Race, Otitis Media, and Antibiotic Selection

AUTHORS: Katherine E. Fleming-Dutra, MD,[a] Daniel J. Shapiro, BA,[b] Lauri A. Hicks, DO,[c] Jeffrey S. Gerber, MD, PhD,[d] and Adam L. Hersh, MD, PhD[e]

[a]Department of Pediatrics, Emory University School of Medicine, Atlanta, Georgia; [b]School of Medicine, University of California, San Francisco, California; [c]Centers for Disease Control and Prevention, Atlanta, Georgia; [d]Children's Hospital of Philadelphia and Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania; and [e]Pediatric Infectious Diseases, University of Utah, Salt Lake City, Utah

WHAT'S KNOWN ON THIS SUBJECT: A previous study suggested that physicians in 1 practice network were less likely to diagnose otitis media (OM) and to prescribe broad-spectrum antibiotics for OM for black versus nonblack children.

WHAT THIS STUDY ADDS: Nationally, black children with OM are more likely to receive guideline-recommended, narrow-spectrum antibiotics than nonblack children. These findings may reflect inappropriate treatment of OM with the use of broad-spectrum antibiotics in a majority of US children.

abstract

BACKGROUND AND OBJECTIVE: Previous research suggests that physicians may be less likely to diagnose otitis media (OM) and to prescribe broad-spectrum antibiotics for black versus nonblack children. Our objective was to determine whether race is associated with differences in OM diagnosis and antibiotic prescribing nationally.

METHODS: We examined OM visit rates during 2008 to 2010 for children ≤14 years old using the National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey. We compared OM visits between black and nonblack children, as percentages of all outpatient visits and visit rates per 1000. We compared antibiotic prescribing by race as the percentage of OM visits receiving narrow-spectrum (eg, amoxicillin) versus broader-spectrum antibiotics. We used multivariable logistic regression to examine whether race was independently associated with antibiotic selection for OM.

RESULTS: The percentage of all visits resulting in OM diagnosis was 30% lower in black children compared with others (7% vs 10%, $P = .004$). However, OM visits per 1000 population were not different between black and nonblack children (253 vs 321, $P = .12$). When diagnosed with OM during visits in which antibiotics were prescribed, black children were less likely to receive broad-spectrum antibiotics than nonblack children (42% vs 52%, $P = .01$). In multivariable analysis, black race was negatively associated with broad-spectrum antibiotic prescribing (adjusted odds ratio 0.59; 95% confidence interval, 0.40–0.86).

CONCLUSIONS: Differences in treatment choice for black children with OM may indicate race-based differences in physician practice patterns and parental preferences for children with OM. *Pediatrics* 2014;134:1059–1066

Inappropriate antibiotic prescribing for respiratory infections is a major public health problem. Overuse and selection of unnecessarily broad-spectrum antibiotics promotes antibiotic resistance[1] and causes avoidable adverse events. Among children <5 years old, otitis media (OM) is the most common diagnosis resulting in an antibiotic prescription.[2] National guidelines from the American Academy of Pediatrics and American Academy of Family Physicians emphasize using stringent diagnostic criteria for OM to minimize overdiagnosis and antibiotic overuse.[3,4] When OM is diagnosed and antibiotics are needed, these guidelines recommend using narrow-spectrum therapy with amoxicillin, instead of broader-spectrum agents, for most children.[3,4]

In a recent study conducted in a network of primary care practices in the Philadelphia area, physicians were less likely to diagnose black children with OM and more likely to treat OM in black children with guideline-recommended narrow-spectrum antibiotics compared with nonblack children during acute care visits.[5] These differences were apparent at the level of the individual physician. This study raises questions about whether physicians underdiagnose and undertreat OM among black children or overdiagnose and overtreat OM among nonblack children. Practice differences by race were apparent in previous studies from the 1990s and early 2000s,[2,6] but more recent studies have suggested that these practice differences may have attenuated.[2,6–9] Our objectives were to determine whether national racial disparities currently exist in the diagnosis of OM or in the antibiotic choice for OM in children.

METHODS

Data Source

The National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS) are publicly available data sets from the National Center for Health Statistics at the Centers for Disease Control and Prevention.[10] NAMCS samples visits to non–federally employed, office-based physicians. NAMCS has a 3-stage probability sampling design involving sampling within geographic regions, then physicians, and finally patient visits during a randomly assigned 1-week reporting period. For each sampled visit, data are collected on patient demographics, symptoms, diagnoses, and medications provided. NHAMCS is a survey of emergency departments and outpatient departments of noninstitutional general and short-stay hospitals.[10] NHAMCS uses a 4-stage probability sampling design involving selecting geographic regions, then hospitals, then outpatient department clinics and emergency service areas, and finally patient visits. During a 4-week reporting period, data for sampled visits are collected on patient demographics, complaints, diagnoses, and medical therapy. Sampled visits in both NAMCS and NHAMCS are distributed randomly throughout the year. Data in both NAMCS and NHAMCS are weighted by using the complex survey design to produce national estimates. Unweighted response rates during the study period ranged from 58.3% to 59.1% for physicians in the NAMCS, 73.2% to 75.1% for outpatient departments in the NHAMCS, and 82.7% to 87.5% for emergency departments in the NHAMCS.

