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Racial/Ethnic Variation in Emergency Department Care for Children with Asthma

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Abstract

Objective—To assess the variation between racial/ethnic groups in emergency department (ED) treatment of asthma for pediatric patients.

Methods—This study was a cross-sectional analysis of pediatric (2 – 18 years) asthma visits among 6 EDs in the Upper Midwest between June 2011 and May 2012. We used mixed-effects logistic regression to assess the odds of receiving steroids, radiology tests, and returning to the ED within 30 days. We conducted a sub-analysis of asthma visits that received at least 1 albuterol treatment in the ED.

Results—The sample included 2909 asthma visits by 1755 patients who were discharged home from the ED. After adjusting for demographics, insurance type, and triage score, African American (adjusted odds ratio [aOR] 1.78, 95% confidence interval [CI] 1.40 – 2.26) and Hispanic (aOR 1.64, CI 1.22 – 2.22) patients had higher odds of receiving steroids than Whites. African Americans (aOR 0.58, CI 0.46 – 0.74) also had lower odds of radiological testing compared to

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Whites. Asians had the lowest odds of 30-day ED revisits (aOR 0.26, CI 0.08 – 0.84), with no other significant differences detected between racial/ethnic groups. Subgroup analyses of asthma patients who received albuterol revealed similar results, with American Indians showing lower odds of radiological testing as well (aOR 0.47, CI 0.22 – 1.01).

Conclusions—In this study, children from racial/ethnic minority groups had higher odds of steroid administration and lower odds of radiological testing than White children. The underlying reasons for these differences are likely multi-factorial, including varying levels of disease severity, health literacy, and access to care.

Keywords

asthma; racial differences; steroids; radiological testing

Introduction

Asthma is a common diagnosis in the United States, affecting over 8% of the adult and nearly 10% of the pediatric population.¹ As the most common chronic condition in children,² asthma is among the top five diagnoses for which children present to the Emergency Department (ED).³ Despite the high prevalence and frequent ED presentation of asthma,^{1–3} there is wide variation in asthma treatment across EDs.^{4,5} The current guidelines for treating asthma recommend administering steroids for all ED visits and reducing radiographs only to cases with suspected cardiopulmonary complications.⁶ However, ED steroid administration rates range from 43%⁷ to 83%,⁴ compared to a benchmark goal of approximately 80% utilization.⁸ Research suggests that radiography may be unnecessary in asthma treatment;⁹ however, compared to a national benchmark goal of approximately 15%,⁸ EDs report radiography rates between 29%⁸ and 35%⁴ for asthma-related visits.

This variation in asthma care is accentuated among racial/ethnic minorities for both adults and children.^{10–16} African Americans have the highest asthma prevalence,¹⁰ along with the highest rates of asthma-related ED visits,^{11,12} primary care visits,¹⁰ hospital admissions,¹² and mortality.¹³ Compared to Whites, the rates of asthma hospitalization and mortality for African Americans have increased dramatically over time.¹⁰ Puerto Ricans and American Indians also have high rates of asthma-related ED and urgent care visits.^{14,15} A 2002 study found that African American and Hispanic children with asthma received fewer β -agonists than White children in primary care and urgent care visits.¹⁶ However, no recent studies have investigated whether differences in asthma care still exist for racial/ethnic minorities, and none have focused on treatment in the ED in particular.

Although not specific to asthma, differences in ED care between Whites and racial/ethnic minorities have been reported among pediatric patients for the administration of pain medication^{17,18} and in ordering laboratory and radiological tests.^{19–21} However, no studies to date have focused on racial/ethnic differences in steroid administration or radiological testing for asthma-related pediatric ED visits. To address these critical issues, we aimed to assess the variation between racial/ethnic groups in ED treatment for asthma patients within a multi-center network of EDs in the Upper Midwest.

Materials and Methods

Study Design and Sample

We conducted a cross-sectional analysis of pediatric patients who presented to one of six EDs in the Upper Midwest (two urban pediatric hospitals, one urban general hospital, and three rural general hospitals). The hospitals previously developed a relationship under a grant received from the National Institute on Minority Health and Health Disparities to better assess the care of American Indian children in the ED setting (Award Number: U54MD008164). This study represents a planned secondary analysis of our cohort. The study was approved by the Institutional Review Boards at all participating hospitals and was granted a waiver of informed consent.

