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Racial Differences in Pediatric Emergency Department Wait Times

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Abstract

Objectives: Wait time for emergency care is a quality measure that affects clinical outcomes and patient satisfaction. It is unknown if there is racial/ethnic variability in this quality measure in pediatric emergency departments (PEDs). We aim to determine whether racial/ethnic differences exist in wait times for children presenting to PEDs and examine between-site and within-site differences.

Methods: We conducted a retrospective cohort study for PED encounters in 2016 using the Pediatric Emergency Care Applied Research Network (PECARN) Registry, an aggregated de-identified electronic health registry comprising 7 PEDs. Patient encounters were included among all patients ≤18 years of age at the time of the ED visit. We evaluated differences in ED wait time (time from arrival to first medical evaluation) considering patient race/ethnicity as the exposure.

Results: Of 448,563 visits, median wait time was 35 minutes (interquartile range, 17-71 minutes). Compared to non-Hispanic White (NHW) children, non-Hispanic Black (NHB), Hispanic, and other race children waited 27%, 33%, and 12% longer, respectively. These differences were attenuated after adjusting for triage acuity level, mode of arrival, sex, age, insurance, time of day, and month (adjusted median wait time ratios [95% confidence intervals (CIs)]: 1.11 [1.10, 1.12] for NHB, 1.12 [1.11, 1.13] for Hispanic, and 1.05 [1.03, 1.06] for other

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race children compared to NHW children). Differences in wait time for NHB and other race children were no longer significant after adjusting for clinical site. Fully adjusted median wait times among Hispanic children were longer compared to NHW children (1.04 [1.03, 1.05]).

Conclusions: In unadjusted analyses, non-White children experienced longer PED wait times than NHW children. After adjusting for illness severity, patient demographics, and overcrowding measures, wait times for NHB and other race children were largely determined by site of care. Hispanic children experienced longer within-site and between-site wait times compared to NHW children. Additional research is needed to understand structures and processes of care contributing to wait time differences between sites that disproportionately impact non-white patients.

Keywords

emergency services; health care disparities; timeliness; quality

INTRODUCTION

Timeliness in emergency department (ED) care can impact clinical outcomes, making ED wait time an important process of care quality measure. For example, early corticosteroid administration for pediatric asthma in the ED can reduce hospital admission rates[1] and timeliness of care impacts organ dysfunction and mortality for pediatric sepsis.[2,3] Wait times also affect ED visit satisfaction.[4,5]

Research has shown racial/ethnic variability in the quality of pediatric emergency department (PED) care.[6-9] Significant racial disparities have also been observed for ED wait times for children using large national databases.[10,11] These prior studies used data from as early as 1997 and included both children's hospitals and general EDs. As the US healthcare system faces growing ED volumes, greater ED overcrowding, and greater demographic diversity,[12,13] it is imperative that we explore current associations between patient race and ED wait time. Furthermore, given prior research that PEDs provide higher quality care for children compared to general EDs,[14] it is important to examine whether inequities in wait times exist in the PED setting.

The objectives of this study were to determine if there are racial/ethnic differences in wait times for children and adolescents presenting to PEDs, and to examine between-site and within-site differences in wait times. We hypothesized that NHW children experience shorter wait times after controlling for the severity of the presenting complaint. We further hypothesized that this association would partially be explained by the site of care.

METHODS

Study design

This was a retrospective cohort study using data from the Pediatric Emergency Care Applied Research Network (PECARN) electronic health record (EHR) Registry[15,16] for visits from January 1, 2016 through December 31, 2016. This study was approved by the institutional review boards of all study sites and the PECARN Data Coordinating Center (DCC).

Data source and study population

Details about the PECARN Registry have been published previously.[9,16] In brief, the PECARN Registry includes all EHR data from 7 sites: 4 PEDs within tertiary care freestanding children's hospitals and 3 of these hospitals' affiliated satellite PEDs. The PECARN Registry uses automated processes to extract and transform EHR data from all PED visits. Data are de-identified and submitted monthly in a uniform format to the DCC. We excluded visits for patients over 18 years of age and for those who left without being seen by a treating provider.

