (13 vs. 26%; $p < 0.03$). African-Americans were more likely than Latinos to use EDs for usual asthma care (68% vs. 44%; $p < 0.01$). In multivariable analyses, poverty was associated with greater odds and having an asthma care plan with lower odds of an asthma attack in the past year; poverty also was associated with half the odds of having an asthma specialist. African-American children were significantly more likely to report the ED as the usual source of asthma care, and having an asthma specialist and male gender were associated with greater odds of having an asthma care plan. **Conclusions.** Urban minority children with asthma average 1 asthma symptom daily, 1 exacerbation monthly, and 7 missed school days, 6 missed parental work days, 3 ED visits, and 1 hospitalization yearly; most receive their usual asthma care in EDs and have no asthma care plan or asthma specialist. Urban minority asthmatic children need interventions to reduce morbidity and improve access to specialists and asthma care plans, especially among the poor and African-Americans.

Keywords asthma, minority groups, children, African-Americans, Hispanic Americans, specialties

INTRODUCTION

Minority children are at particularly high risk for asthma and its associated morbidity and mortality. Among children less than 18 years old, the average annual asthma prevalence is 8% for whites, 13% for African-Americans, and 19% for Puerto Ricans (1), and African-American and Puerto Ricans have about four times the adjusted odds of severe asthma as whites (2). African-American and Latino asth-

matic children are significantly less likely than whites to receive anti-inflammatory and controller medications (3–5) but are more likely to make emergency department (ED) visits or be hospitalized for asthma (6, 7). Asthma mortality is substantially higher among African-American children and in census tracts with higher proportions of Latinos (8, 9).

Poverty and low income also are associated with a higher risk of asthma and associated morbidity and mortality. Compared with non-poor children, poor children have a higher asthma prevalence, spend more days in bed for asthma, and are more likely to use the ED as their usual source of care and to be hospitalized (1, 10). Higher asthma mortality occurs in census tracts with higher poverty rates (8) and low-income children (11). Of relevance, significant portions of minority children are twice as likely as white children to be poor (12).

Although minority race/ethnicity and poverty are associated with higher risks of asthma and associated morbidity and mortality, not enough is known about asthma morbidity,

Funded by grants to G.F. from the Commonwealth Fund and the Improving Chronic Illness Care program of the Robert Wood Johnson Foundation.

Presented in part as a poster at the 2008 annual meetings of Academy-Health in June 2008, in Washington, D.C., and the American Public Health Association in October 2008, in San Diego, CA.

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access to specialty care, quality of care, and the role of poverty among low-income minority children. The study objective, therefore, was to examine factors associated with morbidity, specialty care access, having a written asthma care plan, and use of the ED as a usual source of care among low-income minority children with asthma.

METHODS

Research Design and Study Population

In this cross-sectional study, participants were enrolled between February 2004 and May 2007, from a consecutive series of African-American and Latino children 2 to 18 years old with a primary diagnosis of asthma who resided in Milwaukee, Wisconsin. Children and parents were recruited from the Children's Hospital of Wisconsin ED and inpatient ward, and the EDs of Aurora-Sinai Hospital, St. Joseph's Hospital, and St. Francis Hospital (all in Milwaukee). Together, these hospitals provide care to most asthmatic children in Milwaukee. Data from this study are the baseline data for all participants enrolled in a larger randomized, controlled trial of the effectiveness of parent mentors in improving asthma outcomes in minority children.

Study inclusion criteria included (1) the child was 2 to 18 years old; (2) African-American or Latino race/ethnicity for the child (by parental identification); (3) primary residence in a Milwaukee zip code; and (4) ED or inpatient ward admission with a primary diagnosis of asthma.

Exclusion criteria included significant co-morbidity, including other pulmonary conditions, cardiac pathology, renal abnormalities, diabetes mellitus, epilepsy, and other co-morbidities that might lead to ED visits or hospitalizations, and current enrollment in a case management, intervention, or outreach program for childhood asthma management.

The study protocol was approved by the Institutional Review Boards of Children's Hospital of Wisconsin, Aurora Health Care, and Wheaton Franciscan Health Care. Written informed consent and child assent (when indicated) were obtained.

