Multicenter Evaluation of Emergency Department Treatment for Children and Adolescents With Crohn's Disease According to Race/Ethnicity and Insurance Payor Status

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Background: Racial and socioeconomic disparities exist in the treatment and outcomes of children and adults with Crohn's disease (CD). This study investigated the impact of race and insurance status on emergency department (ED) evaluation and treatment among children with CD in the United States.

Methods: Data from the Pediatric Health Information System included ED visits between January 2007 and December 2013 for patients aged ≤21 years with a primary diagnosis of CD, or a secondary diagnosis of CD plus a primary CD-related diagnosis. Analyses were performed using mixed-effects logistic regression.

Results: Subjects included 2618 unique patients (black, 612 [23%]; white, 2006 [77%]) with 3779 visits from 38 hospitals, a median age of 14.0 ± 4.0 years, and 50% male. White children had a higher median neighborhood income and were more likely to have private insurance (57% vs 30%; *P* < 0.001). Emergency department visits for privately insured patients had higher odds of complete blood count (odds ratio [OR], 1.43; 95% CI, 1.08–1.90) and C-reactive protein/erythrocyte sedimentation rate (OR, 1.39; 95% CI, 1.06–1.82) vs Medicaid insured. Visits for white children had higher odds of receiving antiemetics (OR, 1.52; 95% CI, 1.06–2.17) vs black children. The proportion of patients with repeat visits was greater for black children (33%) than white children (22%; *P* < 0.001) and greater for Medicaid-insured (27%) than privately insured patients (21%; *P* < 0.01).

Conclusions: This cross-sectional database study demonstrated that black children and those with Medicaid insurance made more ED visits and received somewhat fewer treatments, which may be explained by greater use of the ED for routine care. An opportunity exists for better outpatient management of children with IBD so that nonemergent problems are more effectively handled.

Key Words: inflammatory bowel disease, Crohn's disease, pediatric, disparities, race, emergency department

INTRODUCTION

Racial, ethnic, and socioeconomic disparities have been reported for treatment and outcomes of children and adults with Crohn's disease (CD),[1–5] a chronic inflammatory bowel disease (IBD) affecting more than 600,000 adults and children in the United States and Canada alone.[6] According to the Institute of Medicine, disparities refer to differences in treatment or access that are not due to differences in patient health status or preference.[7] Recent public policy initiatives to improve national health care agree that identifying and reducing health-related disparities are essential steps toward that goal.[8]

An especially important area in which to identify potential health care disparities is the emergency department (ED), where multiple diagnostic and treatment decisions are made under stressful conditions.[7] Under stress and in the absence of standard protocols, human decision-making tends to rely upon cognitive biases such as use of the most recent or most available information or most similar past examples,[9, 10] As such, one might expect disparities in diagnosis and treatment to be more apparent in the ED compared with other health care settings.

The populations under study for disparate treatment are also those who use the ED more frequently. Black, Native American, and Hispanic children are significantly more at risk for recurrent ED visits and high-frequency utilization of EDs.[11] Patients with Medicaid coverage, low socioeconomic status, and chronic diseases have also been found to utilize ED services more frequently.[12, 13] There have been similar findings in the IBD population for both adults[4] and children.[2]

Potential disparities in treatment in the ED have been found among adult and pediatric patients. For example, in a recent National Center for Health Statistics report on emergency care in the United States from 2008 to 2010, the mean ED wait time to see a physician for non-Hispanic blacks was 18 minutes longer than for non-Hispanic whites.[14] A 1-year retrospective, case–cohort study of discharged patients from 2 urban pediatric EDs found that black children were 39% less likely than non-Hispanic white children to receive any analgesic when presenting to an ED with abdominal pain, and 68% more likely to have a longer length of stay (LOS).[15] In a large retrospective review of urban pediatric EDs, laboratory testing was ordered almost 40% less often, and radiological testing 20% less often, for black than for white children.[16]

As expected, most studies of IBD patients in the ED have focused on adults. A systematic review of studies looking at racial differences in IBD treatment in the ED found no medication differences by race; however, most of these were single- or multicenter and, on average, had fewer than 100 subjects.[17] In a retrospective review of medical records at a single tertiary care center, black children with IBD were significantly more likely than white children to have a complicated disease course and be treated with corticosteroids and infliximab.[3] The generalizability of this result is limited by the span of time covered, and the single location and small sample size. It also lacks any measure of family socioeconomic status (SES) to potentially account for identified differences.

At this early stage of the literature, it is difficult to assess to what extent racial and economic disparities exist for the diagnosis and treatment of pediatric IBD patients in the ED. To our knowledge, there are no large, nationally representative studies. To address this gap in the literature, our study aimed to determine the impact of race and insurance status on ED evaluation and treatment among children and adolescents with CD from a large, national administrative database.

