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RESEARCH ARTICLE

Racial and Ethnic Differences in Childhood Asthma Treatment in the United States

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Objective. To examine racial–ethnic differences in asthma controller medication use among insured U.S. children.

Data Sources. Linked nationally representative data from the Medical Expenditure Panel Survey (2005–2008), the 2000 Decennial Census, and the National Health Interview Survey (2004–2007).

Study Design. The study quantifies the portion of racial–ethnic differences in children's controller use that are attributable to differences in need, enabling and predisposing characteristics.

Principal Findings. Non-Hispanic black and Hispanic children were less likely to use controllers than non-Hispanic white children. Blinder-Oaxaca decomposition results indicated that observable characteristics explain less than 40 percent of the overall differential in controller use between non-Hispanic whites and non-Hispanic blacks. In contrast, observable characteristics explain more than two-thirds (71.3 percent) of the overall non-Hispanic white-Hispanic differential in controller use. For non-Hispanic blacks, a majority of the explained differential in controller use were attributed to enabling characteristics. For Hispanics, a significant portion of the explained differential in controller use was attributed to predisposing characteristics. In addition, a larger portion of the differential in controller use was explained by observable characteristics for publicly insured non-Hispanic black and Hispanic children.

Conclusions. The large observed differences in controller use highlight the continuing challenges of ensuring that all U.S. children have access to quality asthma care.

Key Words. Children, race–ethnicity, insurance status, asthma controller medications, decomposition

Asthma is a common chronic disease among U.S. children, characterized by chronic airway inflammation, and which results in recurring episodes of coughing, wheezing, breathlessness, and chest tightness. Asthma imposes significant burdens on children and their parents in the United States, in the form of lost school and work days, decreased quality of life, preventable

hospitalizations, and emergency room visits (Akinbami 2006; Akinbami et al. 2009), as well as increased health resource use and costs (Centers for Disease Control and Prevention [CDC] 2011; Miller and Sarpong 2011). In recent years, asthma treatment in U.S. children has changed due to important changes in treatment guidelines and the availability of new medications (National Asthma Education and Prevention Program 2007).

Recommended treatment guidelines call for a stepwise approach to asthma management that primarily uses two general types of medications: relievers and controllers (National Asthma Education and Prevention Program 2007). Relievers such as short-acting beta-agonists are recommended for the treatment of acute symptoms in children with intermittent asthma and may be used in conjunction with controllers in children with persistent asthma. Controllers are medications that are taken daily to reduce airway inflammation and the onset of symptoms. Inhaled corticosteroids, the preferred first-line class of controllers, are the cornerstone of therapy for persistent asthma (O'Connell 2005; Wechsler 2009).

Despite the availability of asthma medications and improved knowledge about treatment options, studies continue to find evidence that minority children are less likely to use controllers (Finkelstein et al. 2002; Lieu et al. 2002; Smith et al. 2008; Crocker et al. 2009; Miller and Sarpong 2011) and more likely to use relievers (Chen and Escarce 2008; Crocker et al. 2009; Miller and Sarpong 2011) to manage their disease. The significant differences in the use of asthma medications across racial and ethnic groups along with persistently worse health outcomes for minority populations with asthma (Akinbami, LaFleur, and Schoendorf 2002; Moorman et al. 2007; Akinbami et al. 2009) raise important health care concerns for researchers and policy makers alike.

As the long-term prognosis of asthma in children is largely determined by the adequacy of treatment with prescription medications, it is important to understand how underlying individual- and family-level characteristics contribute to the persistent differences across racial–ethnic groups in the use of recommended asthma controller medications. A detailed examination of the factors underlying racial–ethnic differences in controller use may provide insights into whether children and their families have responded to recent

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changes in treatment guidelines and the introduction of new pharmacotherapy and may also identify barriers, including biases, in access to these medications.

Our study contributes to the previous literature in several ways. First, unlike most of the previous studies on differences in asthma care that rely on administrative claims data, we use a rich array of variables from a nationally representative survey (MEPS) to investigate the determinants of controller use by children (≤17 years of age). We limit our sample to insured children with reported treatment for asthma and examine racial–ethnic differences in controller use for all insured children. This allows us to focus on differences in medication use among children who actively sought treatment for the condition. Studies also suggest that the determinants of health resource use (e.g., use of controllers) tend to differ across insurance categories (Lozano et al. 1999; Finkelstein et al. 2000; Ortega et al. 2001). In addition to examining differences in controller use among all insured children, therefore, we also examine differences within the privately insured and publicly insured populations. Finally, we use both linear and nonlinear regression decomposition approaches in quantifying racial–ethnic differences in controller use that are due to differences in observable predisposing, enabling, and need characteristics and differences unexplained by these observable characteristics.

Data and Methods

Framework: Behavioral Model of Health Care Utilization

In our analysis of racial–ethnic differences in childhood asthma controller use, we use the behavioral model of health care utilization (Andersen 1995) as a guide to our empirical model specification. The behavioral model of health care utilization posits that access to health care and health resource utilization are determined by predisposing factors (e.g., age, sex, health beliefs, residential neighborhoods, and census regions), enabling factors (e.g., family income, health insurance, and parental education), and need factors (e.g., health status and comorbidities). Thus, the model helps explain the reasons behind families' health resource use, and it helps to define and measure equitable access to health resources (Andersen 1995).

Differences in a wide range of predisposing, enabling, and need factors may potentially result in racial–ethnic differences in asthma care. First, predisposing characteristics such as parents' health-seeking behaviors, nativity, geographic location, and neighborhood characteristics may be associated with differences in the pharmaceutical treatment of childhood asthma (Andersen

1995; Ledogar, Penchaszadeh, and Garden 2000; Brugge et al. 2003; Smedley, Stith, and Nelson 2003; Chan et al. 2005; Crocker et al. 2009; Miller and Sarpong 2011). Second, asthma and other chronic conditions tend to cluster in socioeconomically disadvantaged communities, and access to and use of health care resources is often highly correlated with enabling characteristics such as family income and parental education (Finkelstein et al. 2002; Smedley, Stith, and Nelson 2003; Miller and Sarpong 2011). Finally, differences in need characteristics such as perceived health status may result in racial–ethnic differences in asthma medication use (Miller and Sarpong 2011). We therefore include an array of characteristics in our empirical models that represent each domain of the behavioral model.

Data

The primary data for our study are drawn from the 2005–2008 MEPS. The MEPS is an ongoing overlapping panel survey sponsored by the Agency for Healthcare Research and Quality that collects detailed and nationally representative information on health care utilization and expenditures, insurance coverage, sources of payment, health status, and sociodemographic variables for the U.S. civilian, noninstitutionalized population (Cohen 1997; Ezzati-Rice, Rohde, and Greenblatt 2008). We link the MEPS to county and block group-level information—approximations of neighborhoods (Auchincloss, Van Nostrand, and Ronsaville 2001)—from the 2000 Decennial Census to obtain information on neighborhood characteristics such as the median age of homes, percent receiving public assistance, percent of homes heated with firewood, and percent with adequate plumbing facilities. We also link the MEPS to the National Health Interview Survey to obtain information on parental nativity.