Data Collection

Primary caregivers (hereafter referred to as "parents") for each child completed two questionnaires on enrollment. Both questionnaires were orally administered by trained bilingual research assistants to overcome potential language or literacy barriers. The first questionnaire consisted of 12 multiple-choice questions regarding parental and household sociodemographic characteristics. The second questionnaire addressed children's characteristics. The first part of this second questionnaire consisted of 15 multiple-choice and yes/no items regarding the child's sociodemographic characteristics, health status, healthcare characteristics, and household smoking. The second part addressed characteristics of the child's asthma, including 11 open-ended and 4 multiple-choice and yes/no items.

Outcomes and Hypotheses

Primary study outcomes included (1) asthma exacerbations; (2) missed school days; (3) parental missed work days; (4) asthma ED visits; (5) asthma hospitalizations; (6) asthma doctor visits in the past year; (7) using the ED as the usual

asthma care source; (8) having an asthma specialist; and (9) having a written asthma care plan.

We hypothesized that urban minority children with asthma (1) experience substantial asthma morbidity; (2) have low levels of access to specialty care; (3) often do not have asthma care plans; and (4) experience worse outcomes among those who are poor (compared with the non-poor).

Analyses

Data were analyzed using SAS 9.1. (SAS Institute, Inc.; Cary, NC, USA) Race/ethnicity was by parental self-report. Parents were asked to choose one of 10 annual combined family income categories; $\leq 100\%$ of the federal poverty threshold was defined as any of four income categories $\leq \$17,500$; this was the closest category value to the approximate midpoint between the weighted average federal poverty thresholds for three- versus four-person family units during the years (2004–2007) of participant recruitment (13). Analogously, $\leq 200\%$ of the federal poverty threshold was defined as any of the six-income categories $\leq \$35,000$. The child's health status was assessed by the parent using the customary categories of poor, fair, good, very good, or excellent; such parental ratings generally are considered acceptable proxies for child health status and are significantly associated with use of a variety of pediatric health services (14), and there is high agreement between parental reports of child health events and true occurrences (15).

Bivariate analyses were performed to examine associations between independent variables and study outcomes. Pearson's chi-square test was used to test independence between categorical variables, and the Wilcoxon test was to compare the medians of continuous variables. A $p < 0.05$ was considered to be statistically significant.

Stepwise multivariable analyses (to systematically determine models achieving optimal fit (16)) were performed to examine adjusted associations between statistically significant independent variables in bivariate analyses and study outcomes. A negative binomial model with a log link was used for multivariable analyses of frequency outcomes. Multivariable logistic regressions with logit link were performed for dichotomous outcomes. Asthma severity was classified using standard categories from the National Asthma Education and Prevention Program (17) and was dichotomized as "mild" if the child's asthma was mild intermittent or mild persistent, and "moderate to severe" for moderate or severe asthma.

Multicollinearity was assessed using Pearson's Chi-square test. Employment was dropped as a model covariate owing to income collinearity. The initial α -to-enter was 0.15 to examine all possible candidate variables; final models include only those variables with an α -to-enter of $p < 0.05$. Multivariable analyses are reported as adjusted odds ratios (ORs) and associated 95% confidence intervals (CIs).

RESULTS

Participant Recruitment

A total of 648 candidate subjects were assessed for eligibility; 428 were excluded because they did not meet inclusion criteria ($N = 307$), refused participation ($n = 64$), or did not respond to multiple contacts attempts

TABLE 1.—Sociodemographic characteristics of study parents (n = 220) of minority children with asthma.

Characteristic	Mean (SD) or %
Age in years	31.9 (8.4)
Female	91%
At least some college	25%
Married, living with spouse	17%
Race/ethnicity	
African-American	81%
Latino	19%
Born in US	90%
Limited English proficiency ^a	13%
Annual combined family income	
≤ 100% federal poverty threshold	67%
101–200% federal poverty threshold	25%
>200% federal poverty threshold	8%
Employed full-time	40%

^aDefined as self-reported English-speaking ability of less than “very well” (i.e., chose “well,” “not well,” or “not at all”).

(n = 57). The final sample size was 220 children and their parents.

Sociodemographic Characteristics: Parents

The mean parent age was 32 years, and most were female (Table 1). One quarter had at least some college, and most were not married and living with the spouse. More than three-quarters were African-American, and the remainder was Latino; 90% were US-born, and 13% had limited English proficiency. The annual combined family income was at or below the federal poverty threshold for more than two thirds of households and ≤200% of the federal poverty threshold for 92% of households. Forty-percent of parents were employed full-time.

