

Association of Sociodemographic Factors With Reported Penicillin Allergy in Pediatric Inpatients

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ABSTRACT

OBJECTIVES: Characterize the association of sociodemographic factors with reported penicillin allergy in pediatric inpatients.

METHODS: We conducted a retrospective cohort study of pediatric inpatients admitted to general pediatric units at an academic medical center with reported penicillin allergy and reaction history. Sociodemographic factors evaluated were gender, age, race, ethnicity, language, and insurance payer. We conducted univariable and multivariable logistic regression models to evaluate associations between demographic variables and penicillin allergy.

RESULTS: Of 3890 pediatric inpatients, 299 (7.7%) had a reported penicillin allergy. The majority of documented reaction histories were hives, rash, or unknown. In univariable analysis, odds of penicillin allergy were lower in patients who identify as Black and who prefer a language other than English, and higher in patients of non-Hispanic/Latino ethnicity, those with private insurance, and with increasing age. In multivariable logistic regression, only Black race (adjusted odds ratio 0.42, 95% confidence interval CI 0.30–0.59) and young age were significantly associated with lower odds of penicillin allergy.

CONCLUSIONS: After adjustment for covariates, Black race was associated with lower odds of reported penicillin allergy in hospitalized children. Penicillin allergy reporting may be an indicator of racial differences in the prescribing of antimicrobial agents, patient–clinician communication, and access to health care.

www.hospitalpediatrics.org

DOI: <https://doi.org/10.1542/hpeds.2021-006462>

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HOSPITAL PEDIATRICS (ISSN Numbers: Print, 2154-1663; Online, 2154-1671).

Dr Hampton designed the study, collected data, and interpreted, drafted, revised, and prepared the manuscript; Mr DeBoy designed the study, and collected and managed the data; Dr Hornik managed and interpreted the data, and edited the manuscript; Dr White reviewed and prepared the manuscript; Dr Nazareth-Pidgeon designed the study, collected data, and interpreted, reviewed, and prepared the manuscript; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

FUNDING: Dr White is supported by the National Center for Advancing Translational Sciences of the National Institutes of Health (#1KL2TR002554).

CONFLICT OF INTEREST DISCLAIMER: The authors have indicated they have no conflicts of interest relevant to this article to disclose.

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Penicillins are the most commonly prescribed antibiotic class, and specifically, amoxicillin is the top antibiotic agent prescribed according to 2019 Centers for Disease Control and Prevention data.¹ Unsurprisingly, penicillin allergy is the most common drug allergy, reported in ~10% of patients in the United States.² Likely in part because of the frequency of exposure to β -lactam antibiotics, the label of penicillin-allergic is often overapplied. Nonimmunologic side effects or intolerances, such as diarrhea, can be misinterpreted as true allergies and entered in the electronic medical record (EMR) as such.³

The majority of patients who are labeled penicillin-allergic are not truly allergic to penicillins or have outgrown the sensitivity.⁴ Importantly in pediatrics, the penicillin allergic label is frequently applied in childhood and remains in the health record unquestioned or inadequately verified well into adulthood. One study of parent-reported penicillin allergy in the pediatric emergency department found that 75% of children were labeled as penicillin allergic before the age of 3.⁵ The vast majority of reported penicillin allergy symptoms in pediatrics are low risk (isolated rash, itching, nausea, diarrhea, or a reported family history of allergy) and do not represent an immunoglobulin E-mediated allergic hypersensitivity.⁵ Notably, multiple studies and reviews have found that 94% to 100% of pediatric patients with reported penicillin allergy who have undergone allergy testing have been found to be not allergic.^{6–9}

There is growing literature emphasizing the adverse effects of mislabeled penicillin allergies. Patients with penicillin allergy are prescribed broader-spectrum antimicrobial agents, which can be less effective, more toxic, and more expensive.^{2,10–13} Notably, studies have also found that patients with penicillin allergy labels have increased readmission rates, prolonged hospital length of stay, and increased rate of adverse events.^{14,15} Because of this concerning data, national organizations including the American