Study Population

The primary study population included visits during 2008 to 2010 for patients ≤14 years of age with a diagnosis of OM as defined by an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code of 381 (nonsuppurative otitis media and eustachian tube disorders) or 382 (suppurative and unspecified otitis media) in any of 3 diagnosis fields. National estimates for children ≤14 years of age with a diagnosis of OM were produced from 4178 visits that occurred during 2008 to 2010. We examined visits for children ≤14 years of age, as has been done in previous studies of pediatric antibiotic prescribing,[11,12] and for children 0 to 4 and 5 to 14 years of age. We dichotomized race into black versus nonblack, as was done in a previous study.[5]

Any observed differences in OM visits by race could reflect differences in the rate of care seeking for respiratory conditions, including OM and other conditions, because the symptoms of OM are often nonspecific and overlap with those of other acute respiratory illnesses. Observed differences could also result from actual differences in how physicians diagnose respiratory conditions based on patient race. To address this question, we examined a broader study population composed of visits for all respiratory conditions in a secondary analysis. Respiratory conditions were defined according to a previously published classification system using ICD-9-CM codes for common respiratory diagnoses, including 460–520 ("respiratory" category), mastoiditis (383), allergy (995.3), otitis media (381–382), and streptococcal sore throat (034).[13,14] National estimates for children ≤14 years of age with a diagnosis of respiratory conditions were produced from 15 694 visits that occurred from 2008 to 2010.

Analysis of Visits for OM and All Respiratory Conditions

We analyzed visits for OM and respiratory conditions for comparison between black and nonblack children in 2 ways. First, we calculated the percentage of all visits for OM and respiratory conditions for each patient group. Second, we calculated the number of visits per 1000 population for OM and respiratory conditions. Population denominators were determined from civilian, noninstitutionalized population data obtained from the US Census Bureau and available on the Web site of the National Center for Health Statistics.[10] The black population was defined as "black or African American alone." The

nonblack population consisted of all other people.

Antibiotic Prescribing

We examined the percentage of visits for children ≤14 years of age with OM in which antibiotics were prescribed and the percentage of antibiotics prescribed that were broad-spectrum antibiotics. Patients were excluded from the analysis of antibiotic prescribing for OM if a diagnosis of another condition warranting antibiotics was made concomitantly (eg, mastoiditis, acute pharyngitis, acute tonsillitis, nonviral pneumonia, streptococcal sore throat or scarlet fever, acute sinusitis, peritonsillar abscess, urinary tract infection, or skin and soft tissue infection).[15] Narrow-spectrum antibiotics consisted of penicillins (including amoxicillin), first-generation cephalosporins, tetracyclines, and sulfonamides.[16] Broad-spectrum antibiotics included macrolides (eg, azithromycin), quinolones, broad-spectrum penicillins (eg, β-lactam/β-lactamase inhibitor combinations), lincomycin derivatives (clindamycin), and broad-spectrum (second- or third-generation) cephalosporins.[13,14] Classification of antibiotics was based on the Multum Lexicon therapeutic classification system.[10] As a sensitivity analysis, we repeated the antibiotic prescribing and selection analyses using only the most common diagnostic code for OM (382.9, unspecified otitis media).

Statistical Analysis

We performed all statistical analysis in Stata 12 (Stata Corp, College Station, TX) and accounted for the components of the complex survey design including patient visit weights, strata, and primary sampling unit design variables. We combined survey data for all years (2008–2010) for analyses. We used χ^2 tests to compare categorical variables. We used the χ^2 test for heterogeneity to compare rates in number of visits per 1000 population. We constructed a multivariable logistic regression model to identify patient- and physician-level factors associated with broad-spectrum antibiotic prescribing for OM. Patient- and physician-level factors included in the model were age group (0–4, 5–14 years), gender, race (black, nonblack), region (Northeast, South, Midwest, West), insurance (public, private, self-pay or other), setting (office, hospital outpatient department, emergency department), specialty (pediatrics, nonpediatrics), metropolitan statistical area (metropolitan, nonmetropolitan), and year (2008, 2009, 2010). Because data for physician specialty were available only from NAMCS, a separate model was built to determine the adjusted odds ratio for broad-spectrum antibiotic prescribing associated with physician specialty. We considered an α <.05 as statistically significant.