Sociodemographic Characteristics: Children

The mean child age was 7 years; almost half were female, and 99% were US-born (Table 2). African-Americans comprised 84% of the sample, and Latinos, 16%; about one quarter of children had limited English proficiency. Most children had a primary care provider. Eighty-three percent of children had public health insurance coverage, 13% had private insurance, and 3% were uninsured. Only one third of children were in excellent or very good health.

Asthma Characteristics of Children

Children averaged 12 asthma attacks and 6 asthma physician visits in the past year (Table 3). They had a mean of three ED visits, one hospitalization, and 0.1 ICU admissions for asthma in the prior year. An average of 7 missed school and 6 parental missed workdays occurred during the past year. In the prior month, children experienced a mean of 2 asthma attacks, and 12 daytime, and 12 nighttime asthma symptoms. Because the standard deviations for each finding indicated skewed distributions, medians (which are somewhat lower than the means) also are provided (Table 3).

Most children received prescription medications, but only 44% had an asthma care plan (Table 3). Almost two thirds of parents identified that the ED was the most likely place for the child's asthma care, and only 17% of children had an asthma specialist. Almost 40% of children had severe asthma, and over one quarter of children had mild intermit-

TABLE 2.—Sociodemographic characteristics of study children (n = 220).

Characteristic	Mean (SD) or %
Age in years	7.4 (4.9)
Female	44%
Born in US	99%
Race/ethnicity	
African-American	84%
Latino	16%
Limited English proficiency ^a	28%
Has primary care provider	92%
Health insurance coverage	
Public ^b	83%
Private	13%
None	3%
Other ^c	1%
Health status	
Excellent	11%
Very good	21%
Good	37%
Fair	26%
Poor	5%

^aDefined as self-reported English-speaking ability of less than “very well” (i.e., chose “well,” “not well,” or “not at all”).

^bIncludes both managed-care and non-managed care Medicaid.

^cIncludes combination of public and private insurance.

tent asthma. Approximately one in five children had mild persistent asthma, and only about one in eight had moderate asthma.

Bivariate Analyses

Asthma Severity and Outcomes. No association was found between the child's asthma severity and having an asthma care plan, hospitalization for asthma in the prior year, primary care physician, the ED as the usual asthma care source, or asthma specialist (Table 4). The proportion of children with an asthma specialist was low for all severity categories, ranging from 14% to 18%, and only 42% of severe and 52% of moderate asthmatics had an asthma care plan. As expected, significant differences among asthma severity categories were found for the remaining eight outcomes.

TABLE 3.—Asthma characteristics of study children (n = 220).

Characteristic	Mean (SD) or %	Median (range)
Asthma attacks in past year	12.3 (39)	4.0 (0–360)
Doctor visit for asthma in past year	5.8 (9)	3.5 (0–60)
ED visit for asthma in past year	3.3 (4)	2.0 (0–24)
Hospitalization for asthma in past year	0.8 (2)	0 (0–12)
In ICU for asthma in past year	0.1 (0.5)	0 (0–4)
Missed school days in past year	7.4 (13)	2.0 (0–90)
Parental missed work days in past year	6.1 (12)	1.0 (0–90)
Asthma attacks in past month	2.0 (4.0)	1.0 (0–30)
Daytime asthma symptoms in past month	12.4 (17)	5.0 (0–112)
Nighttime asthma symptoms in past month	12.0 (16)	5.0 (0–112)
Receives prescription medications	95%	—
Has asthma care plan	44%	—
ED is usual source of asthma care	62%	—
Has asthma specialist	17%	—
Asthma severity		
Mild intermittent	27%	—
Mild persistent	21%	—
Moderate persistent	13%	—
Severe persistent	39%	—

TABLE 4.—Association of asthma severity with asthma outcomes in study children (n = 220).

Characteristic	Mild Intermittent (n = 59)	Mild Persistent (n = 46)	Moderate Persistent (n = 29)	Severe Persistent (n = 86)	p
Asthma attacks in past year	4.0	4.4	22.8	17.7	<.0001
Doctor visit for asthma in past year	2.2	5.0	5.4	8.5	<.0001
Asthma attacks in past month	.6	1.5	3.1	2.8	<.0001
Daytime asthma symptoms in past month	1.9	8.8	10.0	21.9	<.0001
Nighttime asthma symptoms in past month	0.8	2.8	6.2	26.0	<.0001
ED visit for asthma in past year	2.2	3.0	3.9	3.8	.01
Parental missed work days in past year	2.5	2.6	5.1	10.7	.01
Receives prescribed medications	88%	96%	100%	98%	.03
Missed school days in past year	2.6	7.2	6.5	11.0	.05
Has asthma care plan	34%	57%	52%	42%	.11
Hospitalizations for asthma in past year	0.5	0.7	0.4	1.1	.14
Has primary care physician	92%	89%	93%	94%	.76
ED is usual source of asthma care	58%	63%	69%	63%	.77
Has asthma specialist	18%	18%	14%	17%	.97