Independent variables

The primary independent variable was patient race/ethnicity. Race in the PECARN Registry is categorized as American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, White, multiple races, stated unknown, and other. Ethnicity, which is recorded separately from race, is categorized as Hispanic or Latino/a, not Hispanic or Latino/a, or stated unknown. Race/ethnicity is reported based on hospital policy, during the study period 3 sites used self-report by asking parents to identify their child's race and ethnicity while the other 4 sites report based on hospital staff observation at the time of registration. For our analyses, we collapsed race and ethnicity into 5 categories: non-Hispanic White (NHW), non-Hispanic Black (NHB), Hispanic, other race/ethnicity (includes children with multiple races/ethnicities), and missing race/ethnicity.

Dependent variables

Our main dependent variable was ED wait time, defined as time from arrival to first medical evaluation by a physician (resident, fellow, or attending) or advanced practice provider (nurse practitioner or physician assistant).

Covariates

We examined potential confounders including measures of illness severity (triage acuity, mode of arrival), patient demographics (sex, age, and insurance status), crowding (time of day and month of year), and system-level factors (ED site of care).

Triage acuity and mode of arrival were used as measures of illness severity. Triage acuity, an important determinate of how quickly a patient is evaluated, is determined by focused assessment of the patient's vital signs, the likelihood of an immediate life-threatening condition, and expected resources needed during the visit (eg, laboratory testing, medications, consultations, or procedures).[17] All sites used the 5-level Emergency Severity Index, defined as: level 1, immediate care; level 2, emergent care; level 3, urgent care; level 4, semi-urgent care; and level 5, non-urgent care.[17] Mode of arrival was categorized as emergency medical services (EMS) air transport, EMS ground transport, non-EMS walk-in, and other.

Patient sex and age were included because these demographics may impact resource utilization and therefore triage acuity for certain chief complaints (eg, neonate with fever, female with lower abdominal pain).[18] Insurance was included as a potential covariate

because insurance status is associated with differences in process of care measures in the ED.[7,19] We categorized insurance as private, public (eg, Medicaid), self-pay, or other.

Overcrowding can also impact timeliness of ED care.[20-24] We included time of day using 4-hour blocks aligned with typical ED work shifts beginning at 7 AM, as well as month of the year to help account for daily and seasonal variations in ED volume. Site of care has previously been described as a factor associated with racial/ethnic disparities.[25-33] Therefore, we included the ED site of care as a potential confounder in our analyses.

Statistical analysis

We used standard descriptive statistics to summarize our patient population stratified by race/ethnicity. We used a logarithmic transformation to calculate percent differences in median ED wait times.[34]

We used bivariable and multivariable quantile regression to examine associations between covariates with median wait time.[35] Variables approaching significance with a p-value up to .2 in bivariable analysis were included in our multivariable model. We fit 4 increasingly complex multivariable quantile regression models. Model 1 adjusted for illness severity by including triage acuity and mode of arrival. Model 2 expanded on Model 1 by adding patient demographics (age, sex, and insurance). Model 3 included variables in Model 2 plus overcrowding measures (time of day and month of year). The fully adjusted model (Model 4) included Model 3 plus ED site of care. We summarized effect estimates as adjusted median wait time ratios (aMWTR) and 95% confidence intervals (CI). For example, the aMWTR comparing NHB to NHW patients is the adjusted median wait time for NHB patients divided by the adjusted median wait time for NHW patients, where the medians are adjusted using quantile regression. We used the interior point algorithm[36] to estimate quantile regression parameters, and the resampling method[37] with 200 resamples to estimate CIs. We used a statistical significance level of .001 for analysis of the full study sample, and .01 for analyses by site. We report 95% CIs for differences.