Academy of Allergy, Asthma, and Immunology, the Infectious Diseases Society of America, and the Centers for Disease Control and Prevention, have released statements emphasizing the rarity of true penicillin allergy, associated risk of carrying an inaccurate label, and importance of evaluation of the allergy as a part of antimicrobial stewardship efforts.^{16,17} Despite the traction of antimicrobial stewardship initiatives in recent years, data regarding sociodemographics of reported penicillin allergy among pediatric inpatients is not well described. However, penicillin-allergic labels are known to be more prevalent among inpatients compared with outpatients, and pediatric patients admitted to the hospital frequently require antibiotics.^{18–20}

Our study seeks to further characterize the demographics and reported reactions of pediatric inpatients with penicillin allergy labels to inform delabeling and antimicrobial stewardship efforts. We hypothesize that sociodemographic characteristics in children may impact penicillin allergy reporting. We theorize that pediatric inpatients who identify within the EMR as female, aged >1 year, are White race, are not Hispanic/Latino ethnicity, prefer English, and who have private insurance will have greater odds of a penicillin allergy label.

METHODS

We conducted a retrospective cohort study of pediatric patients admitted to the general pediatric units of an academic medical center between January 1, 2019, and December 31, 2019. Our hospital is a tertiary-care academic medical center serving patients across much of the Southeastern United States. Within the medical system is our children's hospital, which includes 190 pediatric inpatient beds and accounts for ~6000 total annual admissions across all units. All study data were extracted from the EMR. The study was approved by the university's institutional review board with a waiver of informed consent.

We included patients aged 0 to 18 years with a reported penicillin allergy admitted to the general pediatric inpatient units. Patients admitted to ICUs or other subspecialty units were excluded. Penicillin allergy was defined as a reported allergy to penicillin, amoxicillin, amoxicillin-clavulanate, ampicillin, and ampicillin-sulbactam documented in the EMR.

Allergies can be entered by clinicians, nurses, and allied health professionals, and are widely visible across encounters. The typical process of entering allergies in the EMR in the inpatient setting occurs during the admission intake process. Nursing staff asks patients and families to self-identify their gender, race, ethnicity, and preferred language, and the response is documented in the EMR. Notably, in the EMR available at our institution, the ethnicity options are Hispanic/Latino, non-Hispanic/Latino, or not reported/declined and are not linked to the race options. Separately, patient registration staff enter insurance payer information in the EMR upon admission.

Sociodemographic factors evaluated included gender, age, race, ethnicity, preferred language, and insurance payer. For patients with a reported penicillin allergy, we also reviewed the allergy labels in the medical record to identify reaction history documentation. For patients whose reaction history was documented as unknown or other, sociodemographic factors were examined.

We used χ^2 tests of association to compare distribution of demographic variables between patients with and without a penicillin allergy. Univariable logistic regression was performed to evaluate associations between demographic variables and penicillin allergy. Odds ratios (ORs) and 95% confidence intervals (CIs) were reported. Additionally, we conducted multivariable logistic regression analyses to evaluate adjusted associations between predictor variables significant in univariate analysis and penicillin allergy. All analyses were conducted using Stata SE 16.1 (StataCorp, College Station, TX).

TABLE 1 Sociodemographic Factors Associated With Penicillin Allergy for Pediatric Inpatients Admitted January Through December 2019 to a Tertiary-Care Academic Medical Center