Stratification by poverty level of the association between asthma severity and having an asthma specialist revealed that a substantially lower proportion of poor children had asthma specialists among those with the most severe asthma (Table 5). Only six percent of poor children with moderate persistent asthma have asthma specialists, more than four times lower than for the non-poor (a finding trending toward but not achieving statistical significance [$p = 0.1$]), and only 11% of poor children with severe asthma have asthma specialists, about three times lower than for the non-poor ($p = 0.03$).

TABLE 5.—Associations of asthma severity, poverty status, and having an asthma specialist.

Child's Access to Specialist	Mild Intermittent (n = 59)		Mild Persistent (n = 46)		Moderate Persistent (n = 29)		Severe Persistent (n = 86)	
	Poor	Non-Poor	Poor	Non-Poor	Poor	Non-Poor	Poor	Non-Poor
Has asthma specialist	18%	18%	17%	22%	6% ^a	27%	11% ^b	30%
No asthma specialist	82%	82%	83%	78%	94%	73%	89%	70%

^a $p = 0.10$ for comparison between poor and non-poor among those with moderate persistent asthma.

^b $p = 0.03$ for comparison between poor and non-poor among those with severe persistent asthma.

Factors Significantly Associated with Exacerbations and Access to Care. Having an asthma care plan was associated with a mean reduction of about 10 asthma exacerbations in the past year, with children having a care plan averaging about seven exacerbations in the past year, compared with a significantly higher mean of 17 exacerbations in the past year among those lacking asthma care plans (Figure 1). Having an asthma specialist was associated with a mean reduction of seven exacerbations in the past year; those with a specialist averaged seven exacerbations in the prior year, compared with a significantly higher mean of 14 in the past year among those without a specialist. Full-time employment and having a non-smoking caregiver were also associated with significant reductions in mean asthma exacerbations in the prior year and month, respectively. No other significant associations with asthma exacerbations were noted.

Two factors were found to be associated with access to asthma care measures (Figure 2). Poor children were significantly less likely than non-poor children to have an asthma specialist (13% vs. 26%; $p < 0.03$). African-American children were significantly more likely than Latino children to use the ED for their usual asthma care, at over two thirds versus less than half, respectively ($p < 0.01$). No other factors (including whether the parents had limited English proficiency) were found to be significantly associated with access to asthma care measures or any other outcome examined, except for African-American children being more likely than Latino children to have missed school days in the past year, at a mean of 8.0 versus 4.2 ($p < 0.05$).

Multivariable Analyses

Poverty was associated with about double the adjusted odds of an additional asthma exacerbation in the past year, whereas having an asthma care plan was associated with significantly reduced odds of additional asthma exacerbations (Table 6). Poor children were significantly less likely to have an asthma specialist, with half the adjusted odds of non-poor children.

African-American children have about four times the odds of Latino children of using the ED as the usual source of asthma care (Table 6). Children with asthma specialists have

TABLE 6.—Multivariable analyses of asthma outcomes.

Independent Variable	Odds Ratio (95% Confidence Interval)	
	Asthma Attack in Past Year ^a	Has Asthma Specialist
Poverty	1.6 (1.1, 2.3)	0.5 (0.2, 0.95)
Has asthma care plan	0.6 (0.4, 0.9)	—
Moderate-severe persistent asthma	4.0 (2.7, 5.8)	0.9 (0.4, 1.8)
	Odds Ratio (95% Confidence Interval)	
	ED is Usual Source of Asthma Care ^b	Has Asthma Care Plan ^c
African-American (vs. Latino)	3.6 (1.7, 7.8)	—
Male	—	1.9 (1.1, 3.5)
Has asthma specialist	—	5.0 (2.2, 11.3)

^a Adjusted for having asthma specialist.

^b Adjusted for poverty, caregiver's educational attainment, and asthma severity.

^c Adjusted for poverty, caregiver's educational attainment, has asthma specialist, and asthma severity.