RESULTS

OM Visits

In 2008 to 2010, there were an estimated 19.2 million (95% confidence interval [CI], 16.4–21.9 million) ambulatory visits by children ≤14 years old for OM in the United States, an average of 6.4 million annually. Among these, 2.3 million (95% CI, 1.7–3.0 million) visits were by black children (Table 1). The majority (80.4%) of OM visits used ICD-9-CM code 382.9 (unspecified otitis media; 79.7% for nonblack children and 85.7% for black children). Overall, the percentage of all visits with a diagnosis of OM was significantly lower for black children than nonblack children (≤14 years: 7% vs 10%, $P = .004$; 0–4 years: 10% vs 14%, $P = .004$; 5–14 years: 4% vs 6%, $P = .02$). Visits per 1000 population leading to an OM diagnosis for all ages combined trended lower but were not significantly different for black children and nonblack children. However, rates (visits per 1000 population) leading to an OM diagnosis were lower among black than nonblack children 5 to 14 years of age (89 vs 143, $P = .03$) (Table 1).

TABLE 1 Number of Annual Ambulatory Visits, Percentage of All Ambulatory Visits, and Ambulatory Rates in Number of Visits per 1000 Population by Age Group and Race for OM and All Respiratory Conditions, 2008–2010

Condition	Average Annual Number of Visits in Millions (95% CI)		Proportion of All Ambulatory Visits (95% CI)			Visits per 1000 Population (95% CI)		
	Nonblack	Black	Nonblack	Black	P (χ^2)	Nonblack	Black	P (χ^2)[a]
Children ≤14 y								
OM[b]	16.8 (14.3–19.4)	2.3 (1.7–3.0)	10% (9%–11%)	7% (6%–9%)	.004	321 (272–370)	253 (183–323)	.12
All respiratory[c]	59.7 (52.9–66.5)	10.8 (8.8–12.9)	35% (33%–37%)	34% (31%–37%)	.44	1139 (1008–1269)	1176 (956–1396)	.77
Children 0–4 y								
OM[b]	11.9 (10.0–13.8)	1.8 (1.4–2.2)	14% (12%–15%)	10% (9%–12%)	.004	662 (558–766)	560 (421–699)	.25
All respiratory[c]	31.6 (27.7–35.6)	6.1 (4.9–7.2)	36% (34%–38%)	35% (32%–38%)	.47	1759 (1539–1978)	1889 (1530–2247)	.54
Children 5–14 y								
OM[b]	4.9 (4.1–5.8)	0.5 (0.3–0.8)	6% (5%–7%)	4% (2%–5%)	.02	143 (118–168)	89 (48–130)	.03
All respiratory[c]	28.1 (24.8–31.3)	4.8 (3.8–5.8)	33% (31%–35%)	32% (29%–36%)	.61	815 (721–909)	796 (628–964)	.84

[a] χ^2 for heterogeneity
[b] A diagnosis of OM was assigned using ICD-9-CM codes 381–382 in any of the 3 diagnosis fields; 80.4% of OM visits used ICD-9-CM code 382.9 (unspecified otitis media) versus 11.4% for all 381 ICD-9-CM codes (nonsuppurative otitis media and eustachian tube disorders).
[c] Respiratory diagnoses included ICD-9-CM 460–520 ("respiratory" category), as well as mastoiditis (383), allergy (995.3), otitis media (381–382), and streptococcal sore throat (034).

Respiratory Visits

During the study period, there were an estimated 70.5 million (95% CI, 62.9–78.1 million) visits for children ≤14 years old for all respiratory conditions combined, of which 10.8 million (95% CI, 8.8–12.9 million) visits were by black children (Table 1). Respiratory visits accounted for 35% of total ambulatory visits for children ≤14 years old, and the percentage of respiratory visits for black and nonblack children ≤14 years old was the same (35% vs 34%, P = .44). Rates (visits per 1000 population) for all respiratory visits were similar among black and nonblack children (1176 vs 1139, P = .77) (Table 1).

Antibiotic Prescribing

The percentage of OM visits in which antibiotics were prescribed was similar among black and nonblack children ≤14 years old (81% vs 76%, P = .30, Fig 1). However, antibiotic selection patterns were different. The percentage of antibiotics prescribed that were broad spectrum was significantly lower among black children compared with nonblack children ≤14 years of age (42% vs 52%, P = .01, Fig 1). Almost all narrow-spectrum antibiotics were penicillins or first-generation cephalosporins, with sulfonamides prescribed in <1% of visits and no tetracyclines prescribed. The differences in overall broad-spectrum antibiotic prescribing resulted from selection of specific antibiotic classes; among children receiving antibiotics, nonblack children were more likely than black children to receive both broad-spectrum cephalosporins (21% vs 12%, P = .03) and broad-spectrum penicillins (16% vs 10%, P = .03, Fig 2). Additionally, when we considered only visits with the most common ICD-9-CM code, 382.9, black children were still less likely to receive broad-spectrum antibiotics than nonblack children (40% vs 51%, P = .01).

The multivariable model revealed that physicians were less likely to prescribe broad-spectrum antibiotics during OM visits for black children after adjusting for age, gender, region, insurance, setting of care, metropolitan area, and year (adjusted odds ratio for black race 0.59; 95% CI, 0.40–0.86; Table 2).