Our primary aims were to compare ED medication usage, laboratory and radiological testing, and ED disposition according to race and insurance status. Secondary aims were to determine whether there are race or payor differences in the proportion of patients with repeated visits. Compared with black children, we hypothesized that white children would (1) receive significantly more laboratory and radiologic testing, (2) receive more narcotic pain medications, and (3) have more hospital admissions. We also expected to see a similar trend for those with commercial insurance compared with Medicaid. Finally, the proportion of patients with repeat visits was expected to be greater among black children and those with Medicaid insurance than white and commercially insured children, respectively.

METHODS

Data Source

The data for this study were drawn from the Pediatric Health Information System (PHIS), an administrative database containing inpatient, ED, observation, and ambulatory surgery data from 44 not-for-profit tertiary care pediatric hospitals associated with the Children's Hospital Association (CHA; Overland Park, KS, USA). The PHIS hospitals are among the largest children's hospitals in America. Data in PHIS are de-identified upon submission to CHA, but identification numbers allow a patient to be tracked across multiple visits within the same hospital. Both CHA and the individual sites perform data quality and reliability checks (eg, bimonthly coding consensus meetings, coding consistency reviews, and quarterly data quality reports across hospitals) before data are included in the database. This study included data from 38 hospitals, and the total number of hospitals contributing data for a given year varied between 31 and 38.

Study Design

This was a retrospective, multicenter, cross-sectional study of pediatric CD patients who had at least 1 ED visit at a participating PHIS center during the study period.

Study Cohort and Visit Criteria

The unit of analysis for our primary objectives was the ED visit. We examined data for all visits within a 7-year time window (between January 1, 2007, and December 31, 2013) that met the following inclusion criteria: Visits must have been for patients who were ≤21 years old and presented to the ED with either a primary diagnosis of CD (ICD-9 code: 555.x) or a secondary diagnosis of CD plus a primary CD-related diagnosis. Crohn's disease–related diagnoses (eg, abdominal pain, anemia, extraintestinal manifestations) were determined by author consensus (J.D., W.C., and M.K.) based on a table listing all primary diagnoses among visits with a secondary diagnosis of CD. Generally, the standards of care related to medications and testing studied were consistent across the study period. Additionally, visits must have been for patients who consistently reported being non-Hispanic and either white or black. To maintain strictly defined comparison groups, visits for patients were excluded if race was missing or inconsistently reported, or if patients reported multiracial heritage. As the main analysis is visit-based, payor status could fluctuate for a given individual.

Variables

Demographics were recorded as follows: age, sex, race, ethnicity, hospital location, date of ED visit, date of discharge, insurance payor status, encrypted ZIP code, discharge ID, primary and secondary discharge diagnoses, and median neighborhood income. Median neighborhood income was derived by the PHIS data analytics team and was based on the 2010 US Census data referring to actual patient ZIP codes reported at index hospitalization. As PHIS hospitals transitioned to a new reporting format for race and payor status at different times between 2007 and 2009, coding algorithms were used to convert old and new versions of these variables

into a form that accurately reflects information from both versions. Insurance payor status was coded as Medicaid or private insurance (Appendix A), and race was coded as black or white.

Additional variables included the following: medications administered (eg, corticosteroids, antibiotics, pain medications, anti-emetics, and "other," indicating all other medications that do not belong to 1 of the aforementioned categories), ED disposition (eg, admitted to inpatient status, discharged, transferred), laboratory testing (eg, chemistries, immunology), imaging studies (eg, magnetic resonance imaging [MRI], ultrasound, computed tomography [CT], x-rays), and number of visits within the study time frame.

Outcomes

The primary outcomes were medication usage, laboratory and radiological testing, and patient disposition. The secondary outcome was the number of ED visits per unique patient. Primary outcomes were compared in terms of race (non-Hispanic black vs non-Hispanic white) and insurance payor status (private vs Medicaid).

Statistical Analyses

Demographic characteristics were compared between white and black patients using patient-level data. Pearson chi-square tests were used for categorical characteristics (sex, geographic region, insurance payor status, and income quartile) and to compare the proportion of repeat vs nonrepeat ED visits by race and by payor status. A 2-sample t test was used for age at first visit during the study period, and a nonparametric Kruskal-Wallis rank-sum test was used for the number of ED visits per patient.