Sociodemographic Factor	Allergy (N = 299)	No Allergy (N = 3591)	OR (95% CI)	aOR (95% CI)
Gender				
Female	155 (52%)	1689 (47%)	Reference	Reference
Male	144 (48%)	1902 (53%)	0.82 (0.65–1.04)	0.90 (0.71–1.14)
Age				
<1 y	18 (6%)	828 (23%)	Reference	Reference
1–5 y	68 (23%)	980 (27%)	3.19 (1.88–5.41)*	3.23 (1.90–5.49)*
6–10 y	72 (24%)	642 (18%)	5.16 (3.05–8.74)*	5.17 (3.04–8.77)*
11–15 y	93 (31%)	768 (21%)	5.57 (3.33–9.31)*	5.27 (3.14–8.85)*
16–18 y	48 (16%)	373 (10%)	5.92 (3.40–10.31)*	5.65 (3.22–9.90)*
Race				
White	190 (64%)	1689 (47%)	Reference	Reference
Black/African American	50 (17%)	1066 (30%)	0.42 (0.30–0.57)*	0.42 (0.30–0.59)*
Asian American	10 (3%)	115 (3%)	0.77 (0.40–1.50)	0.91 (0.46–1.79)
Other	10 (3%)	216 (6%)	0.41 (0.21–0.79)*	0.65 (0.30–1.42)
2 or more races	22 (7%)	323 (9%)	0.61 (0.38–0.96)*	0.81 (0.34–1.33)
Not reported/declined	17 (6%)	147 (4%)	1.03 (0.61–1.74)	1.01 (0.30–1.42)
Ethnicity				
Hispanic	25 (8%)	453 (13%)	Reference	Reference
Not Hispanic/Latino	252 (84%)	2939 (82%)	1.55 (1.02–2.37)*	1.16 (0.64–2.11)
Not reported/declined	22 (7%)	195 (5%)	2.04 (1.13–3.71)*	1.41 (0.66–2.99)
Language				
English	284 (95%)	3276 (91%)	Reference	Reference
Other (Spanish, etc)	15 (5%)	312 (9%)	0.55 (0.33–0.94)*	0.67 (0.34–1.32)
Insurance				
Medicaid	95 (32%)	1336 (37%)	Reference	Reference
Private	184 (62%)	1918 (53%)	1.35 (1.04–1.74)*	1.04 (0.79–1.36)
Other government	11 (4%)	179 (5%)	0.86 (0.45–1.64)	0.59 (0.30–1.13)
Self-pay	7 (2%)	129 (4%)	0.76 (0.35–1.68)	0.78 (0.35–1.74)
Special programs	1 (0.3%)	15 (0.4%)	0.94 (0.12–7.17)	1.28 (0.16–10.06)

Univariable and multivariable logistic regression performed to evaluate associations between demographic variables and penicillin allergy. ORs and aORs reported with 95% CIs. All analyses were conducted using Stata SE 16.1 (StataCorp, College Station, TX). * $P < .05$ statistically significant with and without adjustment for multiple comparisons.

We considered a $P < .05$ statistically significant with and without adjustment for multiple comparisons.

RESULTS

We identified a total of 3890 pediatric patients admitted to our hospital's general inpatient units in 2019. There was a total of 299 (7.7%) individual patients who met the inclusion criteria for a reported penicillin allergy, which accounted for 407 patient encounters because multiple patients were readmitted through the course of the year.

As seen in Table 1 and Fig 1, the odds of reporting a penicillin allergy are lower for patients who identify as Black or African American (OR 0.42, 95% CI 0.30–0.57) compared with the White reference group and who prefer a language other than English (OR 0.55, 95% CI 0.33–0.94) compared with the English reference group. The odds of reporting a penicillin allergy are higher for patients who identify as non-Hispanic/Latino ethnicity (OR 1.55, 95% CI 1.02–2.37) compared with the Hispanic/Latino ethnicity group and have private insurance (OR 1.35, 95% CI 1.04–1.74) compared with the Medicaid

reference group. The data demonstrate increasing odds of having a penicillin allergy with increasing age, with those aged 16 to 18 years being almost 6 times more likely to have a penicillin allergy compared with those aged <1 year (OR 5.92, 95% CI 3.40–10.31). No significant difference was found in reported gender between the 2 groups.

A multivariable logistic regression model included gender, age, race, ethnicity, language, and insurance. Black race (adjusted OR [aOR] 0.42, 95% CI 0.30–0.59) remained associated with lower odds of penicillin allergy, whereas age >1 year