Sample: Insured Children with Reported Treatment for Asthma

We used the International Classification of Diseases, Ninth Revision (ICD-9-CM) three-digit codes to construct an indicator variable for asthma. We identified children with reported treatment for asthma within our sample by tying their diagnosis to any reported health services utilization, including inpatient hospital stays, outpatient, office-based and emergency room visits, home health care, and prescribed medicine purchases during the year. The probability that persons with asthma will be diagnosed with the condition may differ by race-ethnicity (Wolfenden et al. 2003; Yeatts et al. 2003a,b; Akinbami,

Rhodes, and Lara 2005; Okelo et al. 2007) and the decision to seek care depends crucially on diagnosis. To circumvent this issue and focus the analysis on children who actively sought care for asthma, we limit our sample to children with reported treatment for asthma. Also, due to the small number of uninsured children with reported treatment for asthma (less than 3 percent), we limit our sample to children who were covered by public or private insurance.

Outcome: Use of Controllers

We identified asthma medications by linking drug purchases in the MEPS Prescribed Medicines Files to the Multum Lexicon database, a product of Cerner Multum, Inc. We created dichotomous variables that identify children who, at any time during the year, used a controller medication. Controllers comprise a number of classes of medications, including inhaled corticosteroids, inhaled long-acting beta-agonists, oral long-acting beta-agonists, leukotriene receptor antagonists, methylxanthines, and nonsteroidal anti-allergy agents and combinations of these medications.

Race–Ethnicity Categories

We categorize children based on their race and ethnicity as Hispanic, non-Hispanic black (NH black), non-Hispanic white (NH white), and non-Hispanic Other (NH Other).[1] The Hispanic grouping includes children of any race who are identified as Hispanic or Latino. The NH Other grouping includes Asian/Pacific Islanders, Aleut/Eskimos, American Indians, and multi-racial children. We use NH white children as the reference group in our analysis and examine differences in the use of controllers between NH black and NH white children and between Hispanic and NH white children. NH Other children are included in our pooled regressions.[2] But due to an insufficient sample, we do not conduct separate decomposition analyses for these children. Our pooled sample consists of an unweighted total of 2,323 insured children under the age of 18 with reported treatment for asthma (853 NH whites; 646 NH blacks; 665 Hispanics; and 159 NH Other).

Group Characteristics

Under the predisposing domain of the behavioral model of health care utilization, which relates to a person's predisposition to seek health and use

health care, we include age, sex, and geographic variables such as metropolitan statistical area (MSA) and Census regions. As attitudes toward health care and differences in social structure and the environment may result in differences in medication use, we also include dichotomous variables that capture parental beliefs about the necessity of health care, parental nativity status, and neighborhood variables such as the median age of homes, and neighborhoods where at least 1 percent of households receive public assistance, use firewood for heating, and have incomplete plumbing facilities. We include these physical neighborhood characteristics in our models to help capture markers for disadvantaged neighborhoods and poor housing quality, which are likely to be associated with increased risk of respiratory disease, poor health, and health care use (Morenoff and Lynch 2004; Oyana and Lwebuga-Mukasa 2004; Corburn, Osleeb, and Porter 2006; Wright and Subramanian 2007). Under the enabling domain, which relates to factors that either facilitate or impede health resource utilization, we include measures of household income as a percentage of the federal poverty line, and dichotomous measures of parental education and marital status. Under the needs domain, we include dichotomous variables that capture the perceived health status of each child as well as two factors that may exacerbate asthma symptoms: the presence of an adult smoker in the household and reported treatment for allergic rhinitis. For a detailed listing of variables, refer to Table 2.

Analytic Approach

We begin our analysis by describing differences across racial–ethnic groups in the treated prevalence of children's asthma and the proportion of NH white, NH black, and Hispanic children who used any controller medications during the year, conditional on reported treatment for asthma. Next, we estimate the means of all predisposing, enabling, and need characteristics and compare these estimates across racial–ethnic groups. Then we estimate pooled auxiliary regressions, which include race–ethnicity dummies to identify the specific characteristics that affect the likelihood of using controllers (Yun 2005; Jann 2008). Finally, we use differences in mean group characteristics along with the coefficients from the pooled auxiliary model to compute the decompositions of the differences in controller use across race–ethnicity groups (Jann 2008). We conduct these analyses separately for three groups of children with reported treatment for asthma: all insured children, children with private insurance, and children with public insurance.

In our primary models, we use the linear decomposition approach first developed by Blinder (1973) and Oaxaca (1973) to quantify racial–ethnic differences in controller use, designating NH white children as the reference group as follows:

$$\bar{y}^{\text{white}} - \bar{y}^{j} = \underbrace{(\bar{x}^{\text{white}} - \bar{x}^{j})\hat{\beta}^{*}}_{\text{Explained}} + \underbrace{\bar{x}^{\text{white}}(\hat{\beta}^{\text{white}} - \hat{\beta}^{*}) + \bar{x}^{j}(\hat{\beta}^{*} - \hat{\beta}^{j})}_{\text{Unexplained}}$$

where $j = \text{NH black, Hispanic}$, $\bar{y}$ represents mean controller use, $\bar{x}$ is a vector of group-specific mean characteristics, $\hat{\beta}^{\text{white}}$ and $\hat{\beta}^{j}$ are vectors of coefficients estimated in separate linear probability models for each racial–ethnic group, and $\hat{\beta}^{*}$ is a vector of coefficients from the pooled linear probability models that reflects the average controller use for each racial–ethnic group that would have existed in the absence of structural and health system barriers (akin to the "non-discriminatory coefficient" in Oaxaca and Ransom 1994).

The first term on the right-hand side is the "explained" portion of the decomposition that reflects differentials in use that are due to differences in mean characteristics. In other words, the explained portion reflects the mean decrease (increase) in controller use for NH blacks (Hispanics) that would result if they had the same predisposing, enabling, and need characteristics as NH whites. For a particular characteristic (e.g., nativity) to explain differential use, there must be a difference across groups in the percentage of children with native parents and nativity must have an effect on controller use (e.g., $\hat{\beta}^{*}$ for nativity $\neq 0$). The second term on the right-hand side is the unexplained part which reflects the differentials due to differences in the coefficients (e.g., differences due to different returns to identical characteristics). The unexplained portion also subsumes unobserved characteristics such as unobserved parental endowments and preferences.