DISCUSSION

We found that in a nationally representative sample of visits for children ≤14 years of age with OM who received antibiotics, black children were more likely to receive narrow-spectrum antibiotics for OM than nonblack children, even after we controlled for insurance status and setting of care. Additionally, we found that black children were 30% less likely than nonblack children to be diagnosed with OM during ambulatory care visits. Our findings suggest that black children may be receiving more appropriate care that is consistent with national guidelines.[4] This suggests that differences in physician practice patterns may exist for the antibiotic treatment choice of OM based on patient race, findings that are similar on a national scale to those reported in a clinician-level analysis in a large practice network in metropolitan Philadelphia.[5] Taken together, these studies suggest that overly broad antibiotic therapy among nonblack children may contribute to antibiotic misuse for this common condition.

These studies raise the question of whether the observation that, when treated for OM, black children receive more narrow-spectrum antibiotics represents undertreatment of OM in black children or overtreatment of OM in nonblack children. Most studies identifying racial disparities, which are especially notable for black patients, have found that disparities result in less appropriate care, including less use of diagnostic tests and lower rates of appropriate treatment, which in some cases are associated with higher mortality rates.[17] Previous studies have shown differences in the amount or "intensity" of care specifically for OM by race. For example, white children are more likely than black children to be referred to a subspecialist and to undergo placement of tympanostomy tubes.[6,18–20] However, the role of tympanostomy tubes
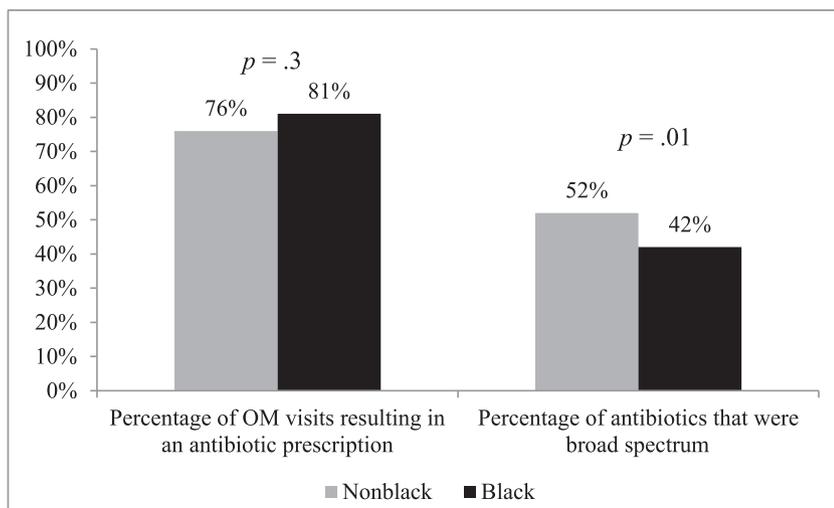
FIGURE 1
Percentage of OM visits resulting in antibiotic prescriptions and percentage of OM visits with antibiotic prescriptions in which broad-spectrum antibiotics were prescribed for children ≤14 years old, 2008–2010. Broad-spectrum antibiotics included macrolides, quinolones, broad-spectrum penicillins (β-lactam/β-lactamase inhibitor combinations), lincomycin derivatives, and second- to fourth-generation cephalosporins.
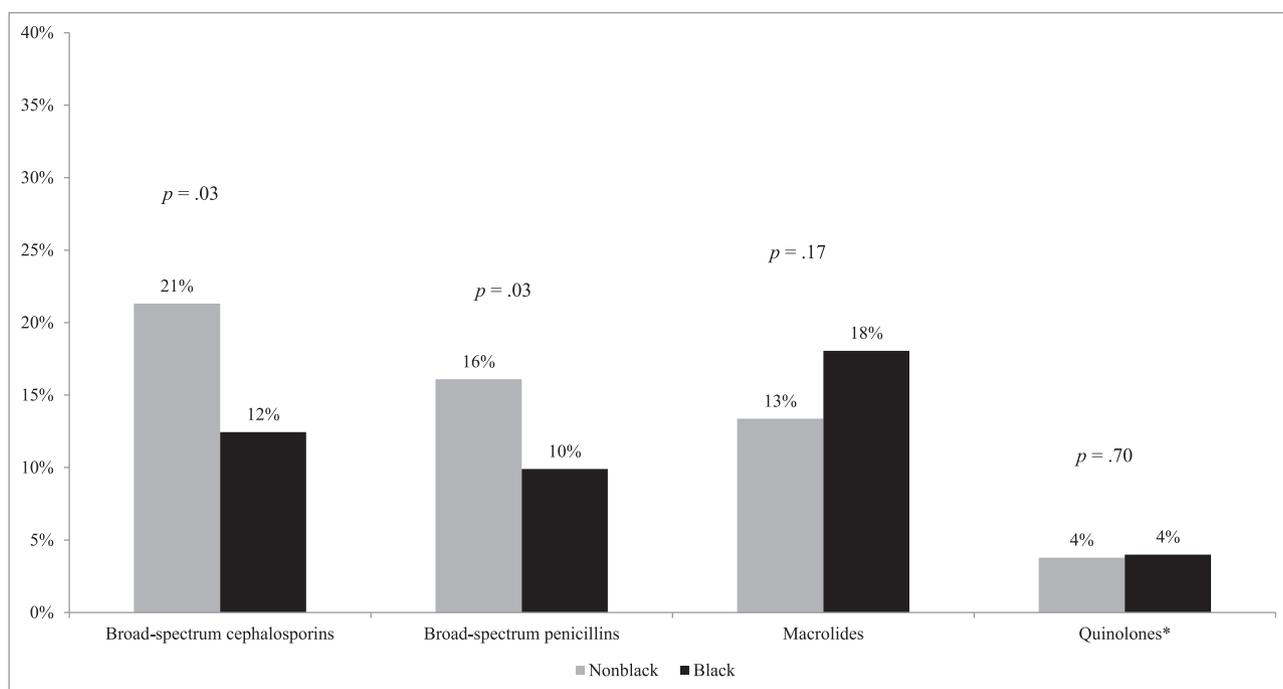
FIGURE 2
Distribution of broad-spectrum antibiotic prescriptions in children ≤14 years old with OM by class and race, 2008 to 2010. Visits where clindamycin was prescribed (n = 2) were too few to display. *Estimate for quinolones in black children are based on <30 observations.