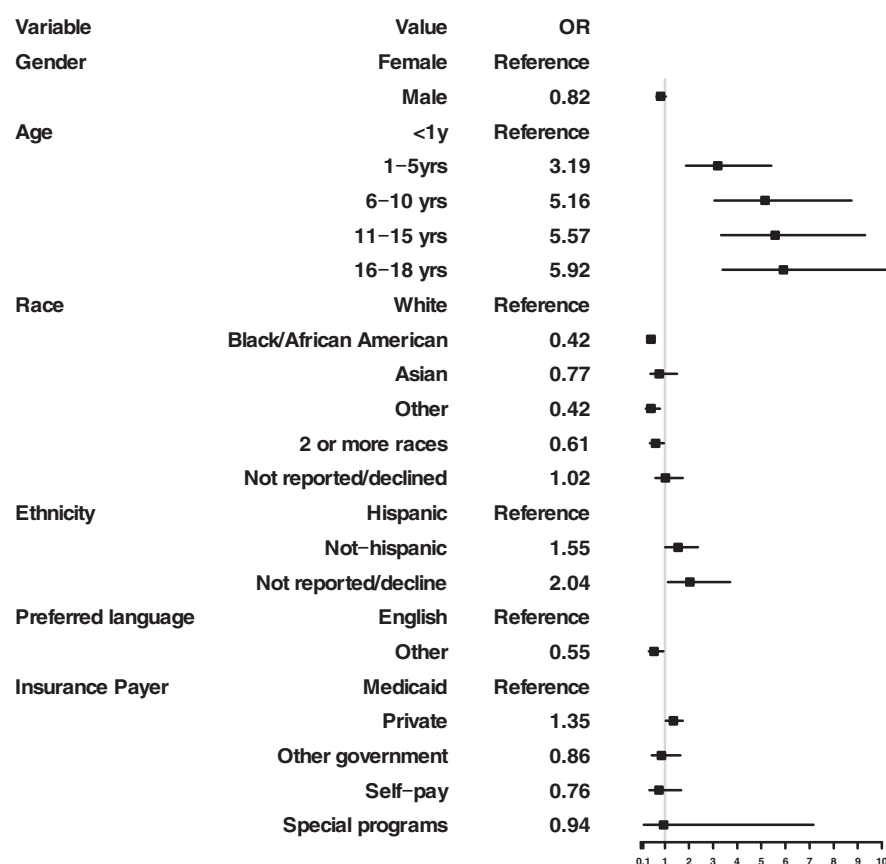


FIGURE 1 Forest plot of sociodemographic factors associated with penicillin allergy for pediatric inpatients.

remained associated with increased odds of penicillin allergy (aOR 3.23, 95% CI 1.90–5.49), (aOR 5.17 95% CI 3.04–8.77), (aOR 5.27, 95% CI 3.14–8.85), (aOR 5.65, 95% CI 3.22–9.90) for children aged 1 to 5 years, 6 to 10 years, 11 to 15 years, and 16 to 18 years, respectively, relative to those aged <1 year. Ethnicity, language preference, and insurance payer were no longer significant after adjustment.

A total of 407 inpatient encounters with a documented penicillin allergy occurred during the 1-year review period. The top 3 reactions comprising 83% (337 of 407) were hives, rash, and unknown/other (Table 2). The subgroup of 36 unique patients, representing 46 patient encounters, whose allergic reaction was unknown/other demonstrated a cohort of mostly children of White race (72%), non-Hispanic/Latino ethnicity (94%), and English as the primary language (100%). Notably, 13% (53 of 407) of patients had

reactions documented as isolated diarrhea, itching, vomiting, abdominal pain, and nausea, which are most likely an intolerance or anticipated side effects.

CONCLUSION

In this study, we characterize the sociodemographic characteristics of pediatric inpatients with reported penicillin allergy and reaction history documentation. Our data demonstrate significantly lower odds of penicillin allergy in children who identify as Black and prefer a language other than English. We identified that patients with non-Hispanic/Latino ethnicity, private insurance, and adolescents had increased odds of having penicillin allergy label. Of note, gender was not associated with increased odds of allergy in our patient population. In multivariable analysis, Black race remained associated with decreased odds of penicillin allergy and increased age remained associated with increased

odds. After controlling for other variables, ethnicity, language preference, and insurance payer were no longer a barrier to allergy reporting. Previous known bias in the predictor variables makes constructing and interpreting the multivariable model challenging because it may perpetuate bias.

Many of the larger studies involving pediatric patients with reported drug allergy have also found distinctions in demographic characteristics. One study of >1800 children with reported β -lactam allergy who then underwent skin and challenge testing found that there was ultimately no gender or age association with β -lactam allergy.²¹ Another study of >400 000 patients, which included almost 5000 children aged <20 years with a reported penicillin allergy, found increased age and female gender was associated with increased rate of reported antibiotic allergy, although exclusively considering the pediatric population, female gender did not appear to have an association with penicillin allergy.²² Two other studies of adults and children suggest drug allergies are reported more frequently in females, White race, adults, and inpatients.^{20,23} The difference in demographic characteristics among studies and as compared with this study may be in part because of varying patient populations and length of review time periods.