The linear decomposition approach is attractive because it offers parsimony in computation and interpretation of point estimates and standard errors. However, the standard Blinder-Oaxaca decomposition approach was designed for linear models with continuous left-hand-side variables or models that are intrinsically linear in the parameters. The assumptions underlying the linear Blinder-Oaxaca decompositions, therefore, may not be applicable to the binary outcome that we study (Yun 2000, 2004; Fairlie 2005; Bauer and Sinning 2008; Pylypchuk and Selden 2008; Sinning, Hahn, and Bauer 2008). Thus, as a sensitivity test, we re-estimated our decomposition models using nonlinear decomposition methods based on Yun (2004) that use logistic regressions and are designed to accommodate limited dependent variables.

The MEPS uses complex sampling methods and our estimates account for the stratification, clustering, and weights to ensure that results are nationally representative for children in the US civilian, noninstitutionalized population with reported treatment for asthma. To increase our sample size, we pool 2005–2008 MEPS data, so our descriptive results are average annual estimates for these years. Taylor series approximation techniques were used to estimate the standard errors of the descriptive statistics, and the delta method was used to compute standard errors for the Blinder-Oaxaca decomposition components in Stata 11.

RESULTS

Treated Prevalence of Asthma and Use of Controllers

Table 1 provides information on racial–ethnic differences in the treated prevalence of asthma and controller use among insured children with reported treatment for asthma. Results show that, overall, NH black children (8.5 percent) were more likely than NH white children (6.3 percent) and Hispanic children (5.8 percent) to have reported treatment for asthma. Among children with reported treatment for asthma, NH blacks (44.1 percent) and Hispanics (49.8 percent) were both less likely than NH whites (67.9 percent) to have used controllers to manage their asthma. These racial–ethnic differences in controller use are also evident within insurance groups, but gaps in controller use are

Table 1: Treated Prevalence of Asthma and Asthma Controller Use among Insured Children, by Race–Ethnicity

	Non-Hispanic White (n = 853)	*Non-Hispanic Black (n = 646)*	*Hispanic (n = 665)*
Percent with reported treatment for asthma			
All insured children	6.3 (0.3)	8.5*** (0.4)	5.8 (0.4)
Privately insured children	6.1 (0.3)	7.4* (0.7)	6.0 (0.7)
Publicly insured children	7.0 (0.6)	9.6*** (0.6)	5.7* (0.4)
Among insured children with reported treatment for asthma, percent using Controllers			
All insured children	67.9 (2.1)	44.1*** (2.9)	49.8*** (3.2)
Privately insured children	70.3 (2.5)	41.4*** (4.8)	51.0*** (6.0)
Publicly insured children	59.6 (3.9)	45.9*** (3.3)	48.9** (3.5)

Note. Authors' calculations using linked data from the Medical Expenditure Panel Survey (2005–2008), the 2000 Decennial Census, and the National Health Interview Survey (2004–2007). Results are not shown for non-Hispanic "Other" children. Standard errors are in parentheses.
Estimate is significantly different from non-Hispanic white at ***$p < .01$ or better, **$p < .05$, *$p < 0.10$.

larger among privately insured children than among the publicly insured.[3] The primary reason is that publicly insured NH white children (59.6 percent) are significantly less likely to use controllers than their privately insured counterparts (70.3 percent).

Differences in Individual- and Family-Level Characteristics

Table 2 presents means of predisposing, enabling, and need characteristics among insured children with treatment for asthma by race–ethnicity. There were a number of differences across racial–ethnic groups as NH black and Hispanic children were less likely than NH white children to have native parents, live in neighborhoods with newer housing units, live in neighborhoods where none of the households have incomplete plumbing facilities, live in families with higher income and higher education, have married parents, have excellent-to-good health status, and live in households with an adult smoker. On the other hand, NH black and Hispanic were more likely than NH white children to live in neighborhoods where at least 1 percent of households receive public assistance and to live in MSAs. NH blacks were less likely to live in the Northeast and more likely to live in the South than NH whites. Hispanics were more likely than NH whites to live in the West.

In nearly every case, these same patterns in group mean characteristics were evident within the privately insured population (Table S1). There were, however, a number of substantive differences in publicly insured children. In particular, within the publicly insured population, there were no statistically, or economically, significant differences across racial–ethnic groups in family income or in two of the neighborhood characteristics—the presence of houses with incomplete plumbing and the presence of families receiving public assistance. On the other hand, racial–ethnic differences in the percentage of children living in MSAs were larger among publicly insured children. The primary reason is that publicly insured NH white children (64.4 percent) are significantly less likely to live in MSAs than their privately insured counterparts (84.6 percent).

Relationship between Characteristics and Controller Use

The first column of Table 3 presents our pooled linear probability models for all insured children. Results confirm that several predisposing, enabling, and needs characteristics are strong predictors of controller use. The mean

Table 2: Percent Distribution of Predisposing, Enabling, and Need Factors for Insured Children with Reported Treatment for Asthma, by Race-Ethnicity

Group Characteristics	*Non-Hispanic White*	*Non-Hispanic Black*	*Hispanic*
Predisposing factors			
Age in years			
0–4	19.4 (2.0)	22.9 (2.4)	23.7 (2.4)
5–11	44.8 (2.3)	45.2 (2.8)	51.6* (3.0)
12–17	35.8 (2.2)	32.0 (3.1)	24.7*** (2.7)
Sex (ref: male)			
Female	40.3 (2.5)	38.8 (2.5)	40.9 (2.9)
Health beliefs (ref: cannot overcome illness without medications)			
Can overcome illness without medications	18.9 (1.8)	15.4 (1.8)	14.6 (2.1)
Nativity (ref: no native parents)			
Native parents	96.2 (0.9)	89.9*** (1.9)	52.8*** (3.5)
MSA (ref: non-MSA			
MSA	80.1 (2.1)	89.1*** (2.3)	93.2*** (1.4)
Census region			
Midwest	25.8 (2.3)	17.2*** (2.4)	9.3*** (1.6)
Northeast	24.0 (2.5)	17.7* (2.5)	18.7 (2.9)
South	33.6 (2.7)	56.3*** (3.3)	34.8 (3.6)
West	16.6 (2.2)	8.8*** (1.9)	37.2*** (3.3)
Neighborhood factors			
Median age of dwelling (ref: before 1969)			
1969 and later	61.6 (2.9)	52.5** (3.2)	52.0** (3.5)
HH receiving any public assistance (ref: none)			
At least 1%	70.4 (2.4)	87.7*** (1.8)	87.3*** (2.7)
HH using firewood for heating fuel (ref: none)			
At least 1%	40.5 (2.8)	15.4*** (2.8)	20.2*** (3.0)
HH with incomplete plumbing facilities (ref: none)			
At least 1%	25.2 (2.4)	36.2*** (3.4)	33.3*** (3.2)
Enabling factors			
Health insurance status (ref: private)			
Public	22.4 (1.9)	58.8*** (3.1)	58.3*** (3.7)
Family income			
Middle/high (>200% of FPL)	72.6 (2.0)	35.9*** (3.4)	41.3*** (3.3)
Low (125% <of FPL ≤200%)	10.5 (1.3)	20.2*** (2.2)	23.7*** (2.2)
Poor/near poor (≤125% of FPL)	16.9 (1.5)	43.9*** (2.8)	35.0*** (2.9)
Parent's education (ref: >high school)			
≤High school	27.7 (2.2)	51.9 (28.9)	61.5*** (3.3)
Parent's marital status (ref: not married)			
Married	75.9 (2.2)	29.1*** (2.7)	58.1*** (3.2)
Need factors			
Perceived health status (ref: excellent/very good/good)			
Fair/poor	14.1 (1.4)	22.8*** (2.1)	23.6*** (2.4)

continued

Table 2 *Continued*

Group Characteristics	*Non-Hispanic White*	*Non-Hispanic Black*	*Hispanic*
Adult smoker in HH (ref: none)			
Adult smoker present	25.7 (2.2)	20.8 (2.1)	20.1 (2.1)
Reported comorbidity (ref: no allergic rhinitis)			
Allergic rhinitis	17.4 (1.7)	9.4*** (1.3)	11.0** (1.9)