in the treatment of recurrent acute OM is debatable,[4] so it is unclear whether this translates into better care.

The difference in broad-spectrum prescribing by race was driven by higher rates of broad-spectrum penicillin (eg, amoxicillin-clavulanate) and broad-spectrum cephalosporin prescribing among nonblack children. There is no evidence that initiating therapy with broader- versus narrower-spectrum antibiotics leads to fewer complications due to OM. Studies show that even without antibiotic therapy, complications of OM are rare.[21,22] Conversely, the risk of inducing antibiotic resistance and adverse events such as diarrhea increases with broader-spectrum antibiotic therapy.[23] Amoxicillin-clavulanate is recommended when amoxicillin fails or for patients with a history of amoxicillin-resistant infections, whereas broad-spectrum cephalosporins are recommended only as alternative initial therapies for acute OM in patients with penicillin allergy.[4] Our study cannot exclude the possibility that the higher percentage of OM visits

among nonblack children is related to race-based care patterns for follow-up visits or racial differences in the prevalence of medication allergies. Our analysis is based on visits, and we were unable to determine whether visits are initial or follow-up visits. However, a related study, which also found that black children with OM were more likely to receive narrow-spectrum antibiotics, excluded patients who had received an antibiotic prescription in the last 3 months and those with medication allergies.[5] It is likely that similar drivers of broad-spectrum antibiotic use in OM are at work in both studies.

In our study, black children sought care for respiratory conditions at a rate that was not different from that of children of other races. However, the percentage of visits resulting in an OM diagnosis was 30% lower in black than nonblack children. Visit rates for OM were significantly lower among black versus nonblack children 5 to 14 years of age and trended lower among black children ≤14 years of age and 0 to 4 years

of age. The difference between these results may reflect limited statistical power in our study when we examined visit rates of OM by race. Although we cannot exclude the possibility that differences in OM diagnosis are due to racial differences in care seeking, this does not appear to be the case because there were no racial differences in care seeking for respiratory conditions overall. These results may indicate racial differences in the diagnosis of OM.

It is unlikely that the true incidence of OM is lower in black children. *Streptococcus pneumoniae* and *Haemophilus influenzae* are the most common pathogens in OM.[4] Black children in the United States are at higher risk for invasive pneumococcal disease than white children[24–26] and appear to have a similar to slightly higher risk than white children of invasive *H influenzae* disease.[27] The risks of noninvasive pneumococcal and *H influenzae* disease, including OM, are likely to follow the same racial patterns as invasive disease. Additionally, prospective studies have shown no

TABLE 2 Factors Associated With Broad-Spectrum Antibiotic Prescribing for OM in Children ≤14 y Old

Factor	Proportion (95% CI) of Broad-Spectrum[a] Antibiotics, at Visits With Antibiotics Prescribed	Adjusted OR for Broad-Spectrum Prescribing (95% CI)
Age, y		
0–4	54% (50%–59%)	1.00
5–14	42% (35%–49%)	0.63 (0.45–0.89)
Gender		
Male	52% (47%–57%)	1.00
Female	50% (45%–55%)	0.87 (0.68–1.11)
Race		
Nonblack	52% (48%–57%)	1.00
Black	42% (35%–49%)	0.59 (0.40–0.86)
Region		
Northeast	48% (39%–58%)	1.00
Midwest	45% (39%–52%)	0.84 (0.51–1.36)
South	60% (53%–66%)	1.67 (1.03–2.71)
West	42% (35%–49%)	0.73 (0.43–1.24)
Insurance		
Private	57% (52%–62%)	1.00
Public	47% (42%–52%)	0.79 (0.57–1.07)
Self-pay or other	35% (24%–48%)	0.50 (0.28–0.89)
Setting		
Office	54% (49%–59%)	1.00
Hospital outpatient department	45% (38%–51%)	0.83 (0.60–1.16)
Emergency department	37% (34%–40%)	0.55 (0.43–0.71)
Specialty[b]		
Nonpediatric specialty	44% (35%–54%)	1.00
Pediatrics	56% (50%–62%)	1.42 (0.88–2.29)
Metropolitan statistical area		
Nonmetropolitan	47% (38%–55%)	1.00
Metropolitan	52% (47%–56%)	1.17 (0.77–1.77)
Year		
2008	56% (48%–63%)	1.00
2009	50% (43%–59%)	0.88 (0.58–1.33)
2010	47% (41%–53%)	0.75 (0.50–1.12)