Mixed-level logistic regression modeling was used to investigate associations between the predictors (race and payor status, in separate models) and primary visit-level outcomes (medication usage, radiological and laboratory testing, and disposition). Fixed effects included race (and/or payor status), and random effects included subject and hospital. The subject-specific intercept controls for within-subject correlation (eg, patients with multiple visits), and hospital location controls for site-specific effects (eg, treatment protocols that may differ by hospital; racial diversity of the local patient population). In addition, for outcomes where there was a statistically significant fixed effect for race or for payor status, a bivariate model with both race and payor status was used to determine whether each effect remained significant after controlling for the other fixed effect. In post hoc analyses for significant unadjusted effects of race or payor status, an interaction model was tested using race, payor status, and their interaction. To look for stratification of race by payor status, this was followed by a model with a single fixed effect for race, which was run with (a) Medicaid only visits and then (b) commercial only visits.

Models were fit using the glmer command from the lme4 package,[18] v1.1–7, in R 3.0.1.[19] Models that failed to converge were retested with recommended trouble-shooting techniques[18] such as increasing the number of iterations and employing alternative nonlinear optimizing algorithms for estimating the variance–covariance matrix of random effects. With continued nonconvergence, a simpler model was chosen, which included the fixed effect (of race or payor status) and either (1) the random effect for hospital or (2) the random effect for patient—depending on convergence and the Bayesian Information Criterion. So that models would be comparable, the random effects component of each bivariate model was the same as that for the corresponding single fixed effect model.

A P value of <0.05 was considered statistically significant. This study was approved by the Nationwide Children's Hospital Institutional Review Board.

RESULTS

Demographics

The data included in this study resulted from 3779 ED visits, representing 2618 patients (23% black, 77% white) with an approximately equal sex distribution (Fig. 1). Table 1 summarizes the subject-based demographics according to race/ethnicity for each patient. There were several differences between the cohorts with respect to geographic region, payor status, and median income. Black children were more likely to have Medicaid insurance ($P < 0.001$) and a lower median neighborhood income ($P < 0.001$).

Medication Usage

Emergency department visits for white children with CD had a higher odds of receiving any medication (OR, 1.50; 95% CI, 1.15–1.96), anti-emetics (OR, 1.72; 95% CI, 1.26–2.34), and other drugs (OR, 1.67; 95% CI, 1.31–2.14) compared with black children. Visits for those who were privately insured had a higher odds of receiving anti-emetics (OR, 1.43; 95% CI, 1.05–1.93) and other drugs (OR, 1.42; 95% CI, 1.10–1.84) compared with those who were Medicaid insured (Table 2). When controlling for payor status, the odds ratios related to race declined. The odds ratio for any drug became only marginally significant (OR, 1.36; 95% CI, 1.00–1.86), whereas the odds ratios for other drugs (OR, 1.50; 95% CI, 1.12–2.01) and for anti-emetics (OR, 1.52; 95% CI, 1.06–2.17) remained significant. When controlling for race, odds ratios relating to payor effects were no longer significant.

Laboratory Evaluation

Emergency department visits for white children had a higher odds of having any laboratory test (OR, 1.57; 95% CI, 1.17–2.11), a complete blood count (CBC; OR, 1.41; 95% CI, 1.09–1.81), chemistries (OR, 1.47; 95% CI, 1.14–1.89), and C-reactive protein (CRP)/erythrocyte sedimentation rate (ESR;
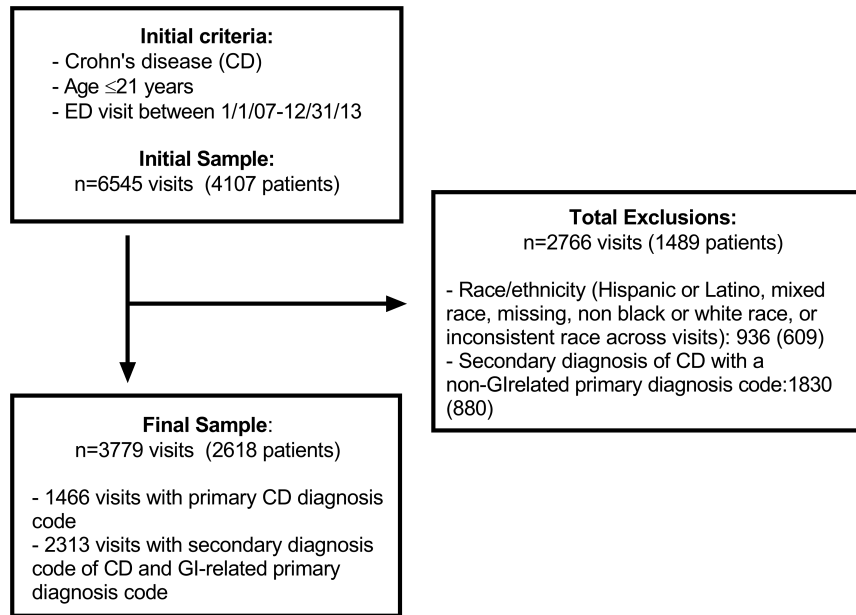
Figure 1. Flowchart for the final cohort selection and exclusion criteria. After applying exclusion criteria to the initial database sample of patients with Crohn's disease age ≤21 years with an ED visit between 2007 and 2013, and subsequently applying race/ethnicity exclusions, the final study cohort was determined. Abbreviation: GI, gastrointestinal.