To account for variables with missing data (2.3% for race/ethnicity, 10.2% for triage acuity, 10.3% for mode of arrival, and 3.5% for insurance), all models were estimated from multiple imputed sets of data generated by a sequence of regression models implemented in IVEWare (University of Michigan, Ann Arbor, MI, USA).[38] We combined results from 5 imputed sets using the chained equations method.[39] For all analyses, we used SAS, version 9.4 (SAS Institute Inc., Cary, NC, USA).

RESULTS

The PECARN Registry had 475,703 patient visits during the study period. We excluded 16,590 visits by patients >18 years of age and 10,550 visits by patients who left without being seen by a treating provider. Our final sample consisted of 448,563 visits, of which 135,296 (30.2%) were NHW, 183,700 (41.0%) NHB, 81,393 (18.1%) Hispanic, 38,013 (8.5%) other races, and 10,161 (2.3%) missing race/ethnicity (Table 1). The mean age was 6.5 years and 47.7% were female. The majority of patients were publicly insured (64.9%).

The overall median wait time was 35 minutes (interquartile range [IQR] 17-71 minutes). Compared to NHW children, NHB children waited 27% longer ($P<.001$), Hispanic children waited 33% longer ($P<.001$), and children of other races/ethnicities waited 12% longer ($P<.001$) (Figure 1, unadjusted). Figure 2 depicts the relationship between site median wait time and proportion of non-White patients.

The results of the multivariable modeling are shown in Figure 1. Model 1 revealed that racial/ethnic differences in wait times persisted, but were attenuated after illness severity adjustment (Figure 1, Model 1; aMWTR [95% CIs]: 1.13 [1.12, 1.14] for NHB, 1.17 [1.15, 1.18] for Hispanic, and 1.07 [1.05, 1.09] for patients of other races). Wait time differences also persisted after adding patient demographics to the multivariable model (Figure 1, Model 2; aMWTRs [95% CIs]: 1.09 [1.08, 1.10] for NHB, 1.12 [1.10, 1.13] for Hispanic, and 1.04 [1.03, 1.06] for patients of other races). Statistically significant racial/ethnic differences in wait time continued to be present after adjusting for overcrowding measures (Figure 1, Model 3; aMWTRs [95% CIs]: 1.11 [1.10, 1.12] for NHB, 1.12 [1.11, 1.13] for Hispanic, and 1.05 [1.03, 1.06] for patients of other races). After adding ED site of care to the fully adjusted model, differences in wait times were no longer significant for NHB and other race children (Figure 1, Model 4; aMWTRs [95% CIs]: 1.01 [1.00, 1.02] for NHB and 1.01 [0.99, 1.02] for patients of other races). However, Hispanic patients continued to have slightly longer wait times compared to NHW patients (Figure 1, Model 4; aMWTR [95% CI]: 1.04 [1.03, 1.05]). In analyses by ED site of care, Hispanic patients at 5 of 7 sites had significantly increased wait times that were 3%-8% longer compared to White patients after adjusting for other clinical and demographic confounders (site aMWTRs [95% CI]: 1.03 [1.01, 1.05], 1.04 [1.01, 1.08], 1.05 [1.03, 1.07], 1.06 [1.03, 1.10], and 1.08 [1.04, 1.11]).

DISCUSSION

In this multi-site study of 448,563 PED visits, we found non-White patients experience up to 33% longer wait times than White patients. Adjusted analyses suggest that this is partially accounted for by differences in severity, with non-White patients more likely to be assigned less urgent triage acuity, thus resulting in longer wait times. However, even after adjusting for severity, demographics, and crowding, we found that non-White patients experience up to 12% longer wait times than White patients. When site of care was held constant, racial differences in wait time were no longer present, suggesting that differences in wait time between NHB and other race children compared to NHW children in this sample were largely determined by where patients were seen. Although there were minimal within-site differences, Hispanic patients at 5 of 7 sites waited up to 8% longer than White children at those sites after adjusting for confounders. In addition to the statistical significance of our finding that non-White patients experienced longer wait times, we conclude that these differences were likely clinically significant because wait time can impact overall timeliness and satisfaction with care.[40] Furthermore, our observed differences in wait times may be a marker for system-wide disparities that warrant further investigation.