Note. Authors' calculations using linked data from the Medical Expenditure Panel Survey (2005–2008), the 2000 Decennial Census, and the National Health Interview Survey (2004–2007). Standard errors are in parentheses.
Estimate is significantly different from non-Hispanic white at ***$p < .01$ or better, **$p < .05$, *$p < .10$.
FPL, federal poverty line; HH, household; MSA, metropolitan statistical area; ref, reference.

level of controller use in our pooled sample was 59.2 percent (data not shown). Controlling for other characteristics, we find that, overall, those more likely to use controllers were children; ages 5–11 (8.5 percentage points), with native parents (6.8 percentage points), living in neighborhoods with newer housing units (9.5 percentage points), living in neighborhoods where at least 1 percent of households receive public assistance (6.7 percentage points), living in neighborhoods where at least 1 percent of homes are heated with firewood (5.8 percentage points), living with married parents (8.6 percentage points), in fair or poor health (9.3 percentage points), and with reported treatment for allergies (20.3 percentage points). Those less likely to use controllers were NH blacks (14.9 percentage points) and girls (6.2 percentage points) as well as children living in neighborhoods where at least 1 percent of households have incomplete plumbing facilities (6.3 percentage points), living in the West (17.5 percentage points), and living in low-income households (10.2 percentage points).

Columns 2 and 3 present linear probability results for privately and publicly insured children, respectively. In most cases, the direction of estimated effects is the same within the insurance groups as in our overall model, but in many cases, the point estimate is larger for one insurance group, and smaller for the other, than in our overall model.

Blinder-Oaxaca Decomposition

Table 4 presents our Blinder-Oaxaca decompositions of the racial–ethnic differences in controller use. Columns 1 and 2 present results for all insured children. Column 1 presents results for the decomposition of the 23.8 percentage point difference in controller use between NH blacks and NH whites. The

Table 3: Linear Probability Models: Effects of Predisposing, Enabling, and Need Characteristics on Controller Use, Insured Children with Reported Treatment for Asthma

Group Characteristics	*All Insured Children*	*Privately Insured Children*	*Publicly Insured Children*
Race-ethnicity (ref: non-Hispanic white)			
non-Hispanic black	−0.149*** (0.040)	−0.214*** (0.057)	−0.046 (0.052)
Hispanic	−0.052 (0.043)	−0.078 (0.063)	0.026 (0.056)
non-Hispanic other	−0.041 (0.062)	−0.069 (0.096)	0.01 (0.068)
Predisposing factors			
Age in years (ref: 0–4)			
5–11	0.085*** (0.033)	0.031 (0.045)	0.144*** (0.046)
12–17	0.01 (0.038)	−0.038 (0.052)	0.064 (0.046)
Sex (ref: male)			
Female	−0.062** (0.029)	−0.101** (0.039)	−0.002 (0.032)
Health beliefs (ref: cannot overcome illness without medications)			
Can overcome illness without medications	0.009 (0.034)	0.024 (0.046)	−0.043 (0.048)
Nativity (ref: no native parents)			
Native parents	0.068* (0.040)	0.047 (0.063)	0.078* (0.047)
MSA (ref: non-MSA)			
MSA	−0.036 (0.039)	−0.009 (0.052)	−0.124** (0.054)
Census region (ref: Midwest)			
Northeast	0.021 (0.045)	0.026 (0.060)	−0.011 (0.072)
South	−0.04 (0.039)	−0.027 (0.048)	−0.068 (0.063)
West	−0.175*** (0.044)	−0.203*** (0.054)	−0.129* (0.067)
Neighborhood factors			
Median age of dwelling (ref: before 1969)			
1969 and later	0.095*** (0.035)	0.099** (0.046)	0.090** (0.041)
HH receiving any public assistance (ref: none)			
At least 1%	0.067* (0.040)	0.080* (0.043)	0.073 (0.073)
HH using firewood for heating fuel (ref: none)			
At least 1%	0.058* (0.034)	0.100** (0.041)	−0.007 (0.050)
HH with incomplete plumbing facilities (ref: none)			
At least 1%	−0.063** (0.031)	−0.102** (0.043)	−0.036 (0.041)
Enabling factors			
Health insurance status (ref: private)			
Public	0.017 (0.034)		
Family income (ref: middle/high [>200% of FPL])			
Low (125% <of FPL ≤200%)	−0.102*** (0.039)	−0.087 (0.059)	−0.033 (0.054)
Poor/near poor (≤125% of FPL)	−0.004 (0.037)	−0.062 (0.065)	0.052 (0.052)
Parent's education (ref: >high school)			
≤High school	−0.053 (0.034)	−0.086* (0.045)	−0.005 (0.042)
Parent's marital status (ref: not married)			
Married	0.086*** (0.030)	0.055 (0.041)	0.121*** (0.042)

continued

Table 3 *Continued*

Group Characteristics	*All Insured Children*	*Privately Insured Children*	*Publicly Insured Children*
Need factors			
Perceived health status (ref: excellent/very good/good)			
Fair/poor	0.093*** (0.028)	0.048 (0.045)	0.134*** (0.037)
Adult smoker in HH (ref: none)			
Adult smoker present	0.000 (0.030)	−0.008 (0.047)	0.033 (0.036)
Reported comorbidity (ref: no allergic rhinitis)			
Allergic rhinitis	0.203*** (0.030)	0.215*** (0.036)	0.181*** (0.052)

Note. Authors' calculations using linked data from the Medical Expenditure Panel Survey (2005–2008), the 2000 Decennial Census, and the National Health Interview Survey (2004–2007). All models include year dummy. Standard errors are in parentheses.
Significance level: *$p < .10$, **$p < .05$, ***$p < .01$.
FPL, federal poverty line; HH, household; MSA, metropolitan statistical area; NH, non-Hispanic; ref, reference.

explained part of this differential (8.9 percentage points) reflects the mean increase in controller use for NH blacks if they had the same predisposing, enabling, and need characteristics as NH whites. In other words, less than two fifths (37.4 percent) of the difference in controller use can be explained by differences in characteristics. About two-thirds (65.2 percent) of the explained differential is attributable to enabling characteristics, with parental marital status playing the largest role.[4]

Column 2 presents results for the decomposition of the 18.1 percentage point difference in controller use between Hispanics and NH whites. The explained part of this differential (12.9 percentage points, or 71.3 percent of the overall difference) reflects the mean increase in controller use for Hispanics if their predisposing, enabling, and need characteristics were adjusted to match those of NH whites. Predisposing characteristics accounted for almost two-thirds (64.3 percent) of the explained differential. The most important predisposing characteristics were having native parents and living in the West. Enabling characteristics, particularly income and marital status of parents, accounted for almost one-third (31.8 percent) of the explained differential.