OR, 1.39; 95% CI, 1.08–1.78) as part of the evaluation compared with black children. Similarly, visits for those who were privately insured had a higher odds of having any laboratory test (OR, 1.43; 95% CI, 1.04–1.97), a complete blood count (OR, 1.51; 95% CI, 1.16–1.98), chemistries (OR, 1.36; 95% CI, 1.05–1.77), and CRP/ESR (OR, 1.47; 95% CI, 1.14–1.89) (Table 3). However, after controlling for payor status, odds ratios based on race were diminished, and none remained significant. When controlling for race, odds ratios based on payor status remained significant for CBC (OR, 1.43; 95% CI, 1.08–1.90) and for CRP/ESR (OR, 1.39; 95% CI, 1.06–1.82).

Radiologic Imaging

Emergency department visits for white children had a higher odds of having any imaging (OR, 1.44; 95% CI, 1.15–1.80) and a CT scan (OR, 2.12; 95% CI, 1.36–3.31) compared with black children. Visits for those with private insurance had a higher odds of receiving any radiologic imaging (OR, 1.35; 95% CI, 1.08–1.70), x-ray (OR, 1.29; 95% CI, 1.02–1.63), and CT scan (OR, 1.67; 95% CI, 1.06–2.61) compared with those with Medicaid insurance (Table 3). For each imaging outcome, the odds ratio for race was diminished and became nonsignificant after controlling for payor status and race.

ED Repeat Visit Frequency and Disposition

When evaluating a cohort of patients with more than 1 ED visit within the 7-year study period, there was a higher proportion of black children (33% vs 22%; $P < 0.001$) and those with Medicaid insurance (27% vs 21%; $P < 0.01$) compared with white children and private insurance, respectively

(Table 4).There were no apparent differences by race or payor status in the percentage of visits where patients were admitted, discharged, or transferred following ED visits. Of note, visits involving private insurance were less likely than those involving Medicaid to have missing disposition data (OR, 0.34; 95% CI, 0.17–0.66).

Post Hoc Analyses

In post hoc analysis of the significant unadjusted outcomes in Tables 2 and 3, there was a significant interaction between race and payor status for 4 separate laboratory outcomes (any lab, CBC, chemistries, and CRP/ESR). To explore the nature of these interactions, we evaluated the effects of race stratified by payor status. For each lab outcome, there was a small effect of race in the Medicaid population and no effect of race in the commercial payor population. (Table 5)

DISCUSSION

In a comprehensive evaluation of pediatric IBD patients who use the ED, adjusted analyses (with minor exceptions) found no significant racial or insurance-related differences in the use of imaging, laboratory testing, and medications. Contrary to expectations, white children were no more likely to receive narcotic analgesics. By contrast, in a large, nationally representative sample of pediatric patients in the ED with abdominal pain, Johnson et al.[15] found small- to medium-sized effects, with whites being 1.6 times more likely than blacks to receive any analgesic and 2.6 times more likely to receive a narcotic analgesic. A key difference may be that the prior study included subjects whose primary complaint was abdominal

TABLE 1: Demographic Characteristics of Emergency Department Visits by Race for a Pediatric Crohn's Disease Cohort

Variable	Total	Subject-Based		P
		NH Black No. (%)	NH White No. (%)	
Total	2618	612 (23)	2006 (77)	
Male	1312 (50)	297 (49)	1015 (51)	>0.99
Age-1st visit, mean (SD), y	13.97 (4.00)	13.86 (4.30)	14.00 (3.90)	>0.99
Region[a]				**<0.001**
Midwest	891 (34)	211 (34)	680 (34)	
Northeast	559 (21)	95 (16)	464 (23)	
South	877 (33)	271 (44)	606 (30)	
West	291 (11)	35 (6)	256 (13)	
Payor[b]				**<0.001**
Private	1331 (51)	186 (30)	1145 (57)	
Medicaid	612 (23)	261 (43)	351 (17)	
Other	374 (14)	100 (16)	274 (14)	
Missing	301 (11)	65 (11)	236 (12)	
Median income[c]				**<0.001**
Q1: $11,130–$35,562	493 (23)	196 (42)	297 (17)	
Q2: $35,564–$45,666	534 (24)	117 (25)	417 (24)	
Q3: $45,730–$59,671	581 (27)	81 (17)	500 (29)	
Q4: $59,718–$148,263	577 (26)	69 (15)	433 (30)	