An important contributory consideration for the observed sociodemographic factors associated with penicillin allergy are racial and ethnic differences in the prescribing of antimicrobial agents. Racial and ethnic differences in antimicrobial prescribing have been reported nationally, as well as in pediatric outpatient and emergency department settings. One study of a United States national survey found that respondents who identified as White reported twice as many antimicrobial medication fills compared with other identified races.²⁴ In pediatric outpatient prescribing, Black children receive fewer antibiotics than non-Black children.²⁵ In a pediatric emergency department study using the Pediatric Emergency Care

TABLE 2 Penicillin Allergy Reaction Documentation From Pediatric Inpatient Admissions January Through December 2019 at a Tertiary-Care Academic Medical Center

	Patient Encounters (Total 407)	
	N	%
Allergy reaction		
Rash	171	42.01
Hives	120	29.48
Other/unknown	46	11.30
Diarrhea	24	5.90
Itching	16	3.93
Anaphylaxis	9	2.21
Vomiting	9	2.21
Swelling	6	1.47
Nausea and vomiting	2	0.49
Shortness of breath	2	0.49
Abdominal pain	1	0.25
Nausea	1	0.25

Total patient encounters with penicillin allergy = 407.

Applied Research Network registry including nearly 40 000 emergency department visits, non-Hispanic Black and Hispanic patients were less likely to receive antibiotics compared with White patients for acute viral respiratory tract infections.²⁶ Our finding that penicillin-allergic labels were less likely to be found in Black and Hispanic patients may reflect lower overall exposure to antibiotics in these groups compared with non-Hispanic and White individuals.

Differences in penicillin allergy labeling by language, race, and ethnicity may also reflect the quality of clinician–family communication and difficulty accessing care.^{27–30} Allergy documentation reflects multiple health care system encounters. Consider that, to have a documented penicillin allergy in the EMR, one must have previously received a prescription for penicillin, taken the medication, developed a reaction, and subsequently sought care at a point in time after the reaction. The differences in sociodemographic factors raise the question that a reported penicillin allergy may actually be an indicator of overall access to health care. When interpreting these results, it is important to consider that, although health disparities are systematic, traditionally disadvantaged groups may fare better on some indicators of health,

such as in the case of decreased odds of having a penicillin allergy label. The difference may not itself indicate a health disparity but rather a distinction that warrants public health consideration given the potential underlying reasons for sociodemographic difference, which include differences in antibiotic prescribing, access to care, and communication.³¹

In addition to demographic findings in our study, the majority of patients had a reaction history of hives, unspecified rash, or unknown consistent with previous studies describing the frequency of rash and inadequate allergy documentation.^{19,32–34} Patients with isolated mild cutaneous symptoms are considered at relatively low risk of true allergy and should be referred to allergy testing.³⁵ In the inpatient setting, we have an obligation to our patients to elicit drug allergy reaction history with the support of medical interpreters when language barriers exist, and to adequately document and consider referral for further allergy testing when feasible. A recent publication outlines recommendations for hospitalists to obtain drug allergy history because many allergy labels can be removed on the basis of reaction history, and emphasized the importance of adequate documentation,

particularly because many patients have tolerated penicillin since initial reaction.³⁶

We acknowledge the limitation of a single-center study at an academic center, which may not be generalizable across pediatric inpatient populations. The study is also limited to retrospective data of patients admitted to general pediatrics units during the course of 12 months and did not include ICUs or other subspecialty units. Notably, sociodemographic and allergy history data from the EMR are patient- or caregiver-reported, entered in the record by health care staff, and limited by the options available in the EMR. Although we did conduct multivariable logistic regression modeling, sample size limitations may have precluded us from identifying all potential associations and any interactions between predictor variables.