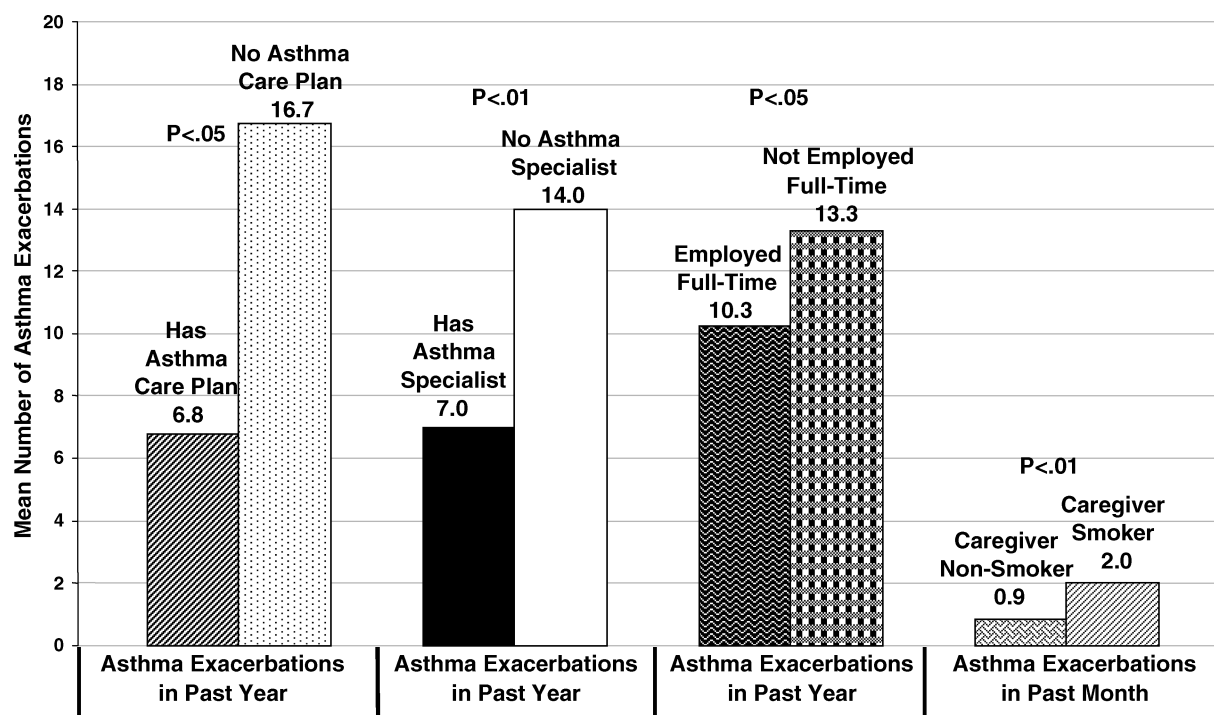


FIGURE 1.—Factors associated with asthma exacerbations

five times the odds and male children about twice the odds of having an asthma care plan.

Multivariable analyses were conducted for five other outcomes (not shown). Having an asthma specialist (OR, 2.1; 95% CI, 1.4-3.1) and moderate to severe asthma (OR, 2.5;

95% CI, 1.8-2.4) were associated with additional asthma doctor visits in the past year. Moderate to severe asthma (OR, 1.5; 95% CI, 1.2-2.0) was associated with asthma ED visits. Having an asthma care plan was associated with greater odds of asthma hospitalization (OR, 1.9; 95% CI, 1.1-3.2),