All percentages are by column. Subjects are counted by index visit. Bolded P values represent significant findings.
Abbreviation: NH, non-Hispanic.
[a]Midwest (OH, IL, MI, IN, MO, WI, MN, NE, ND, SD, KS, IA); Northeast (ME, NH, VT, NY, MA, CT, RI, PA, NJ); South (DC, MD, VA, DE, WV, KY, TN, NC, SC, GA, AL, MS, FL, LA, TX, AR, OK); West (AZ, CO, CA, WA, OR, MT, WY, ID, NV, UT, NM, HI, AK).
[b]Commercial = Blue Cross, HMO, TRICARE, commercial HMO, commercial PPO, commercial other; Medicaid = Medicaid, in-state Medicaid (managed care), in-state Medicaid (other), out-of-state Medicaid (all); Other = Medicare, Title V, other government, workers compensation, other insurance company, self-pay, no charge, other payor, charity, hospital chose not to bill; Missing = not recorded, invalid code, unknown.
[c]Median of median neighborhood income based on 2010 US Census data compared with ZIP code reported at index hospitalization. Patients (n = 433) and visits (n = 1336) missing on income are excluded. Visit-based income quartiles differ at Q2 as follows: Q2 ($35,564–$45,706).

pain, cramps, or spasms, whereas abdominal pain was only 1 of several secondary CD-related diagnoses in the present study. The present study may also have been underpowered to identify analgesic treatment differences by race.

In adjusted analyses, white children were just as likely to receive any imaging overall, and those with private insurance, compared with public insurance, were as likely to receive any imaging, and x-ray and CT scans. By contrast, a previous study found that white patients were more likely than English-speaking black patients to receive any imaging (adjusted OR, 1.18; 95% CI, 1.05–1.32).[16] Although the present study looked at all visits, the prior study restricted its focus to patient diagnoses with a greater likelihood for imaging services (ie, asthma, fever, or acute respiratory tract infection).

The finding that black patients and those with Medicaid had more repeat visits to the ED within the study period could indicate greater use of the ED for more routine, less urgent care and receiving fewer services, although this is speculative without definitive information on disease severity at presentation.

Previous studies have found that those with Medicaid are more likely than those with private insurance to use the ED for routine care,[20, 21] and this may be due to a variety of factors including convenience (ie, scheduling and proximity) and lack of copays.[22, 23]

Patient cost-sharing[24, 25] and education have been proposed as potential solutions to better manage outpatient and emergency care. Copays are effectively used by private insurers to control costs and disincentivize the use of the ED for nonurgent care.[24, 25] For example, prior literature consistently finds that copayments reduce the use of medications,[26] with lower-income patients being more sensitive to cost. For ED visits, Selby et al.[27] found a greater reduction among low-SES neighborhoods (22.5%) compared with all other neighborhoods (14.6%) after the introduction of moderate copays of $25–$30 in a large HMO. Slightly larger reductions in ED visits (26%) were found with more substantial copayments of $50–$100; however, these results were not stratified by visit severity.[28] Those with low income and/or chronic conditions may be especially vulnerable

TABLE 2: Medication Administration and Disposition During Emergency Department Visits by Race and Payor Status