This study adds to the limited literature regarding the characteristics of pediatric inpatients who carry the label of penicillin allergy and may also be an indicator of persistent racial and ethnic difference in the prescribing of antimicrobial agents and access to health care. A future opportunity could investigate differences in clinician prescribing for particular diagnoses or indications (ie, pneumonia or surgical site prophylaxis) by patient sociodemographic factors as suggested by a recent study of differential management in inpatient antibiotics for skin and soft tissue by race after controlling for the presence of a penicillin allergy label.³⁷ The further evaluation of the relationship of sociodemographics to reported drug allergy may elucidate trends which could then be used for targeted patient and clinician education and delabeling initiatives. Establishing hospital and clinic partnerships within health systems for targeted outpatient allergy testing could promote more accurate allergy labels and contribute to antibiotic stewardship efforts. Additionally, the potential for inpatient pediatric allergy testing may become more routine as we define further the penicillin allergic sociodemographics and impact. The results of this study will direct future efforts on ensuring

completeness of penicillin allergy documentation and risk stratification of reactions to guide delabeling initiatives.

REFERENCES

- Centers for Disease Control and Prevention. Outpatient Antibiotic Prescriptions — United States. Available at: <https://www.cdc.gov/antibiotic-use/pdfs/Annual-Report-2019-H.pdf>. Accessed November 4, 2021
- Joint Task Force on Practice Parameters; American Academy of Allergy, Asthma and Immunology; American College of Allergy, Asthma and Immunology; Joint Council of Allergy, Asthma and Immunology. Drug allergy: an updated practice parameter. *Ann Allergy Asthma Immunol*. 2010;105(4):259–273
- Saxon A, Beall GN, Rohr AS, Adelman DC. Immediate hypersensitivity reactions to beta-lactam antibiotics. *Ann Intern Med*. 1987;107(2):204–215
- Trubiano JA, Adkinson NF, Phillips EJ. Penicillin allergy is not necessarily forever. *JAMA*. 2017;318(1):82–83
- Vyles D, Chiu A, Simpson P, Nimmer M, Adams J, Brousseau DC. Parent-reported penicillin allergy symptoms in the pediatric emergency department. *Acad Pediatr*. 2017;17(3):251–255
- Vyles D, Adams J, Chiu A, Simpson P, Nimmer M, Brousseau DC. Allergy testing in children with low-risk penicillin allergy symptoms. *Pediatrics*. 2017;140(2):e20170471
- Mill C, Primeau MN, Medoff E, et al. Assessing the diagnostic properties of a graded oral provocation challenge for the diagnosis of immediate and nonimmediate reactions to amoxicillin in children. *JAMA Pediatr*. 2016;170(6):e160033
- Pichichero ME. A review of evidence supporting the American Academy of Pediatrics recommendation for prescribing cephalosporin antibiotics for penicillin-allergic patients. *Pediatrics*. 2005;115(4):1048–1057
- Abrams EM, Wakeman A, Gerstner TV, Warrington RJ, Singer AG. Prevalence of beta-lactam allergy: a retrospective chart review of drug allergy assessment in a predominantly pediatric population. *Allergy Asthma Clin Immunol*. 2016;12:59
- McDanel JS, Perencevich EN, Diekema DJ, et al. Comparative effectiveness of beta-lactams versus vancomycin for treatment of methicillin-susceptible *Staphylococcus aureus* bloodstream infections among 122 hospitals. *Clin Infect Dis*. 2015;61(3):361–367
- Blumenthal KG, Ryan EE, Li Y, Lee H, Kuhlen JL, Shenoy ES. The impact of a reported penicillin allergy on surgical site infection risk. *Clin Infect Dis*. 2018;66(3):329–336
- Mattingly TJ II, Fulton A, Lumish RA, et al. The cost of self-reported penicillin allergy: a systematic review. *J Allergy Clin Immunol Pract*. 2018;6(5):1649–1654.e4
- Solensky R, Earl HS, Gruchalla RS. Clinical approach to penicillin-allergic patients: a survey. *Ann Allergy Asthma Immunol*. 2000;84(3):329–333
- Macy E, Contreras R. Health care use and serious infection prevalence associated with penicillin “allergy” in hospitalized patients: a cohort study. *J Allergy Clin Immunol*. 2014;133(3):790–796
- MacFadden DR, LaDelfa A, Leen J, et al. Impact of reported beta-lactam allergy on inpatient outcomes: a multicenter prospective cohort study. *Clin Infect Dis*. 2016;63(7):904–910
- Hong M, Blumenthal KG. Centers for Disease Control and Prevention. Evaluation and diagnosis of penicillin allergy for healthcare professionals. Available at: <https://www.cdc.gov/antibiotic-use/clinicians/Penicillin-Allergy.html>. Accessed November 4, 2021
- American Academy of Allergy, Asthma, and Immunology. Penicillin allergy testing. Available at: <https://www.aaaai.org/About/Advocacy/More-Advocacy-Campaigns/Penicillin-Allergy-Testing>. Accessed November 4, 2021
- Macy E, Ho NJ. Multiple drug intolerance syndrome: prevalence, clinical characteristics, and management. *Ann Allergy Asthma Immunol*. 2012;108(2):88–93
- Lee CE, Zembower TR, Fotis MA, et al. The incidence of antimicrobial allergies in hospitalized patients: implications regarding prescribing patterns and emerging bacterial resistance. *Arch Intern Med*. 2000;160(18):2819–2822
- Sousa-Pinto B, Fonseca JA, Gomes ER. Frequency of self-reported drug allergy: a systematic review and meta-analysis with meta-regression. *Ann Allergy Asthma Immunol*. 2017;119(4):362–373.e2
- Ponvert C, Perrin Y, Bados-Albiero A, et al. Allergy to betalactam antibiotics in children: results of a 20-year study based on clinical history, skin and challenge tests. *Pediatr Allergy Immunol*. 2011;22(4):411–418
- Macy E, Poon K-Y T. Self-reported antibiotic allergy incidence and prevalence: age and sex effects. *Am J Med*. 2009;122(8):778.e1–778.e7
- Zhou L, Dhopeshwarkar N, Blumenthal KG, et al. Drug allergies documented in electronic health records of a large healthcare system. *Allergy*. 2016;71(9):1305–1313
- Olesen SW, Grad YH. Racial/ethnic disparities in antimicrobial drug use, United States, 2014–2015. *Emerg Infect Dis*. 2018;24(11):2126–2128
- Gerber JS, Prasad PA, Localio AR, et al. Racial differences in antibiotic prescribing by primary care pediatricians. *Pediatrics*. 2013;131(4):677–684
- Goyal MK, Johnson TJ, Chamberlain JM, et al. Pediatric Care Applied Research Network (PECARN). Racial and ethnic differences in antibiotic use for viral illness in emergency departments. *Pediatrics*. 2017;140(4):e20170203
- Flores G, Tomany-Korman SC. The language spoken at home and disparities in medical and dental health, access to care, and use of services in US children. *Pediatrics*. 2008;121(6):e1703–e1714