Our overall dataset included pediatric visits by patients aged 2 to 18 years who presented to the ED between June 1, 2011 and May 31, 2012. Researchers extracted data from each hospital's electronic medical records and then sent it to a central data collection site where research staff cleaned, de-identified, and merged the data into a single database. We removed duplicate records meeting all of the following criteria: 1) ED visit occurred within a 24-hour period of previous visit and showed an identical triage score, presenting complaint, and diagnosis, 2) neither visit was an elopement, 3) ED length of stay ≤ 45 minutes, and 4) time between visits ≤ 120 minutes (Figure 1). We excluded patients < 2 years old, due to concerns with incorrect asthma diagnosis for that age group (Figure 1). Patients who died in the hospital or were discharged to a correctional facility were also excluded from our analyses (Figure 1). After analyzing our data, we discovered that some of the medication information for patients who entered through the ED and were later admitted was incorrectly coded. Therefore, our final sample included only patients who were discharged home from the ED (Figure 1). For this study, we limited our final analytic sample to patients with a primary diagnosis of asthma (International Classification of Diseases, Ninth Revision codes 493.0 – 493.92). A majority of the asthma visits (91%) presented at two of the six EDs in our sample.

In order to identify a cohort of asthma patients with “active disease” as opposed to a chronic condition, we conducted a sub-analysis of asthma patients who received at least one albuterol treatment in the ED (Figure 1). The administration of albuterol is often used in the ED literature to differentiate between patients who presented for asthma-related complaints and those with asthma who presented for other reasons.^{4,8,22–24} Medication data was missing from one of the larger EDs in our sample, so the albuterol subgroup was smaller than we expected. Rather than restricting our sample to those who received albuterol, our primary analysis included all visits ending in an asthma diagnosis so that we had enough patients representing each racial/ethnic group. We used triage score and discharge status (all visits were discharged home) as indicators of symptom severity. Patients from both the overall asthma cohort and the albuterol subgroup presented to the ED with the same top five chief complaints: cough, difficulty breathing, asthma, wheezing, and fever.

Outcome Measures

Our primary outcome measures included steroid administration⁶ and the ordering of radiology tests^{5,8} among patients with a diagnosis of asthma. We utilized 30-day ED revisit rates as a marker for poor disease control, which was defined as a patient who presented with asthma and then returned to the ED within 30 days of the index visit.

Statistical Analysis

Demographic, insurance, clinical, and hospital data were electronically extracted from the medical record and used in bivariate and multiple regression analyses. Racial/ethnic group was self-reported at registration. Insurance type was categorized as private, public, or other. Prepaid Medical Assistance plans and self-pay patients were included in the public insurance category. Distance between the patient's residence and the ED was estimated based on the distance from the center of the patient's zip code to the ED at which the patient sought care. We assigned patients the median income for the zip code in which they resided²⁵ using Truven Health Analytics (Ann Arbor, MI) data. Median incomes were grouped into quartiles and defined as high (76–100th percentile: \$62,322 – \$103,309), moderately high (51–75th percentile: \$46,392 – \$62,234), moderately low (26–50th percentile: \$39,901 – \$46,390), and low (1–25th percentile: \$14,524 – \$39,845).²⁵ Patients were assigned to a visit category based on their total number of ED visits (< 4 vs. ≥ 4) in the study period.^{26,27} To account for illness severity and anticipated ED resource utilization, we included Emergency Severity Index, version 4 (ESI)^{28–30} triage scores (ranging from 1 – most acute to 5 – least acute), and we combined ESI levels 1 and 2 for analyses due to the low number of visits in ESI level 1. We classified hospital type as either “urban” (city population > 100,000) or “rural” (city population < 100,000) based on the size of the city it served.

We used Chi-square tests to analyze bivariate associations between treatment outcomes and racial/ethnic groups. To calculate the odds of each treatment outcome, we utilized mixed-effects logistic regression models (routine “xtmelogit”) with the following binary outcome variables: received steroids (yes/no), radiology test ordered (yes/no), and returned to the ED within 30 days (yes/no). The site with missing medication data was excluded from the steroid analyses, but included in all other analyses. Covariates were selected based on a hypothesized association with the outcome variables and a significant association in bivariate analyses ($p < 0.05$). We developed a pair-wise correlation matrix to identify variables that were highly correlated, and all of the final covariates had correlation coefficients < 0.7. We adjusted the steroid and radiology models by racial/ethnic group, age, sex, insurance type, and triage level, and included all but sex in the 30-day revisit model due to a non-significant relationship between sex and 30-day revisits. In all models, ED visits were clustered within each hospital. Statistical analyses were performed using Stata version 13.1 (Stata Corp, College Station, TX).