| | | Race | | | | Payor Status | | | |
| | | NH Black | NH White | Odds Ratio (95% CI) | | Private | Medicaid | Odds Ratio (95% CI) | |
Group	Total			Unadjusted	Adjusted			Unadjusted	Adjusted
Total No.		1036	2743			1857	998		
Medication									
Any medication	2592	660 (64)	1932 (70)	**1.50 (1.15–1.96)**	1.36 (1.00–1.86)	1322 (71)	649 (65)	1.31 (1.00–1.72)	1.20 (0.90–1.60)
Other	2021	478 (46)	1543 (56)	**1.67 (1.31–2.14)**	**1.50 (1.12–2.01)**	1039 (56)	481 (48)	**1.42 (1.10–1.84)**	1.26 (0.96–1.65)
Antiemetic	810	158 (15)	652 (24)	**1.72 (1.26–2.34)**	**1.52 (1.06–2.17)**	455 (25)	189 (19)	**1.43 (1.05–1.93)**	1.28 (0.93–1.75)
Pain narcotic	810	225 (22)	585 (21)	1.33 (0.92–1.93)	1.26 (0.80–1.99)	414 (22)	192 (19)	1.32 (0.89–1.95)	1.23 (0.81–1.86)
Pain non-narcotic	609	151 (15)	458 (17)	1.03 (0.75–1.41)	1.05 (0.72–1.54)	302 (16)	167 (17)	0.94 (0.68–1.30)	0.93 (0.66–1.30)
Corticosteroid	210	60 (6)	150 (5)	1.20 (0.21–6.89)[b]	1.73 (0–>10)	94 (5)	62 (6)	0.82 (0.15–4.57)[b]	0.42 (0.00–>10)
Antibiotic	172	33 (3)	139 (5)	1.55 (0.89–2.68)[a]	2.00 (0.53–7.61)	79 (4)	43 (4)	0.30 (0.04–2.28)[b]	—
Disposition									
Admitted	132	21 (2)	112 (4)	1.51 (0.73–3.09)[a]	1.35 (0.46–3.93)	97 (5)	26 (3)	1.58 (0.64–3.89)	1.46 (0.58–3.71)
Discharged	2859	733 (71)	2129 (78)	1.25 (0.84–1.85)	1.03 (0.52–2.04)	1687 (91)	809 (81)	1.69 (0.98–2.92)	1.68 (0.95–2.96)
Other/missing[c]	316	280 (27)	493 (18)	0.72 (0.47–1.10)	0.72 (0.31–1.67)	70 (4)	158 (16)	**0.34 (0.17–0.66)**	**0.36 (0.18–0.71)**
Transferred	10	2 (0)	9 (0)	1.64 (0.21–12.55)[a]	1.23 (0.14–>10)	3 (0)	5 (1)	0.31 (0.04–2.27)	0.30 (0.04–2.25)

For race, the odds ratios refer to having each treatment (vs not) for white relative to black; for payor status, the odds ratio refers to having each treatment (vs not) for those with Medicaid. Adjusted race and payor status odds ratios control for payor status and race, respectively. If alternative models also failed, this was indicated with a line; this occurred with small sample sizes (0.2% to 6% of visits) at 1 or both levels. Significant results are listed in bold.

Abbreviation: NH, non-Hispanic.

[a,b]For outcomes where a mixed model failed to converge with both random variables, an alternative model was used with either [a]hospital as the only random variable or [b]subject ID as the only random variable.

[c]This disposition category represents the following data fields: missing data (n = 302), "hospice–medical facility" (n = 1) and "left against medical advice or discontinued care" (n = 13).

TABLE 3: Laboratory and Radiologic Imaging Evaluation During Emergency Department Visits by Race and Payor Status

Group	Total	NH Black	NH White	Race Odds Ratio (95% CI) Unadjusted	Adjusted	Private	Medicaid	Payor Status Odds Ratio (95% CI) Unadjusted	Adjusted
Total No.		1036	2743			1857	998		
Lab									
Any lab	3152	827 (80)	2325 (85)	**1.57 (1.17–2.11)**	1.26 (0.88–1.80)	1571 (85)	798 (80)	**1.43 (1.04–1.97)**	1.33 (0.96–1.85)
CBC	2736	705 (68)	2031 (74)	**1.41 (1.09–1.81)**	1.21 (0.89–1.64)	1425 (77)	664 (67)	**1.51 (1.16–1.98)**	**1.43 (1.08–1.90)**
Chemistries	2724	709 (68)	2015 (73)	**1.47 (1.14–1.89)**	1.28 (0.95–1.73)	1367 (74)	681 (68)	**1.36 (1.05–1.77)**	1.27 (0.96–1.67)
CRP/ESR	2484	646 (62)	1838 (67)	**1.39 (1.08–1.78)**	1.20 (0.89–1.61)	1294 (70)	610 (61)	**1.47 (1.14–1.89)**	**1.39 (1.06–1.82)**
Other	2133	550 (53)	1583 (58)	1.28 (1.00–1.64)	1.18 (0.88–1.59)	1002 (54)	540 (54)	1.19 (0.92–1.54)	1.13 (0.86–1.49)
Microbiology	1256	313 (30)	943 (34)	1.21 (0.94–1.55)	1.14 (0.84–1.53)	608 (33)	313 (31)	1.10 (0.85–1.43)	1.06 (0.81–1.40)
Coagulation/blood bank	182	49 (5)	133 (5)	1.04 (0.16–7.01)[b]	—	72 (4)	42 (4)	0.99 (0.56–1.74)[b]	1.04 (0.32–3.37)
Immunology	68	16 (2)	52 (2)	1.23 (0.56–2.71)[b]	—	34 (2)	21 (2)	0.87 (0.40–1.87)[b]	—
Imaging									
Any image	1742	412 (40)	1330 (48)	**1.44 (1.15–1.80)**	1.29 (1.00–1.68)	917 (49)	415 (42)	**1.35 (1.08–1.70)**	1.25 (0.99–1.60)
X-ray	1410	354 (34)	1056 (38)	1.20 (0.96–1.51)	1.10 (0.84–1.44)	749 (40)	339 (34)	**1.29 (1.02–1.63)**	1.25 (0.97–1.60)
CT	302	46 (4)	256 (9)	**2.12 (1.36–3.31)[a]**	1.76 (0–>10)	153 (8)	51 (5)	**1.67 (1.06–2.61)[a]**	2.19 (0.05–>10)
US	228	47 (5)	181 (7)	1.63 (0.98–2.72)	—	118 (6)	60 (6)	0.88 (0.17–4.58)[b]	—
MRI	15	3 (0)	12 (0)	1.24 (0.21–7.25)[a]	—	6 (0)	6 (1)	0.53 (0.11–2.48)[a]	—
Fluoro	12	2 (0)	10 (0)	1.80 (0.22–>10)[a]	1.12 (0–>10)	8 (0)	3 (0)	1.44 (0.24–8.59)[a]	2.00 (0–>10)