In most respects, decomposition results are qualitatively similar when the sample is limited to privately insured children (Columns 3 and 4). For NH black children, a little more than one-quarter (26.0 percent) of the 28.8 percentage point differential in controller use can be explained by differences in characteristics and most (61.3 percent) of the explained differential is, again, attributable to enabling characteristics. For Hispanic children, most (59.1 percent) of the 19.3 percentage point differential in controller use is

Table 4: Blinder-Oaxaca Decomposition Results for Insured Children with Reported Treatment for Asthma

	All Insured Children		*Privately Insured Children*		*Publicly Insured Children*	
	Non-Hispanic White Children Compared to					
	Non-Hispanic Black	*Hispanic*	*Non-Hispanic Black*	*Hispanic*	*Non-Hispanic Black*	*Hispanic*
Difference in controller use	0.238*** (0.033)	0.181*** (0.036)	0.288*** (0.051)	0.193*** (0.057)	0.136*** (0.047)	0.107** (0.050)
Portions of explained differences in controller use						
Explained difference (overall)	0.089*** (0.023)	0.129*** (0.027)	0.075** (0.029)	0.114*** (0.034)	0.090*** (0.033)	0.133*** (0.037)
Portion of explained difference						
Predisposing factors	0.022 (0.016)	0.083*** (0.023)	0.013 (0.021)	0.065** (0.030)	0.034 (0.026)	0.099*** (0.033)
Enabling factors	0.058*** (0.018)	0.041*** (0.016)	0.046** (0.018)	0.040*** (0.015)	0.037** (0.016)	0.008 (0.010)
Need factors	0.008 (0.007)	0.004 (0.007)	0.016* (0.008)	0.01 (0.010)	0.016 (0.014)	0.016 (0.016)
Unexplained difference (overall)	0.149*** (0.039)	0.052 (0.042)	0.214*** (0.053)	0.078 (0.057)	0.046 (0.051)	−0.026 (0.054)
Percentage of explained differences in controller use						
Explained difference (overall)	37.4	71.3	26.0	59.1	66.2	124.3
Percent of explained difference						
Predisposing factors	24.7	64.3	17.3	57.0	37.8	74.4
Enabling factors	65.2	31.8	61.3	35.1	41.1	6.0
Need factors	9.0	3.1	21.3	8.8	17.8	12.0
Unexplained difference (overall)	62.6	28.7	74.3	40.4	33.8	−24.3

Note. Authors' calculations using linked data from the Medical Expenditure Panel Survey (2005–2008), the 2000 Decennial Census, and the National Health Interview Survey (2004–2007). All decomposition models are estimated with controls for all variables listed in Table 2 and year dummies. The predisposing, enabling, and need factors do not sum up to the overall explained portion of the difference—the remainder is accounted for by the year dummies. Standard errors are in parentheses.
Significance level: *$p < .10$, **$p < .05$, ***$p < .01$.

explained by differences in characteristics and, again, predisposing characteristics (57.0 percent) account for most of the explained differential while enabling characteristics (35.1 percent) account for about one-third of the explained differential.

By contrast, there are some qualitative differences in the decomposition results when the sample is limited to publicly insured children. For NH black children, most (66.2 percent) of the 13.6 percentage point differential in controller use is explained by differences in characteristics, with predisposing (37.8 percent) and enabling (41.1 percent) characteristics accounting for similar portions of the explained differential. For Hispanic children, 124.3 percent (13.3 percentage points) of the 10.7 percentage point differential is explained. In other words, publicly insured Hispanic children would be more likely to use controllers than their NH white counterparts, given comparable observable characteristics. Predisposing characteristics account for nearly three-quarters (74.4 percent) of the explained differential. There were no significant differences across racial–ethnic groups, perhaps due to insignificant differences in family income within the publicly insured population.

Sensitivity of Results to Alternative Specifications

To test the robustness of the linear probability and Blinder-Oaxaca models to alternative specifications, we estimate nonlinear versions of the models in Tables 3 and 4. The nonlinear pooled results (Table S2) as well as the nonlinear decomposition results (Table S3) are, in most respects, very similar to those presented in Tables 3 and 4. The only qualitative difference was a change in statistical significance for two variables—parental nativity and education—in the pooled regression model for publicly insured children.

DISCUSSION

In this study, we use nationally representative data from the 2005–2008 MEPS to document racial–ethnic differences in the use of asthma medications and to examine the extent to which underlying individual and family level characteristics account for persistent differences in the use of controllers. We found that among insured children who actively sought treatment for asthma, NH black children (23.8 percentage points) and Hispanic children (18.1 percentage points) were both less likely than NH white children to use controllers. Our results on the differential use of controllers are consistent with

previous studies (Finkelstein et al. 2002; Lieu et al. 2002; Smith et al. 2008; Crocker et al. 2009; Miller and Sarpong 2011).

Results from our Blinder-Oaxaca decompositions show that observable characteristics explain about three-quarters (71.3 percent) of the differential in controller use for Hispanic children but explain only about one-third (37.4 percent) of the difference for NH black children. Enabling characteristics, especially, lower family incomes and a lower percentage of children with married parents, were important explanatory variables accounting for 5.8 percentage points (24.4 percent) of the differential in controller use for NH black children, and 4.1 percentage points (22.7 percent) of the differential for Hispanic children. The importance of enabling characteristics may reflect the inability of low-income families to devote adequate time and financial resources to the successful management of their children's asthma. Previous research also finds that unmarried parents tend to invest less in their children's health (Harknett 2009) and are less likely to engage in beneficial parenting practices than their married counterparts (Aronson and Huston 2004).

Predisposing characteristics, especially having non-native parents and living in the West, were even more important for Hispanic children as they account for 8.3 percentage points (45.9 percent) of the differential in controller use. The nexus between non-native parents and lower controller use may reflect a number of factors, including lack of acclimatization to the U.S. health system and acculturation to the broader U.S. culture (Koinis-Mitchell et al. 2011) as well as differences in parents' perceptions of asthma severity and awareness of asthma treatment options (Subramanian et al. 2009). Lower controller use in the West may reflect regional differences in practice patterns as well as the disproportionate presence of Hispanics in the western United States. Indeed, studies of other therapeutic classes have documented significant variation in prescription drug use across geographic regions (Cox et al. 2003) and have shown that concentrations of ethnic minorities are negatively associated with several types of medication purchases (Morgan, Cunningham, and Hanley 2010).