Our finding that non-White patients experience longer wait times is consistent with other research in pediatric[10,11] and adult populations.[20,41-43] An analysis of National Hospital Ambulatory Care Survey (NHAMCS) data from 1997-2000 found that ED wait times

for children differed according to patient race/ethnicity.[10] After adjusting for potential confounders, these differences remained significant for Hispanic patients.[10] Similar results were seen in 2005-2006 NHAMCS data, which found that NHB and Hispanic children had significantly longer unadjusted and adjusted ED wait times.[11] That study also found that children seen in EDs serving a greater proportion of minority patients had longer wait times.[11] Over a decade later, we found that racial/ethnic disparities persist in ED wait times, even in PEDs at academic and community satellite centers. While research shows that hospitals with higher pediatric volume are associated with greater pediatric readiness[44] and academic PEDs provide higher quality care for children compared to general EDs,[14] our findings suggest that the PED setting is not immune from inequities in care.

Although datasets such as NHAMCS may be more nationally representative, because sites within these datasets are unknown, they preclude further research aimed at addressing disparities. In contrast, the PECARN Registry is constantly collecting data at known sites and has the capacity to not only identify disparities in care, but also allow for multi-site research to understand the sources of such disparities, as well as test interventions and follow outcomes within a multicenter network. Therefore, future research should leverage the PECARN Registry data to understand and address disparities in PED care.

Our analyses revealed that triage acuity and mode of arrival, which served as proxies for illness severity, partially explain racial/ethnic differences in PED wait times. Interpretation of these findings should take into consideration research documenting disparities in the ED triage process, with White patients receiving more urgent triage acuity compared to their Black counterparts.[45-47] It should also be noted that a low-acuity visit does not always indicate inappropriate ED use. A growing body of research has studied the use of the ED for low-acuity conditions.[48-55] Several studies have found that for many visits triaged as non-urgent, parents first call their primary care provider and are referred to the ED.[50,51] Primary care center characteristics that are associated with high patient PED use include the number of available sick visit slots per physician, practice policies related to accepting walk-in sick visits, and turnaround time for laboratory tests.[52] Furthermore, racial/ethnic disparities have been noted, with non-White children more likely to have no usual source of care, unmet medical and prescription needs, and not been seen a doctor in the past year.[56] This suggests that system-level interventions are needed to address barriers to accessing primary care, such as expanded office hours and additional availability for sick visits in primary care.

While adjustment for triage acuity and arrival mode attenuated the observed differences in wait times, we found that differences among NHB and other race patients were primarily explained by site of care. This is important as patients may be limited in choosing where they seek emergency care because of geographic constraints or financial resources. Research in adult populations demonstrates an association between hospitals serving a disproportionately large percentage of minority patients with increased mortality and poorer quality care.[25-33] These findings have policy implications for ensuring that hospitals caring for vulnerable populations have adequate resources, including adequate staffing to reduce overcrowding. Future research should explore characteristics of sites with longer wait times, such as nurse and physician staffing, availability of interpreter services, or different

processes for triage that may contribute to longer wait times. Although we were able to adjust for ED site of care, our findings may also be impacted by neighborhood-level factors such as access to primary care and non-ED based urgent care services in the community, which we were not able to evaluate in this study.

Significant differences in PED wait times remained for Hispanic patients that were not accounted for by the clinical, demographic, and site-level factors included in our analyses. One potential explanation for this finding is limited English proficiency of patients or parents requiring interpreter services. Others have shown an association of language barriers between families and ED physicians with significantly longer ED length of stay.[57] We were unable to account for preferred language and interpreter use in our analyses; this represents an important area of future research investigating disparities in PED care.