[a] Percentages reflect the proportion of antibiotics that were broad-spectrum agents. Broad-spectrum antibiotics included macrolides, quinolones, broad-spectrum penicillins (including β-lactam/β-lactamase inhibitor combinations), clindamycin, and broad-spectrum (second- to fourth-generation) cephalosporins.

[b] Data on physician specialty are for offices only. Thus, the odds ratio for specialty is from a separate model that included data from visits to offices only.

difference in the rates of middle ear effusion and acute OM diagnosis between black and white children.[28,29] Furthermore, a retrospective study that examined children of the same socioeconomic level at a public health clinic also found no differences in OM episodes by race.[30]

Given the clinical nature of the OM diagnosis, it is possible that providers tailor the visit diagnosis to justify an antibiotic prescription (ie, assigning a diagnosis of OM instead of viral upper respiratory infection), which in turn might be influenced by the interaction with the child's parent or caregiver. Providers often report that parents want antibiotics, despite evidence that explicit requests for antibiotics are rare.[31] When providers perceive that parents expect antibiotics, they are more likely to assign a bacterial diagnosis and to prescribe antibiotics.[32,33] Additionally, patient race appears to affect whether providers perceive that parents expect antibiotics.[32] Thus, subjective diagnoses and antibiotic selection may be influenced by race via possible differences in parent expectations and interactions with providers. Similarly, receiving care in an emergency department was associated with lower odds of receiving broad-spectrum antibiotics for

OM, suggesting that office-based providers may be more susceptible to factors such as perceived parent demand for antibiotics and concerns about parent satisfaction and patient retention.

Our study had certain limitations. First, NAMCS and NHAMCS are administrative data sets that lack detailed clinical information. Therefore, we were unable to verify the OM diagnosis based on documented clinical examination findings. With OM, sometimes antibiotics are prescribed but intentionally not filled immediately (ie, "wait and see"), but we were unable to verify whether prescriptions were actually filled. In our study, overall antibiotic prescribing for OM remained high in all races, and we were unable to assess the impact of national guidelines recommending observation without antibiotics as a treatment option. Additionally, we were unable to distinguish between initial visits and repeat visits; antibiotic selection during repeat visits for children not improving might be different. We used a broad definition of OM to be consistent with earlier studies published using NAMCS,[34] but we found differences in diagnosis rates and antibiotic selection by race even when we restricted our analysis to patients with the most common diagnostic code for OM (382.9). In our analysis for the nonblack patients, we did not differentiate between white and other racial groups because of sample size limitations. However, only 5% of all children were of races other than black or white. Furthermore, race is often missing in visit data from NAMCS and NHAMCS. We used imputed race data as provided by NAMCS and NHAMCS to maximize our power and more accurately reflect the true visit volume. However, we replicated our analysis eliminating visits with imputed race and found similar results, particularly that a greater proportion of ambulatory visits were for OM in nonblack

patients and that a greater proportion of antibiotic visits in nonblack patients featured broad-spectrum antibiotics. Finally, broad-spectrum antibiotics are often more expensive, which could influence antibiotic selection. Although we controlled for insurance status, other patient-level factors such as socioeconomic status or copays could have contributed to antibiotic choices for OM.

CONCLUSIONS

Black children in the United States, when diagnosed with OM during an ambulatory care visit, were more likely to receive narrow-spectrum antibiotics than nonblack children. These findings raise concerns that differences in care for OM based on race may reflect inappropriate treatment of OM with the use of broad-spectrum antibiotics in a majority of US children. The differences in the proportions of black and nonblack children diagnosed with OM must be explored further to elucidate whether cultural or social factors are playing a role in the diagnosis. Finally, raising awareness about these differences in practice patterns may provide a target for public health campaigns and interventions focused on improving antibiotic prescribing.