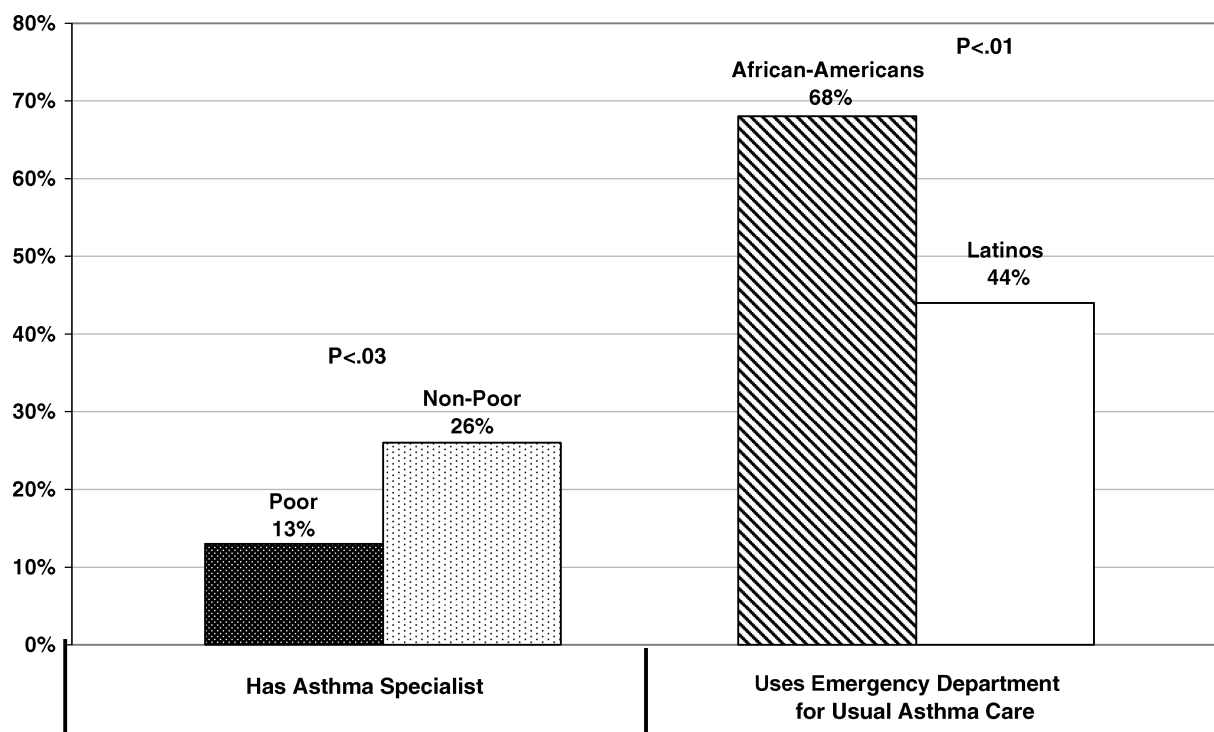


FIGURE 2.—Factors significantly associated with access to asthma care for study children (n = 220.)

and moderate to severe asthma was the only factor associated with missed school days and missed parental work days.

DISCUSSION

In this cross-sectional study of urban minority children with asthma, poverty was associated with twice the adjusted odds of an additional asthma exacerbation in the past year, even after controlling for severity of illness and having an asthma specialist. These findings are consistent with prior research documenting that poor children have a significantly higher mean number of days spent in bed for asthma than non-poor children (10) and the highest annual mean asthma attack prevalence of any income group (1). Our study results are particularly concerning, given that most participants (97%) had health insurance, and specialty care access did not affect asthma exacerbations. However, a promising and innovative finding was that having a written asthma care plan was associated with significantly reduced odds of asthma exacerbations. This finding suggests that consistently providing poor minority children with asthma care plans has the potential to reduce asthma exacerbations among minority children and may be an especially useful strategy for poor minority children. Indeed, bivariate analyses revealed that an asthma care plan was associated with a mean reduction of 10 asthma exacerbations annually.

Receipt of specialty care by asthmatic children is associated with significant reductions in asthma ED visits and hospitalizations and a greater likelihood of asthma care consistent with national practice guidelines, including greater odds of pulmonary function testing, peak flow meter instruction, trigger identification, written asthma care plans, medication adjustment with exacerbations, and controller medication use (18, 19). The National Asthma Education and Prevention Program (NAEPP) recommends asthma specialty care and consultation for asthmatic children 0 to 4 years old with moderate or severe persistent asthma and those ≥ 12 years old with severe persistent asthma (16). NAEPP also recommends specialty care consideration for 5- to 11-year olds with moderate or severe asthma and those ≥ 12 years old with moderate asthma. In our study population of minority children, however, despite substantial asthma morbidity, only 17% had an asthma specialist. Of particular concern, children with higher asthma severity were no more likely to receive specialty care than those with mild asthma, and poor children with moderate or severe asthma were three to four times less likely to receive specialty care, at only 6% and 11%, respectively. Multivariable analyses showed a significant lower likelihood of asthma specialty care for poor children. Although this is the first study (to our knowledge) to report these specific findings, analogous results were found in analyses from a university-based managed care organization showing that Medicaid-covered children had significantly lower odds of receiving asthma subspecialty care (20). These findings indicate an urgent need for greater specialty care access for minority asthmatic children, particularly among the poor.