Provider stereotyping and bias represent additional unmeasured confounders that can impact racial/ethnic differences in care that we were unable to explore in the current study. For example, it is possible that providers may identify a presumed Hispanic name and have assumptions about English proficiency or need for interpreter services, leading to delays in seeing the patient and longer wait times. Research has shown that provider bias is associated with disparities in care[58,59] and influences patient-provider communication.[60,61] Although research has demonstrated that providers in the PED have implicit racial bias,[62,63] the impact of provider bias on racial/ethnic disparities in PED care remains unknown and represents an important area of future research.

Limitations

Our study has limitations that warrant consideration. Although we analyzed data on more than 400,000 visits by patients presenting to 7 PEDs, our findings may not be generalizable to general EDs or EDs in more rural areas. Also, our study design did not allow us to examine sources of disparities beyond the site of care such as the impact of preferred language and need for interpreter services. Additionally, while we adjusted for insurance status, we were unable to adjust for other socioeconomic factors such as parent occupation, income, education, or health literacy. We adjusted for triage as a proxy of illness severity; however, research suggests that disparities exist in assigning triage acuity,[45-47] which may have resulted in an underestimation of the adjusted racial/ethnic differences in wait time in our study. Finally, race/ethnicity is determined by self-report at 3 of the PECARN Registry sites, whereas 4 sites rely on observation by registration staff, which may result in misclassification bias. Socially assigned race/ethnicity, defined as the race/ethnicity ascribed to individuals by others in social interactions, may be discordant from one's self-identified race/ethnicity and has been linked with disparities in healthcare outcomes.[64,65] For example, self-identified minorities who are socially assigned as White report less healthcare discrimination compared to self-identified minorities that are also socially identified as minorities.[65] Therefore, for this purposes of this study, staff observation is useful in understanding how PED care differs based on patients' socially identified race/ethnicity.

Conclusions

Our findings indicate that NHB, Hispanic, and children of other races experience up to 33% longer unadjusted wait times than NHW children when presenting to PEDs. While adjusting for triage acuity attenuated these differences, our results suggest that differences in wait times between Black and other race children compared to White children are largely determined by the site where patients are seen. Hispanic children have longer between-site and within-site differences in PED wait time compared to NWH children, even after adjusting for confounders. These findings expand our knowledge of known disparities in ED wait time by examining more recent data and examining disparities specifically in PEDs.

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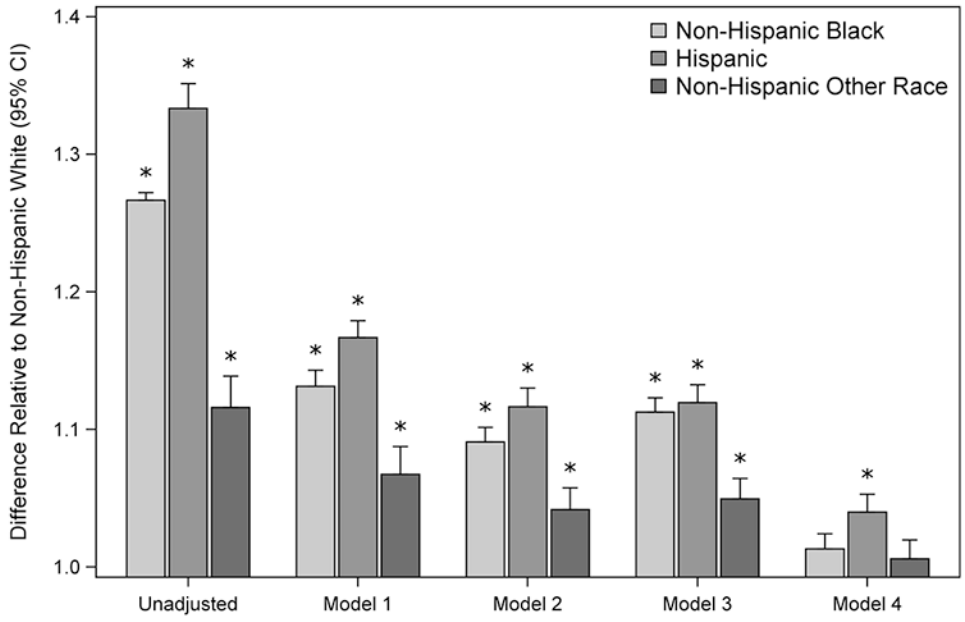