REFERENCES

1. van de Sande-Bruinsma N, Grundmann H, Verloo D, et al; European Antimicrobial Resistance Surveillance System Group; European Surveillance of Antimicrobial Consumption Project Group. Antimicrobial drug use and resistance in Europe. *Emerg Infect Dis.* 2008;14(11):1722–1730

2. Halasa NB, Griffin MR, Zhu Y, Edwards KM. Differences in antibiotic prescribing patterns for children younger than five years in the three major outpatient settings. *J Pediatr.* 2004;144(2):200–205

3. American Academy of Pediatrics Subcommittee on Management of Acute Otitis Media. Diagnosis and management of acute otitis media. *Pediatrics.* 2004;113(5):1451–1465

4. Lieberthal AS, Carroll AE, Chonmaitree T, et al. The diagnosis and management of acute otitis media [published correction appears in *Pediatrics.* 2014;133(2):346]. *Pediatrics.* 2013;131(3). Available at: www.pediatrics.org/cgi/content/full/131/3/e964

5. Gerber JS, Prasad PA, Localio AR, et al. Racial differences in antibiotic prescribing by primary care pediatricians. *Pediatrics.* 2013;131(4):677–684

6. Smith DF, Boss EF. Racial/ethnic and socioeconomic disparities in the prevalence and treatment of otitis media in children in the United States. *Laryngoscope.* 2010;120(11):2306–2312

7. Coco A, Vernacchio L, Horst M, Anderson A. Management of acute otitis media after publication of the 2004 AAP and AAFP clinical practice guideline. *Pediatrics.* 2010;125(2):214–220

8. Coco AS, Horst MA, Gambler AS. Trends in broad-spectrum antibiotic prescribing for children with acute otitis media in the United States, 1998–2004. *BMC Pediatr.* 2009;9:41

9. Sidell D, Shapiro NL, Bhattacharyya N. Demographic influences on antibiotic prescribing for pediatric acute otitis media. *Otolaryngol Head Neck Surg.* 2012;146(4):653–658

10. Centers for Disease Control and Prevention. Ambulatory health care data. 2012. Available at: www.cdc.gov/nchs/ahcd.htm. Accessed December 14, 2012

11. Centers for Disease Control and Prevention (CDC). Office-related antibiotic prescribing for persons aged ≤ 14 years—United States, 1993–1994 to 2007–2008. *MMWR Morb Mortal Wkly Rep.* 2011;60(34):1153–1156

12. McCaig LF, Besser RE, Hughes JM. Antimicrobial drug prescription in ambulatory care settings, United States, 1992–2000. *Emerg Infect Dis.* 2003;9(4):432–437

13. Hersh AL, Shapiro DJ, Pavia AT, Shah SS. Antibiotic prescribing in ambulatory pediatrics in the United States. *Pediatrics.* 2011;128(6):1053–1061

14. Shapiro DJ, Hicks LA, Pavia AT, Hersh AL. Antibiotic prescribing for adults in ambulatory care in the USA, 2007–09. *J Antimicrob Chemother.* 2014;69(1):234–240

15. Paul IM, Maselli JH, Hersh AL, Boushey HA, Nielson DW, Cabana MD. Antibiotic prescribing during pediatric ambulatory care visits for asthma. *Pediatrics.* 2011;127(6):1014–1021

16. National Center for Health Statistics. Ambulatory Care Drug Database System. Available at: www.cdc.gov/nchs/ahcd/ahcd_database.htm. Accessed March 30, 2010

17. Institute of Medicine, Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care. *Unequal Treatment.* Washington, DC: National Academies Press; 2003

18. Bright RA, Moore RM Jr, Jeng LL, Sharkness CM, Hamburger SE, Hamilton PM. The prevalence of tympanostomy tubes in children in the United States, 1988. *Am J Public Health.* 1993;83(7):1026–1028

19. Kogan MD, Overpeck MD, Hoffman HJ, Casselbrant ML. Factors associated with tympanostomy tube insertion among preschool-aged children in the United States. *Am J Public Health.* 2000;90(2):245–250

20. Park CH, Kogan MD, Overpeck MD, Casselbrant ML. Black–white differences in health care utilization among US children with frequent ear infections. *Pediatrics.* 2002;109(5). Available at: www.pediatrics.org/cgi/content/full/109/5/e84

21. Hoberman A, Paradise JL, Rockette HE, et al. Treatment of acute otitis media in children under 2 years of age. *N Engl J Med.* 2011;364(2):105–115

22. Thompson PL, Gilbert RE, Long PF, Saxena S, Sharland M, Wong ICK. Effect of antibiotics for otitis media on mastoiditis in children: a retrospective cohort study using the United Kingdom general practice research database. *Pediatrics.* 2009;123(2):424–430

23. Hersh AL, Jackson MA, Hicks LA; American Academy of Pediatrics Committee on Infectious Diseases. Principles of judicious antibiotic prescribing for upper respiratory tract infections in pediatrics. *Pediatrics.* 2013;132(6):1146–1154

24. Pilishvili T, Zell ER, Farley MM, et al. Risk factors for invasive pneumococcal disease in children in the era of conjugate vaccine use. *Pediatrics.* 2010;126(1). Available at: www.pediatrics.org/cgi/content/full/126/1/e9