In addition to examining differences in controller use for all insured children, we also examine differences within the privately and publicly insured populations. Our decompositions show that observable characteristics explain a majority of the differential in controller use for both privately and publicly insured Hispanic children. Observable characteristics also explain about two-thirds (66.2 percent) of the differential for publicly insured NH black children, but only explain about one-quarter (26.0 percent) for privately insured NH black children.

Our results suggest, therefore, that unobservable differences in group characteristics play a larger role in the differential use of controllers within the privately insured population of NH black and NH white children than in the other two populations that we examine. In considering the qualitatively different outcomes for the two groups of NH black children, it is important to note that there are pronounced differences in family income across racial–ethnic groups in the privately insured population that do not exist among publicly insured children. There may be unobservable racial–ethnic differences in characteristics among privately insured children that affect controller use. More generally, with the exception of publicly insured Hispanic children, unobservable differences play a significant role in all of our decompositions. There are a plethora of possible reasons for the substantial unexplained differences including racial–ethnic minority parents' preferences for affordable nonprescription remedies (Conn et al. 2007); parents' motivation and cultural beliefs (Chan et al. 2005; Crocker et al. 2009); and other health system barriers (Halterman et al. 2001, 2002; Smith et al. 2002; Smedley, Stith, and Nelson 2003; Zorc et al. 2003; Zorc, Scarfone, and Li 2005; Ferris et al. 2006; Galbraith et al. 2010). These factors may all contribute to the unexplained part of the differentials, but they are difficult to control for in our regression models using the MEPS data.

LIMITATIONS

The decomposition methods used in this study are based on regression analysis of the relationships between controller use and individual- and family-level characteristics using cross-sectional data from the MEPS. Our data do not, therefore, allow us to predict causal effects such as the effects of reducing differences in some individual- and family-level characteristics on differences in the use of controllers. Also, the MEPS does not include measures of asthma severity; therefore, we implicitly assumed that the distribution of asthma severity is similar within each racial–ethnic group.

CONCLUSION

Our results suggest that the reasons for racial–ethnic differences in controller use are complex and multifaceted and that even among insured children with asthma, NH black-NH white differences in controller use are largely unex-

plained by differences in observable characteristics. Health strategies that raise awareness about racial–ethnic disparities in asthma care (Smedley, Stith, and Nelson 2003), improve awareness of asthma treatment options (National Asthma Education and Prevention Program 2007), increase the demand for recommended asthma medications by reducing the cost of care for low-income parents, and provider-community outreaches that provide culturally competent educational materials to non-native parents (Ireys et al. 2001; Bonner et al. 2002; Fisher et al. 2004) may help bridge the racial–ethnic gap in recommended asthma medication use. Yet focusing on equalizing health strategy designs that are based on readily measurable characteristics (e.g., income, parental nativity, and marital status) may not eliminate or reduce the racial–ethnic gap in recommended controller use if there are differential responses to key characteristics that are unobserved.

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NOTES

1. These racial–ethnic categories follow Office of Management and Budget guidelines (Office of Management and Budget 1997) and have been widely used in studies of disparities (see, for example, U.S. Department of Health and Human Services 2011).
2. Regressions include a dummy variable for non-Hispanic Other children. Although we do not conduct separate decomposition analyses for these children, their presence in the regression means that they contribute to the pooled coefficients, which are intended to capture the average controller use for each racial–ethnic group that would have existed in the absence of structural and health system barriers.
3. For both Hispanic and NH black children, the point estimate of the difference in controller use (see Table 4) is larger among the privately insured than among the publicly insured, but the difference in these differences is not statistically significant for Hispanic children.

4. Decomposition results for specific characteristics (e.g., parental marital status) are not shown in the table, but they are available from the authors on request.

REFERENCES

Akinbami, L. J. 2006. *The State of Childhood Asthma, United States, 1980–2005.* Advance Data from Vital and Health Statistics, no 381, Hyattsville, MD: National Center for Health Statistics [accessed on August 1, 2012]. Available at http://www.cdc.gov/nchs/data/ad/ad381.pdf

Akinbami, L. J., B. J. LaFleur, and K. C. Schoendorf. 2002. "Racial and Income Disparities in Childhood Asthma in the United States." *Ambulatory Pediatrics* 2 (5): 382–7.

Akinbami, L. J., J. C. Rhodes, and M. Lara. 2005. "Racial and Ethnic Differences in Asthma Diagnosis among Children Who Wheeze." *Pediatrics* 115 (5): 1254–60.

Akinbami, L. J., J. E. Moorman, P. L. Garbe, and E. J. Sondik. 2009. "Status of Childhood Asthma in the United States: 1980–2007." *Pediatrics* 123 (3): S131–45.

Andersen, R. M. 1995. "Revisiting the Behavioral Model and Access to Medical Care: Does It Matter?" *Journal of Health and Social Behavior* 36 (1): 1–10.

Aronson, S. R., and A. C. Huston. 2004. "The Mother–Infant Relationship in Single, Cohabiting, and Married Families: A Case for Marriage?" *Journal of Family Psychology* 18 (1): 5–18.

Auchincloss, A. H., J. F. Van Nostrand, and D. Ronsaville. 2001. "Access to Health Care for Older Persons in the United States: Personal, Structural, and Neighborhood Characteristics." *Journal of Aging and Health* 13 (3): 329–54.

Bauer, T. K., and M. Sinning. 2008. "An Extension of the Blinder-Oaxaca Decomposition to Non-Linear Models." *Advances in Statistical Analysis* 92 (2): 197–206.

Blinder, A. 1973. "Wage Discrimination: Reduced Form and Structural Estimates." *Journal of Human Resources* 8 (4): 436–55.

Bonner, S., B. J. Zimmerman, D. Evans, M. Irigoyen, D. Resnick, and R. B. Mellins. 2002. "An Individualized Intervention to Improve Asthma Management among Urban Latino and African-American Families." *Journal of Asthma* 39 (2): 167–79.

Brugge, D., J. Vallarino, L. Ascolillo, N. D. Osgood, S. Steinbach, and J. Spengler. 2003. "Comparison of Multiple Environmental Factors for Asthmatic Children in Public Housing." *Indoor Air* 13 (1): 18–27.

Centers for Disease Control and Prevention (CDC). 2011. "Vital Signs: Asthma in the US Growing Every Year" [accessed on August 1, 2012]. Available at http://www.cdc.gov/VitalSigns/pdf/2011-05-vitalsigns.pdf

Chan, K. S., E. Keeler, M. Schonlau, M. Rosen, and R. Mangione-Smith. 2005. "How Do Ethnicity and Primary Language Spoken at Home Affect Management Practices and Outcomes in Children and Adolescents with Asthma?" *Archives of Pediatrics and Adolescent Medicine* 159 (3): 283–9.