African-American children had four times the odds of Latino children of using the ED as the usual asthma care source. These findings are consistent with prior research documenting that African-American children have a higher prevalence than whites of using the ED as the usual asthma care source, ranging from 39% to 69% of African-American

children (21, 22). Frequent lack of specialty care access among African-American children (particularly among the urban poor), as documented in this study, might be a possible cause of high rates of ED use for usual asthma care. In addition to enhanced specialist access, reductions in ED use for usual asthma care by African-American children might occur with targeted education of parents and children. For example, a study of a predominantly urban, minority population revealed that many pediatric asthma hospitalizations might be prevented if parents and children were better educated about the child's condition, medications, need for follow-up care, and avoiding disease triggers (23). Similar educational efforts could also potentially prevent asthma ED visits among African-American children. The study findings also raise unanswered questions about why subjects were experiencing adverse outcomes despite the fact that most had primary care providers. Additional research is needed to examine whether additional interventions for these populations are needed in the primary care setting, such as greater adherence to national asthma guidelines, improvements in patient adherence, or intensive case management.

Additional noteworthy and original findings of this study were that having a written asthma care plan was associated with significantly reduced odds of asthma exacerbations, but only 44% of children in this study had an asthma care plan, and those with more severe asthma were not more likely to have a care plan. Although data are limited on whether having an asthma care plan is superior to none (24), a randomized, controlled trial documented that having a care plan was associated with significantly fewer asthma exacerbations, fewer missed school days, lower symptom scores, and less nocturnal awakening (25). Written asthma care plans also are associated with reduced odds of asthma ED visits and hospitalizations in children (26), and 90% of urban parents in one study cited asthma care plans as useful in managing children's asthma exacerbations (27). Our findings that less than half of urban minority children have an asthma care plan are consistent with prior studies documenting that 0 to 39% of urban children have asthma care plans (28–30), and African-American and Latino children are significantly less likely to have plans (31). Given the available evidence indicating that asthma care plans are associated with better outcomes and are viewed as useful by parents, it would seem prudent to ensure that each urban minority child with asthma has such a plan. Study findings suggest that enhanced access to asthma specialists is one effective means of increasing the number of urban minority children with asthma care plans. Further research, however, is needed on why female urban minority children are less likely to have asthma care plans.

Certain study limitations and strengths should be noted. In terms of limitations, all data originated from parental reports; it is unclear whether parental reports would correspond with data abstracted from medical records. Subjects were recruited from a consecutive series of patients seen in the ED or admitted to the hospital for asthma; further research on similar outcomes in less severely ill asthmatic patients is needed. Only African-American and Latino asthmatic children residing in Milwaukee were enrolled in this study, so the findings may not necessarily generalize to asthmatic children in other urban areas, in suburban or rural areas, or in other

minority groups. In terms of strengths, this is the first study (to our knowledge) to comprehensively examine asthma morbidity and access to specialty care in urban minority children, including performing multivariable analyses of the role of poverty and the factors associated with asthma care plans, exacerbations, having an asthma specialist, and using the ED as the usual source of asthma care.

In conclusion, urban minority children with asthma experience substantial morbidity, averaging one asthma symptom daily, one exacerbation monthly, and 7 missed school days, 6 missed parental workdays, 3 ED visits, and 1 hospitalization yearly. Most of these children receive their usual asthma care in EDs and have no asthma care plan or asthma specialist. Poverty was associated with twice the odds of an additional asthma exacerbation and half the adjusted odds of having an asthma specialist, and African-American children have greater odds of citing the ED as the usual asthma care. Urban minority asthmatic children need interventions to reduce morbidity and improve access to specialists and asthma care plans, especially among the poor and African-Americans.

ACKNOWLEDGMENT

The authors thank the following individuals for their assistance with this study: Laurie Smrz, Rhonda Durst, Rebecca Schultz de Parra, Jacqueline Gonzales, Martha Stevens, Duke Wagner, Amanda Schultz, John Meurer, Jennifer Cohen, Kevin Kelly, Marc Gorelick, Joseph Lee, and John Whitcomb. They are grateful to Anne Beal at the Commonwealth Fund and Brian Austin in the Improving Chronic Illness Care Program of the Robert Wood Johnson Foundation for their continuous support and assistance.

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