For race, the odds ratios refer to having each treatment (vs not) for white relative to black; for payor status, the odds ratio refers to having each treatment (vs not) for those with private insurance relative to those with Medicaid. Adjusted race and payor status odds ratios control for payor status and race, respectively. If alternative models also failed, this was indicated with a line; this occurred with small sample sizes (0.2% to 6% of visits) at 1 or both levels. Significant results are listed in bold.

Abbreviation: NH, non-Hispanic.

[a,b]For outcomes where a mixed model failed to converge with both random variables, an alternative model was used with either [a]hospital as the only random variable or [b]subject ID as the only random variable.

TABLE 4: Emergency Department Visits According to Patient Race/Ethnicity and Payor Status Over the 7-Year Study Period

	Patients by Race/Ethnicity				Patients by Payor Status		
	Total	NH[a] Black	NH White	P	Private	Medicaid	P
Total No. visits	3779	1036	2743	—	1857	998	—
Total No. patients	2618	612	2006	—	1392	661	—
Visits/patient, median (IQR)	1 (1–1)	1 (1–1)	1 (1–1)	>0.99	1 (1–1)	1 (1–2)	>0.99
Patients = 1 visit, No. (%)	1983 (76)	411 (67)	1572 (78)		1101 (79)	485 (73)	
[a,c]Patients >1 visit, No. (%)	635 (24)	201 (33)	434 (22)	**<0.001**	291 (21)	176 (27)	**<0.01**
[b,c]Patients >3 visits, No. (%)	105 (5)	39 (9)	66 (4)	**<0.001**	38 (3)	31 (6)	**<0.05**

Bolded P values represent significant findings.
Abbreviation: NH, non-Hispanic.
[a]Chi-square comparisons: repeat ED visitor (1 visit vs >1 visit) × (1) race and (2) payor status
[b]Chi-square comparisons: repeat ED visitor (1 visit vs >3 visits) × (1) race and (2) payor status
[c]Percentages are a function of the number of patients included in the chi-square, which may or may not sum to the total number of patients.

TABLE 5: Post Hoc Interaction and Stratified Models for Significant Outcomes

Interaction Model, OR (95 % CI)[a]		
Race	Payor	Race × Payor
Any lab		

	Race	Payor	Race × Payor
Any lab	**1.82 (1.11–2.98)**	**2.29 (1.25–4.22)**	**0.45 (0.22–0.93)**
CBC	**1.76 (1.15–2.68)**	**2.51 (1.49–4.25)**	**0.44 (0.24–0.82)**
Chemistries	**2.07 (1.36–3.17)**	**2.52 (1.51–4.20)**	**0.37 (0.20–0.67)**
CRP/ESR	**1.84 (1.22–2.78)**	**2.59 (1.57–4.28)**	**0.41 (0.23–0.74)**

Race stratified by payor status[b]		
Race OR (95% CI)		
	Medicaid only	Commercial only
Any lab	**1.79 (1.05–3.05)**	0.81 (0.46–1.42)
CBC	**1.77 (1.14–2.74)**	0.78 (0.49–1.25)
Chemistries	**2.02 (1.31–3.10)**	0.75 (0.47–1.19)
CRP/ESR	**1.80 (1.19–2.73)**	0.74 (0.47–1.15)

Significant odds ratios listed in bold.
[a]The interaction model for each outcome includes race, payor status, and race × payor status fixed effects plus hospital and patient medical record number as random effects.
[b]For each outcome, the model included the fixed effect of race (reference = black) plus hospital and patient medical record number as random effects. This model was run separately for visits with Medicaid and commercial payor status.

to "cost-offset" effects. Incentivizing patients to delay care until their condition is more severe could lead to more expensive care for the same episode, though this may not be true for child visits.[29]

Parent medical knowledge may be unreliable to determine the appropriate use of the ED[30]; however, interventions involving patient or parent education can be effective. Sturm et al.[23] encouraged families with children to use their primary care physicians for less urgent episodes over a 12-month period through a program that developed medical decision guidelines for afterhours care, outlined primary care provider services and availability, and sometimes included access to physician advice after hours by phone. In this study, 12% fewer families in the intervention used ED services for nonurgent episodes compared with controls.