Chen, A. Y., and J. J. Escarce. 2008. "Family Structure and the Treatment of Childhood Asthma." *Medical Care* 46 (2): 174–84.

Cohen, J. W. 1997. *Design and Methods of the Medical Expenditure Panel Survey Household Component.* MEPS Methodology Report No. 1. Rockville, MD: Agency for

Health Care Policy [accessed on August 1, 2012]. Available at http://www.meps.ahrq.gov/mepsweb/data_files/publications/mr1/mr1.shtml

Conn, K. M., J. S. Halterman, K. Lynch, and M. D. Cabana. 2007. "The Impact of Parents' Medication Beliefs on Asthma Management." *Pediatrics* 120 (3): e521–6.

Corburn, J., J. Osleeb, and M. Porter. 2006. "Urban Asthma and the Neighborhood Environment in New York City." *Health Place* 12 (2): 167–79.

Cox, E. R., B. R. Motheral, R. R. Henderson, and D. Mager. 2003. "Geographic Variation in the Prevalence of Stimulant Medication Use among Children 5 to 14 Years Old: Results from a Commercially Insured US Sample." *Pediatrics* 111 (2): 237–43.

Crocker, D., C. Brown, R. Moolenaar, J. Moorman, C. Bailey, D. Mannino, and F. Holguin. 2009. "Racial and Ethnic Disparities in Asthma Medication Usage and Health-Care Utilization." *Chest* 136 (4): 1063–71.

Ezzati-Rice, T. M., F. Rohde, and J. Greenblatt. 2008. *Sample Design of the Medical Expenditure Panel Survey Household Component, 1998-2007.* Methodology Report No. 22. Rockville, MD: Agency for Healthcare Research and Quality [accessed on August 1, 2012]. Available at http://www.meps.ahrq.gov/mepsweb/data_files/publications/mr22/mr22.shtml

Fairlie, R. W. 2005. "An Extension of the Blinder–Oaxaca Decomposition Technique to Logit and Probit Models." *Journal of Economic and Social Measurement* 30 (4): 305–16.

Ferris, T. G., K. Kuhlthau, J. Ausiello, J. Perrin, and R. Kahn. 2006. "Are Minority Children the Last to Benefit from a New Technology? Technology Diffusion and Inhaled Corticosteroids for Asthma." *Medical Care* 44 (1): 81–6.

Finkelstein, J. A., M. B. Barton, J. G. Donahue, P. Algatt-Bergstrom, L. E. Markson, and R. Platt. 2000. "Comparing Asthma Care for Medicaid and non-Medicaid Children in a Health Maintenance Organization." *Archives of Pediatrics and Adolescent Medicine* 154 (6): 563–8.

Finkelstein, J. A., P. Lozano, H. J. Farber, I. Miroshnik, and T. A. Lieu. 2002. "Underuse of Controller Medications among Medicaid-Insured Children with Asthma." *Archives of Pediatrics and Adolescent Medicine* 156 (6): 562–7.

Fisher, E. B., R. C. Strunk, L. K. Sussman, R. Sykes, and M. S. Walker. 2004. "Community Organization to Reduce the Need for Acute Care for Asthma among African American Children in Low Income Neighborhoods: The Neighborhood Asthma Coalition." *Pediatrics* 114 (1): 116–23.

Galbraith, A. A., L. A. Smith, B. Bokhour, I. L. Miroshnik, G. S. Sawicki, J. H. Glauber, K. H. Hohman, C. Gay, and T. A. Lieu. 2010. "Asthma Care Quality for Children with Minority-Serving Providers." *Archives of Pediatrics and Adolescent Medicine* 164 (1): 38–45.

Halterman, J. S., H. L. Yoos, K. Sidora, H. Kitzman, and A. McMullen. 2001. "Medication Use and Health Care Contacts among Symptomatic Children with Asthma." *Ambulatory Pediatrics* 1 (5): 275–9.

Halterman, J. S., H. L. Yoos, J. M. Kaczorowski, K. McConnochie, R. J. Holzhauer, K. M. Conn, S. Lauver, and P. G. Szilagyi. 2002. "Providers Underestimate Symp-

tom Severity among Urban Children with Asthma." *Archives of Pediatrics and Adolescent Medicine* 156 (2): 141–6.

Harknett, K. 2009. "Why are Children with Married Parents Healthier? The Case of Pediatric Asthma." *Population Research and Policy Review* 28 (3): 347–65.

Ireys, H. T., R. Chernoff, K. A. DeVet, and Y. Kim. 2001. "Maternal Outcomes of a Randomized Controlled Trial of a Community-Based Support Program for Families of Children with Chronic Illnesses." *Archives of Pediatrics and Adolescent Medicine* 155 (7): 771–7.

Jann, B. 2008. "The Blinder–Oaxaca Decomposition for Linear Regression Models." *The Stata Journal* 8 (4): 453–79.

Koinis-Mitchell, D., A. F. Sato, S. J. Kopel, E. L. McQuaid, R. Seifer, R. Klein, C. Esteban, D. Lobato, A. N. Ortega, G. Canino, and G. K. Fritz. 2011. "Immigration and Acculturation-Related Factors and Asthma Morbidity in Latino Children." *Journal of Pediatric Psychology* 36 (10): 1130–43.

Ledogar, R. J., A. Penchaszadeh, and C. I. Garden. 2000. "Asthma and Latino Cultures: Different Prevalence Reported among Groups Sharing the Same Environment." *American Journal of Public Health* 90 (6): 929–35.

Lieu, T. A., P. Lozano, J. A. Finkelstein, F. W. Chi, N. G. Jensvold, A. M. Capra, C. P. Quesenberry, J. V. Selby, and H. J. Farber. 2002. "Racial/Ethnic Variation in Asthma Status and Management Practices among Children in Managed Medicaid." *Pediatrics* 109 (5): 857–65.

Lozano, P., S. D. Sullivan, D. H. Smith, and K. B. Weiss. 1999. "The Economic Burden of Asthma in US Children: Estimates from the National Medical Expenditure Survey." *Journal of Allergy and Clinical Immunology* 104 (5): 957–63.

Miller, G. E., and E. M. Sarpong. 2011. *Trends in the Pharmaceutical Treatment of Children's Asthma, 1997 to 2008.* Research Findings No. 31. Rockville, MD: Agency for Healthcare Research and Quality [accessed on August 1, 2012]. Available at http://meps.ahrq.gov/mepsweb/data_files/publications/rf31/rf31.pdf

Moorman, J. E., R. A. Rudd, C. A. Johnson, M. King, P. Minor, C. Bailey, M. R. Scalia, and L. J. Akinbami. 2007. "National Surveillance for Asthma – United States, 1980–2004." *Morbidity and Mortality Weekly Report Surveillance Summaries* 56 (8): 1–54 [accessed on August 1, 2012]. Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5608a1.htm

Morenoff, J., and J. W. Lynch. 2004. "What Makes a Place Healthy? Neighborhood Influences on Racial/Ethnic Disparities in Health over the Life Course." In *Critical Perspectives on Racial and Ethnic Differences in Health in Late Life*, edited by N. B. Anderson, R. A. Bulatao, and B. Cohen, pp. 406–49. Washington, DC: National Academy Press.