Results

Demographics

Our final asthma sample included 2909 ED visits by 1755 patients. Among asthma visits, African Americans, males, and children between 2–5 years old had the highest proportion of ED visits (Table 1). A majority of asthma visits were made by patients with public insurance, living 5 miles from the ED, with a moderately low income level, and with < 4 ED visits in the study period (Table 1). Asthma visits were most likely to be triaged at ESI level 3, and they occurred more often in an urban vs. rural hospital (Table 1). The subgroup of asthma patients who received albuterol reflected a similar distribution in demographic characteristics as the overall asthma cohort, with slightly more albuterol patients receiving high acuity triage scores and presenting at urban hospitals (Table 1).

Steroid Administration

Overall, steroids were administered in 64.4% of asthma visits (Table 2). American Indians, African Americans, Asians, Hispanics, and Others had higher rates of steroid administration than Whites ($p < 0.001$, Table 2). After adjusting for demographics, insurance type, and triage level, children from African American (adjusted odds ratio [aOR] 1.78, 95% confidence interval [CI] 1.40 – 2.26, $p < 0.001$), Hispanic (aOR 1.64, CI 1.22 – 2.22, $p < 0.001$), and Other (aOR 1.77, CI 1.29 – 2.43, $p < 0.001$) racial/ethnic groups had higher odds of steroid administration than Whites (Table 3). The 5–10 age group had higher odds of steroids than those ages 2–5, and males had higher odds of steroids than females (Table 3). Patients triaged at ESI levels 3, 4 and 5 had significantly lower odds of receiving steroids than those triaged at ESI levels 1 and 2 (Table 3).

Radiological Testing

Radiology tests were ordered for 32.9% of asthma visits in our sample (Table 2). In bivariate analysis, White children were more likely to have a radiology test ordered than children from all other racial/ethnic groups ($p < 0.001$, Table 2). In adjusted analysis, African American (aOR 0.58, CI 0.46 – 0.74, $p < 0.001$) and Other (aOR 0.60, CI 0.44 – 0.81, $p < 0.001$) racial/ethnic groups had lower odds of radiological testing compared to White children (Table 4). As may be expected, patients receiving a triage score of 4 or 5 had lower odds of radiological testing than those with a triage score of 1 or 2 (Table 4).

30-Day ED Revisits

Fifteen percent of our asthma patients revisited the ED within 30 days of their index asthma visit (Table 2). Asian patients had the lowest proportion of 30-day ED revisits, and Whites had a lower proportion of revisits than African Americans and Hispanics ($p < 0.01$, Table 2). After adjusting for covariates, Asians (aOR 0.26, CI 0.08 – 0.84, $p < 0.05$) were the only racial/ethnic group with significantly lower odds of 30-day ED revisits than Whites, and we observed no other differences between racial/ethnic groups (Table 5). However, children with public insurance had significantly higher odds of 30-day revisits than those with private insurance (aOR 1.70, CI 1.27 – 2.27, $p < 0.001$; Table 5).

Albuterol Subgroup

There were 2106 visits (72.4% of asthma sample) with a final diagnosis of asthma that received at least one albuterol treatment in the ED. In this subgroup, 79.3% of visits received steroids, 32.6% were ordered a radiology test, and 15.4% revisited the ED within 30 days of their index visit. Subgroup bivariate analyses revealed no significant differences between racial/ethnic groups in steroid administration; however, American Indians (22.7%) and African Americans (27.9%) received lower proportions of radiology tests than Whites (40.7%, $p < 0.001$). Asians (7.4%) and Others (10.3%) had lower proportions of 30-day revisits than the other racial/ethnic groups (ranging from 13.2% to 18.3%, $p < 0.05$).

In adjusted analysis, African Americans (aOR 1.50, CI 1.09 – 2.07, $p = 0.01$) and Others (aOR 1.56, CI 1.01 – 2.39, $p = 0.05$) had higher odds of steroid administration than Whites (Table 6). Adjusted analysis also revealed that American Indian (aOR 0.47, CI 0.22 – 1.01, $p = 0.05$), African American (aOR 0.59, CI 0.45 – 0.77, $p < 0.001$), and Other (aOR 0.67, CI 0.47 – 0.95, $p = 0.05$) racial/ethnic groups had lower odds of radiology tests compared to Whites (Table 6). In the albuterol subgroup adjusted analysis, there were no significant differences between Whites and the other racial/ethnic groups in 30-day ED revisits (Table 6).