There were several important limitations in this study. One of the biggest limitations is the lack of detailed information regarding the characteristics of the source population from which patients were drawn at each hospital location. Thus, we cannot determine how many people of each race and payor

status had 0 visits to derive an accurate proportion of total visits for each subgroup. Questions regarding which groups use the ED more frequently are therefore beyond the scope of the current study. We evaluated ED visits within PHIS-associated hospitals, and this does not account for differences in outpatient management that are not captured by PHIS. Approximately 8% of ED visits were missing the disposition field. As this disproportionately affected those with Medicaid insurance, results for low-frequency dispositions (admitted and transferred visits) may be less reliable. The PHIS database is not weighted for extrapolation to national estimates; thus results may not be generalizable to all pediatric centers. This was a retrospective study based on administrative data, so reporting bias or classification errors may be present, although there are data quality measures in place to minimize errors. As the findings were not based on detailed medical record review, we were unable to assess or control for disease presentation or disease severity. Finally, although we have interpreted treatment differences by race as an underuse of services among black patients, they might represent overuse among white patients. The absence of a clear guideline or reference point for expected treatment in each case renders it difficult to distinguish between these 2 interpretations. The strengths of the study include its large, regionally diverse sample population of ED visits and the use of an analytical method that appropriately accounted for data clustering by patient and hospital.

In summary, several small[31] treatment differences were identified separately by race and by insurance payor status in a large and diverse cohort of pediatric patients with CD visits to the ED. Given the strong overlap between race and insurance type with white patients more likely to have private insurance and black patients more likely to have Medicaid, it is not surprising that, for several treatment outcomes, racial differences were no longer apparent after accounting for payor differences, despite expectations based on the literature. To the extent that the 2 predictors are correlated, the effective sample size is reduced, and it is often difficult to tease out their independent effects. Although effect sizes identified in this study were small, it is important to minimize such differences as much as possible. Interestingly, in the post hoc analyses, white patients were more likely to receive any lab testing when using Medicaid but not private insurance. It seems that being black and having limited access to insurance represents a double risk in terms of access to some care. Perhaps white patients were treated the same irrespective of insurance. These differences may represent differences between hospitals (eg, black patients in some urban areas may use hospitals with lower rates of evidence-based practices[32] or limited resources).

The root causes of health care disparities in the United States are complex and beyond the scope of this study, which is limited to identifying racial and economic disparities. Given the limitations of our data set, we cannot determine whether these small apparent differences represent racial disparities in the quality of health care. In general, multiple strategies may be necessary to address the inappropriate use of the ED, especially among families with lower incomes. Our results suggest an opportunity for better outpatient management of children with IBD, particularly among black children and those with Medicaid, so that nonemergent problems are more effectively handled in the office setting rather than ED. Examples of interventions to improve our outpatient management approach include extended evening and weekend clinic hours, enhancement and utilization of electronic patient portals, increasing the focus on proactive management of these patients (eg, use of clinical dashboards to monitor from a population perspective), providing additional education and resources to our patients and families, and fully integrating supportive multidisciplinary teams—including case managers, social workers, and psychologists—into our practice. Addressing these complex psychosocial issues and social determinants of health is particularly challenging without embedded social workers and psychologists. Large, carefully crafted prospective studies with a focus on social determinants of health are needed to address these issues.

In addition, future research should focus on how to address family concerns about inconvenience surrounding primary care or specialty outpatient clinics and the effective use of copays without discouraging ED services when necessary.

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APPENDIX A: Mapping Key for Each Payor Category According to PHIS Payor Titles from Version 1 and Version 2

Payor Categories	PHIS Payor Title	
	Version 1[a]	Version 2[a]
Medicaid	Medicaid	In-state Medicaid (managed care); in-state Medicaid (other), out-of-state Medicaid (all)
Commercial	HMO, Blue Cross	Commercial (HMO, PPO, or other), TRICARE
Other	Medicare, other government, self-pay, other insurance company, no charge, Title V, workers compensation, other	Medicare, Other government, self-pay, other payor, hospital chose not to bill, charity
Missing	Not recorded, invalid	Not recorded, invalid, unknown

[a]During the study period, PHIS changed its reporting from version 1 to version 2, which affected how payor status was reported. This table depicts the mapping process of each version into the 3 categories we used for analysis.