Morgan, S. G., C. M. Cunningham, and G. E. Hanley. 2010. "Individual and Contextual Determinants of Regional Variation in Prescription Drug Use: An Analysis of Administrative Data from British Columbia." *Public Library of Science ONE* 5 (12): e15883.

National Asthma Education and Prevention Program. 2007. *Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma: Full Report 2007.* Bethesda, MD: National Institutes of Health, US Dept of Health and Human Services,

National Heart, Lung, and Blood Institute [accessed on August 1, 2012]. Available at http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf

Oaxaca, R. L. 1973. "Male-Female Wage Differentials in Urban Labor Markets." *International Economic Review* 14 (3): 693–709.

Oaxaca, R. L., and M. R. Ransom. 1994. "On Discrimination and the Decomposition of Wage Differentials." *Journal of Econometrics* 61 (1): 5–21.

O'Connell, E. J. 2005. "Optimizing Inhaled Corticosteroid Therapy in Children with Chronic Asthma." *Pediatric Pulmonology* 39 (1): 74–83.

Office of Management and Budget. 1997. Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity [accessed on February 25, 2013]. Available at http://www.whitehouse.gov/omb/fedreg_1997standards

Okelo, S. O., A. W. Wu, B. Merriman, J. A. Krishnan, and G. B. Diette. 2007. "Are Physician Estimates of Asthma Severity Less Accurate in Black Than in White Patients?" *Journal of General Internal Medicine* 22 (7): 976–81.

Ortega, A. N., K. D. Belanger, A. D. Paltiel, S. M. Horwitz, M. B. Bracken, and B. P. Leaderer. 2001. "Use of Health Services by Insurance Status among Children with Asthma." *Medical Care* 39 (10): 1065–74.

Oyana, T. J., and J. S. Lwebuga-Mukasa. 2004. "Spatial Relationships among Asthma Prevalence, Health Care Utilization, and Pollution Sources in Neighborhoods of Buffalo, New York." *Journal of Environmental Health* 66 (8): 25–37, 44.

Pylypchuk, Y., and T. M. Selden. 2008. "A Discrete Choice Decomposition Analysis of Racial and Ethnic Differences in Children's Health Insurance Coverage." *Journal of Health Economics* 27 (4): 1109–28.

Sinning, M., M. Hahn, and T. K. Bauer. 2008. "The Blinder–Oaxaca Decomposition for Nonlinear Regression Models." *The Stata Journal* 8 (4): 480–92.

Smedley, B., A. Stith, and A. Nelson. 2003. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare.* Washington, DC: National Academies Press.

Smith, S. R., G. R. Highstein, D. M. Jaffe, E. B. Fisher, and R. C. Strunk. 2002. "Parental Impressions of the Benefits (Pros) and Barriers (Cons) of Follow-up Care after an Acute Emergency Department Visit for Children with Asthma." *Pediatrics* 110 (2 Pt 1): 323–30.

Smith, L. A., B. Bokhour, K. H. Hohman, I. Miroshnik, K. P. Kleinman, E. Cohn, D. E. Cortes, A. Galbraith, C. S. Rand, and T. A. Lieu. 2008. "Modifiable Risk Factors for Suboptimal Control and Controller Medication Underuse among Children with Asthma." *Pediatrics* 122 (4): 760–9.

Subramanian, S. V., H. J. Jun, I. Kawachi, and R. J. Wright. 2009. "Contribution of Race/Ethnicity and Country of Origin to Variations in Lifetime Reported Asthma: Evidence for a Nativity Advantage." *American Journal of Public Health* 99 (4): 690–7.

U.S. Department of Health and Human Services. 2011. "2010 National Healthcare Disparities Report". Agency for Healthcare Research and Quality Publication No. 11-0005, March, 2011 [accessed on February 26, 2013]. Available at www.ahrq.gov/qual/qrdr10.htm

Wechsler, M. E. 2009. "Managing Asthma in Primary Care: Putting New Guideline Recommendations Into Context." *Mayo Clinical Proceedings* 84 (8): 707–17.

Wolfenden, L. L., G. B. Diette, J. A. Krishnan, E. A. Skinner, D. M. Steinwachs, and A. W. Wu. 2003. "Lower Physician Estimate of Underlying Asthma Severity Leads to Undertreatment." *Archives of Internal Medicine* 163 (2): 231–6.

Wright, R. J., and S. V. Subramanian. 2007. "Advancing a Multilevel Framework for Epidemiologic Research on Asthma Disparities." *Chest* 132 (5): S757–69.

Yeatts, K., K. J. Davis, M. Sotir, C. Herget, and C. Shy. 2003a. "Who Gets Diagnosed with Asthma? Frequent Wheeze among Adolescents with and without a Diagnosis of Asthma." *Pediatrics* 111 (5): 1046–54.

Yeatts, K., C. Shy, M. Sotir, S. Music, and C. Herget. 2003b. "Health Consequences for Children with Undiagnosed Asthma-Like Symptoms." *Archives of Pediatrics and Adolescent Medicine* 157 (6): 540–4.

Yun, M.-S. 2000. *Decomposition Analysis for a Binary Choice Model.* IZA Discussion Paper 145. Institute for the Study of Labor (IZA).

———. 2004. "Decomposing Differences in the First Moment." *Economics Letters* 82 (2): 275–80.

———. 2005. "A Simple Solution to the Identification Problem in Detailed Wage Decompositions." *Economic Inquiry* 43 (4): 766–72.

Zorc, J. J., R. J. Scarfone, and Y. Li. 2005. "Predictors of Primary Care Follow-up after a Pediatric Emergency Visit for Asthma." *Journal of Asthma* 42 (7): 571–6.

Zorc, J. J., R. J. Scarfone, Y. Li, T. Hong, M. Harmelin, L. Grunstein, and J. B. Andre. 2003. "Scheduled Follow-up after a Pediatric Emergency Department Visit for Asthma: A Randomized Trial." *Pediatrics* 111 (3): 495–502.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

Table S1. Percent Distribution of Predisposing, Enabling, and Need Factors for Privately and Publicly Insured Children with Reported Treatment for Asthma by Race–Ethnicity.

Table S2. Logit Models: Marginal Effects of Predisposing, Enabling, and Need Characteristics on Controller Use for Insured Children with Reported Treatment for Asthma.

Table S3. Nonlinear Blinder-Oaxaca Decomposition Results for Insured Children with Reported Treatment for Asthma.