28. Wilson E, Chen AHM, Grumbach K, Wang F, Fernandez A. Effects of limited English proficiency and physician language on health care comprehension. *J Gen Intern Med.* 2005;20(9):800–806
29. Shen MJ, Peterson EB, Costas-Muñiz R, et al. The effects of race and racial concordance on patient-physician communication: a systematic review of the literature. *J Racial Ethn Health Disparities.* 2018;5(1):117–140
30. McKay S, Parente V. Health disparities in the hospitalized child. *Hosp Pediatr.* 2019;9(5):317–325
31. Braveman PA, Kumanyika S, Fielding J, et al. Health disparities and health equity: the issue is justice. *Am J Public Health.* 2011;101(Suppl 1):S149–S155
32. Preston SL, Briceland LL, Lesar TS. Accuracy of penicillin allergy reporting. *Am J Hosp Pharm.* 1994;51(1):79–84
33. Absy M, Glatt AE. Antibiotic allergy: inaccurate history taking in a teaching hospital. *South Med J.* 1994;87(8):805–807
34. Albin S, Agarwal S. Prevalence and characteristics of reported penicillin allergy in an urban outpatient adult population. *Allergy Asthma Proc.* 2014;35(6):489–494
35. Blumenthal KG, Peter JG, Trubiano JA, Phillips EJ. Antibiotic allergy. *Lancet.* 2019;393(10167):183–198
36. Kleris RS, Lugar PL. Things we do for no reason: failing to question a penicillin allergy history. *J Hosp Med.* 2019;14(10):704–706
37. Wurcel AG, Essien UR, Ortiz C, et al. Variation by race in antibiotics prescribed for hospitalized patients with skin and soft tissue infections. *JAMA Netw Open.* 2021;4(12):e2140798