Discussion

In our study, children from minority racial/ethnic groups were more likely to receive steroids and less likely to receive radiology tests than their White counterparts. African Americans, in particular, received more steroids and fewer radiology tests than Whites in each of our analyses. These findings may indicate poor access to primary care, a lack of asthma management at home^{31–33} or simply that these patients were presenting to the ED with more severe disease. It is possible that some patients received a radiology test at a previous ED visit, and so providers may have chosen not to order a new test after seeing the previous test results in the medical record. On the other hand, our results may also represent a trend towards over-testing White patients in the ED. Recent studies have found higher rates of testing for Whites compared to non-Whites in the ED for conditions such as asthma,⁵ appendicitis,²⁰ and chest pain.³⁴ In our albuterol subgroup, Whites underwent 24% more radiological testing than was recommended by national benchmarks (17% for asthma patients receiving albuterol)⁸, compared to only 11% more testing for African Americans.

Significant variation exists between EDs in pediatric asthma management across the United States, in spite of nationally established treatment guidelines.⁶ In general, studies report lower rates of steroid administration and higher rates of radiological testing than is recommended by the guidelines, thereby, exposing children to potentially unnecessary testing.^{4,7–9} The rate of steroid administration in our albuterol subgroup (79%) was fairly close to the National Asthma Education and Prevention Program recommendations (100%),⁶ met national benchmarks (79%),⁸ and was similar to the rate from a previous study (83%).⁴ Our albuterol subgroup rate of radiological testing reflected that found in one previous report⁴ and was lower than the rate in other reports.²²

Repeat ED visits for asthma have previously been associated with minority racial/ethnic groups.^{35,36} The higher rates of steroid administration for African American, Hispanic, and Other children in the ED may indicate a lack of adherence to asthma action plans, perhaps due to racial/ethnic differences in parental perceptions of asthma³⁷ or differing levels of health literacy.³⁸ Racial/ethnic differences in access to primary care may also impact ED presentation for children with asthma. In a study by Withy et al., asthma patients who had an office visit after their initial ED visit were 10% less likely to have a 30-day ED revisit.³⁹ Furthermore, a recent study by Forester et al. found that among children living on military bases, racial/ethnic differences in asthma ED visits, steroid prescriptions, and hospitalizations were eliminated when children had equal access to care.⁴⁰

Limitations

Our study is subject to several limitations. First, our data came only from EDs in the Upper Midwest, and results from other regions might differ. However, we did enroll a large, racially diverse sample. A limitation with a chart review design is the possibility that the data were entered incorrectly, so some patients may have mistakenly been coded with an asthma diagnosis and included in our sample. Due to the coding, we were also unable to determine whether the radiology tests were chest x-rays specifically, and we were limited to the potential covariates that were present in the electronic medical record. We had limited ability to determine disease severity, due to the nature of our data and available variables. Although some key variables may have been missing, we were able to analyze more socio-demographic information than is often available in national databases. Next, medication data was not available for all of the hospitals in our sample, so the number of visits in our albuterol subgroup was relatively small and may not be representative of each racial/ethnic group. Similarly, one site was missing racial/ethnic classification for 14.3% of its asthma visits; however, these missing visits made up only 0.3% of the overall asthma cohort. It is possible that patients in our sample received care at an ED outside of our network at some point during the study period; however, the EDs in our cohort represent some of the largest providers of pediatric care in their respective areas. Lastly, there was an unequal distribution of visits between the EDs in our study, with 91% of the asthma visits coming from two of the six sites. However, when we restricted the analysis to only the other four sites, the results were reasonably consistent with the overall model.

Conclusions

In summary, we report racial/ethnic differences in asthma care among pediatric ED patients. Even when controlling for demographic and clinical variables, children from minority racial/ethnic groups were more likely to receive steroids and less likely to receive radiology tests than White children. Whatever the explanation, these differences certainly warrant further investigation to ensure that all children receive proper asthma treatment in the ED.

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Figure 1.
Flow diagram of study sample.