25. Flannery B, Schrag S, Bennett NM, et al; Active Bacterial Core Surveillance/Emerging Infections Program Network. Impact of childhood vaccination on racial disparities in invasive *Streptococcus pneumoniae* infections. *JAMA.* 2004;291(18):2197–2203

26. Robinson KA, Baughman W, Rothrock G, et al; Active Bacterial Core Surveillance (ABCs)/Emerging Infections Program Network. Epidemiology of invasive *Streptococcus pneumoniae* infections in the United States, 1995–1998: opportunities for prevention in the conjugate vaccine era. *JAMA.* 2001;285(13):1729–1735

27. MacNeil JR, Cohn AC, Farley M, et al. Current epidemiology and trends in invasive *Haemophilus influenzae* disease—United States, 1989–2008. *Clin Infect Dis*. 2011;53 (12):1230–1236

28. Paradise JL, Rockette HE, Colborn DK, et al. Otitis media in 2253 Pittsburgh-area infants: prevalence and risk factors during the first two years of life. *Pediatrics*. 1997;99(3):318–333

29. Casselbrant ML, Mandel EM, Kurs-Lasky M, Rockette HE, Bluestone CD. Otitis media in a population of black American and white American infants, 0–2 years of age. *Int J Pediatr Otorhinolaryngol*. 1995;33(1):1–16

30. Woods CR. Lack of association of race/ethnicity and otitis media in the first 2 years of life. *Clin Pediatr (Phila)*. 2003;42 (8):687–696

31. Stivers T, Mangione-Smith R, Elliott MN, McDonald L, Heritage J. Why do physicians think parents expect antibiotics? What parents report vs what physicians believe. *J Fam Pract*. 2003;52(2):140–148

32. Mangione-Smith R, Elliott MN, Stivers T, McDonald L, Heritage J, McGlynn EA. Racial/ethnic variation in parent expectations for antibiotics: implications for public health campaigns. *Pediatrics*. 2004;113(5). Available at: www.pediatrics.org/cgi/content/full/113/5/e385

33. Mangione-Smith R, McGlynn EA, Elliott MN, Krogstad P, Brook RH. The relationship between perceived parental expectations and pediatrician antimicrobial prescribing behavior. *Pediatrics*. 1999;103(4 pt 1):711–718

34. Grijalva CG, Nuorti JP, Griffin MR. Antibiotic prescription rates for acute respiratory tract infections in US ambulatory settings. *JAMA*. 2009;302(7):758–766

THE COST OF CARBON: *I love to cycle. Several years ago I bought a cyclocross racing bike with a lightweight aluminum frame, a carbon fiber fork (the part that holds the front wheel and allows the rider to steer) and seat, and aluminum alloy wheels. I have ridden my bike over all kinds of terrain, including dirt, gravel, and incredibly rutted roads. Regardless of my speed, I have never worried much about the frame breaking or a serious accident as the result of a mechanical failure. Unfortunately, that is not the case for the riders in the Tour de France.*

As reported in The New York Times *(Sports: July 26, 2014), riders in this year's Tour de France only rode bikes made of carbon. The advantage of carbon is that the material is incredibly strong, light, and allows for infinite design flexibility. The disadvantage is that, when under stress, carbon shatters rather than bends. While professional riders are somewhat loathe to discuss the issue – because the bike manufacturers support the riders and teams – serious accidents are far more common, with bike components (such as the frame) shattering or splintering, and throwing the rider to the ground. Professional teams go through many carbon frame bikes each riding season.*

Non-professional riders with enough money can also purchase the same bikes used in the Tour de France. While it is less likely that non-professional riders will put the same stress on the bikes as the professionals, cyclists should know that there is some tradeoff for the weight and design flexibility of carbon. As for me, I am quite happy with my bike. I do not think the back roads and trails of Vermont are designed for an all-carbon bike.

Noted by WVR, MD

Updated Information & Services	including high resolution figures, can be found at: http://pediatrics.aappublications.org/content/134/6/1059
References	This article cites 31 articles, 13 of which you can access for free at: http://pediatrics.aappublications.org/content/134/6/1059#BIBL
Subspecialty Collections	This article, along with others on similar topics, appears in the following collection(s): **Ear, Nose & Throat Disorders** http://www.aappublications.org/cgi/collection/ear_nose_-_throat_disorders_sub **Otitis Media** http://www.aappublications.org/cgi/collection/otitis_media_sub **Infectious Disease** http://www.aappublications.org/cgi/collection/infectious_diseases_sub **Epidemiology** http://www.aappublications.org/cgi/collection/epidemiology_sub
Permissions & Licensing	Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: http://www.aappublications.org/site/misc/Permissions.xhtml
Reprints	Information about ordering reprints can be found online: http://www.aappublications.org/site/misc/reprints.xhtml

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Race, Otitis Media, and Antibiotic Selection

Katherine E. Fleming-Dutra, Daniel J. Shapiro, Lauri A. Hicks, Jeffrey S. Gerber and
Adam L. Hersh

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™