Table 1

Emergency Department (ED) Demographics

Patient Characteristics	Asthma Sample [†] n = 2909	Albuterol Subgroup* n = 2106
Racial/Ethnic Group		
White	638 (22.5) ^π	371 (18.1)
American Indian	118 (4.2)	44 (2.1)
African American	1265 (44.7)	1011 (49.3)
Asian	75 (2.7)	54 (2.6)
Hispanic	413 (14.6)	328 (16.0)
Other	323 (11.4)	244 (11.9)
Age		
2–5 Years	1201 (41.3)	843 (40.0)
5–10 Years	1101 (37.9)	818 (38.8)
> 10 Years	607 (20.9)	445 (21.1)
Sex		
Female	1135 (39.0)	807 (38.3)
Male	1774 (61.0)	1299 (61.7)
Insurance Type		
Private	806 (27.7)	574 (27.3)
Public	2079 (71.5)	1529 (72.7)
Other	21 (0.7)	0 (0.0)
Distance from ED		
5 Miles	1616 (55.6)	1188 (56.4)
> 5 Miles	1292 (44.4)	918 (43.6)
Income Level[€]		
High	561 (19.5)	406 (19.4)
Moderately High	619 (21.6)	458 (21.9)
Moderately Low	910 (31.7)	675 (32.2)
Low	783 (27.3)	555 (26.5)
Number of ED Visits		
< 4 Visits	2170 (74.6)	1560 (74.1)
4 Visits	739 (25.4)	546 (25.9)
Triage Level		
Levels 1–2	334 (11.6)	283 (13.5)

Patient Characteristics	Asthma Sample [†] n = 2909	Albuterol Subgroup* n = 2106
Level 3	1356 (46.9)	1024 (48.8)
Level 4	1055 (36.5)	725 (34.5)
Level 5	144 (5.0)	68 (3.2)
Hospital Type		
Urban	2732 (93.9)	2074 (98.5)
Rural	177 (6.1)	32 (1.5)

[†]Visits with a discharge diagnosis of asthma.

*Visits with a discharge diagnosis of asthma and at least 1 albuterol treatment in the ED.

^πNumbers represent n (%) of visits with the row characteristic within the column group.

[€]Income levels defined as high (76–100th percentile), moderately high (51–75th percentile), moderately low (26–50th percentile), and low (1–25th percentile) based solely on the sample data.

Table 2Treatment Outcomes for Asthma Sample[†]

Racial/Ethnic Group	Steroids ^{*π} n = 1809 (64.4%) ^μ	Radiology Test [*] n = 956 (32.9%)	30-Day Revisit [€] n = 425 (14.6%)	Total Sample ^α n = 2909 (100.0%)
White	332 (56.4) ^μ	262 (41.1)	80 (12.5)	638 (22.5)
American Indian	52 (61.9)	39 (33.1)	15 (12.7)	118 (4.2)
African American	856 (67.7)	354 (28.0)	207 (16.4)	1265 (44.7)
Asian	44 (60.3)	28 (37.3)	4 (5.3)	75 (2.7)
Hispanic	265 (64.5)	151 (36.6)	71 (17.2)	413 (14.6)
Other	212 (68.2)	96 (29.7)	37 (11.5)	323 (11.4)

[†]Visits with a discharge diagnosis of asthma.^{*}
 $p < 0.001$ ^πOne site was missing steroid data, so it was excluded from this analysis.[€]
 $p < 0.01$ ^αIncludes ED visits with an unidentified racial/ethnic group.^μNumbers represent n (%) of asthma visits in each racial/ethnic group that had the column outcome.

Table 3Odds Ratios of Steroid Administration^{†*}

Patient Characteristics	aOR ^π	95% CI	p
Racial/Ethnic Group			
White		Referent	
American Indian	1.66	0.92 – 2.98	0.09
African American	1.78	1.40 – 2.26	< 0.001
Asian	0.93	0.55 – 1.57	0.78
Hispanic	1.64	1.22 – 2.22	0.001
Other	1.77	1.29 – 2.43	< 0.001
Age			
2–5 Years		Referent	
5–10 Years	1.28	1.06 – 1.54	0.01
> 10 Years	1.12	0.90 – 1.40	0.31
Sex			
Female		Referent	
Male	1.27	1.08 – 1.50	0.005
Insurance Type			
Private		Referent	
Public	1.11	0.90 – 1.36	0.34
Other	0.50	0.04 – 5.84	0.58
Triage Level			
Levels 1–2		Referent	
Level 3	0.74	0.55 – 1.00	0.05
Level 4	0.29	0.22 – 0.40	< 0.001
Level 5	0.14	0.09 – 0.21	< 0.001

[†]For visits with a discharge diagnosis of asthma.^{*}One site was missing steroid data, so it was excluded from this analysis.^πAdjusted odds ratio (aOR) and 95% confidence interval (CI) of steroid administration, controlling for racial/ethnic group, age, sex, insurance type, triage level, and clustered by hospital.

Table 4Odds Ratios of Radiology Tests[†]

Patient Characteristics	aOR*	95% CI	p
Racial/Ethnic Group			
White		Referent	
American Indian	0.82	0.50 – 1.35	0.44
African American	0.58	0.46 – 0.74	< 0.001
Asian	0.78	0.47 – 1.30	0.34
Hispanic	0.89	0.67 – 1.19	0.44
Other	0.60	0.44 – 0.81	0.001
Age			
2–5 Years		Referent	
5–10 Years	0.89	0.74 – 1.07	0.21
> 10 Years	0.93	0.75 – 1.15	0.50
Sex			
Female		Referent	
Male	0.95	0.81 – 1.12	0.54
Insurance Type			
Private		Referent	
Public	1.03	0.84 – 1.25	0.79
Other	1.50	0.55 – 4.14	0.43
Triage Level			
Levels 1–2		Referent	
Level 3	1.07	0.82 – 1.38	0.63
Level 4	0.73	0.56 – 0.96	0.02
Level 5	0.61	0.39 – 0.95	0.03

[†]For visits with a discharge diagnosis of asthma.

* Adjusted odds ratio (aOR) and 95% confidence interval (CI) of a radiology test, controlling for racial/ethnic group, age, sex, insurance type, triage level, and clustered by hospital.

Table 5Odds Ratios of 30-Day ED Revisit[†]

Patient Characteristics	aOR*	95% CI	p
Racial/Ethnic Group			
White		Referent	
American Indian	0.83	0.45 – 1.53	0.55
African American	1.05	0.77 – 1.43	0.77
Asian	0.26	0.08 – 0.84	0.02
Hispanic	1.08	0.74 – 1.57	0.70
Other	0.73	0.47 – 1.12	0.15
Age			
2–5 Years		Referent	
5–10 Years	0.85	0.67 – 1.08	0.18
> 10 Years	0.85	0.63 – 1.13	0.26
Insurance Type			
Private		Referent	
Public	1.70	1.27 – 2.27	< 0.001
Other	0.49	0.06 – 3.75	0.49
Triage Level			
Levels 1–2		Referent	
Level 3	1.11	0.77 – 1.60	0.59
Level 4	1.17	0.80 – 1.69	0.42
Level 5	0.84	0.46 – 1.55	0.58

[†] For visits with a discharge diagnosis of asthma.

* Adjusted odds ratio (aOR) and 95% confidence interval (CI) of a 30-day ED revisit, controlling for racial/ethnic group, age, insurance type, triage level, and clustered by hospital.

Table 6Odds Ratios for Albuterol Subgroup[†]

Racial/Ethnic Group	Steroids ^Ω n = 1669 (79.3%)	Radiology Test n = 687 (32.6%)	30-Day Revisit n = 325 (15.4%)
	aOR (95% CI) [*]	aOR (95% CI) [*]	aOR (95% CI) ^{*π}
White	Referent	Referent	Referent
American Indian	1.84 (0.79 – 4.32)	0.47 (0.22 – 1.01) ^α	1.07 (0.45 – 2.51)
African American	1.50 (1.09 – 2.07) [€]	0.59 (0.45 – 0.77) ^μ	1.01 (0.69 – 1.47)
Asian	1.16 (0.55 – 2.47)	0.94 (0.51 – 1.70)	0.33 (0.10 – 1.11)
Hispanic	1.35 (0.91 – 2.00)	0.98 (0.70 – 1.36)	1.07 (0.69 – 1.68)
Other	1.56 (1.01 – 2.39) ^α	0.67 (0.47 – 0.95) ^α	0.60 (0.35 – 1.01)

[†]Visits with a discharge diagnosis of asthma and at least 1 albuterol treatment in the ED.^ΩOne site was missing steroid data, so it was excluded from this analysis.^{*} Adjusted odds ratio (aOR) and 95% confidence interval (CI) of each outcome variable in the albuterol subgroup, controlling for racial/ethnic group, age, sex, insurance type, triage level, and clustered by hospital.^πThis model did not adjust for sex.[€]_p 0.01^α_p 0.05^μ_p < 0.001