Figure 1.

Unadjusted and adjusted differences in emergency department (ED) wait time. Multivariable quantile regression models were used to examine associations between covariates and median ED wait times. Relative differences compare racial/ethnic groups to non-Hispanic Whites; a relative difference of 1.0 is no difference. Model 1 is adjusted for triage acuity and mode of arrival (severity measures). Model 2 adds adjustment for sex, age, and insurance (patient demographic measures). Model 3 adds adjustment for time of day and month of year (crowding measures). Model 4 adds adjustment for clinical site. [a] $P<.001$. CI = confidence interval.

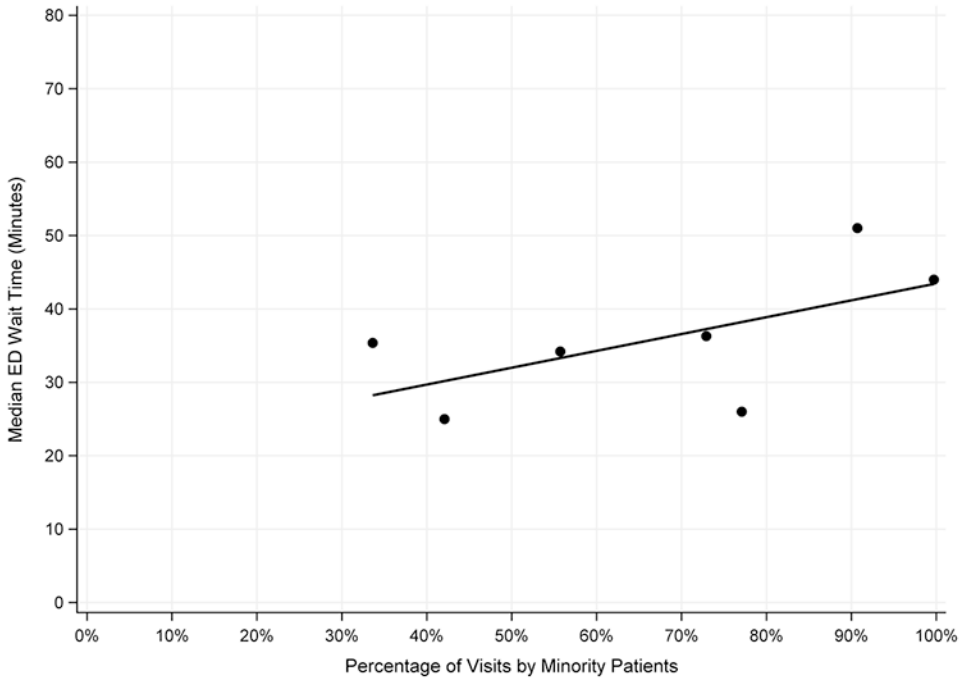

Figure 2.

Median emergency department (ED) wait time by clinical site. Scatterplot examining the linear association between the percentage of visits to an ED site by non-White patients, and the median unadjusted ED wait time. Each point represents an ED site. A linear regression solution is plotted, P=.15.

Table 1.

Study Cohort Characteristics[a,b]

Characteristic	Total (n =448,563)	Non-Hispanic White (n =135,296)	Non-Hispanic Black (n =183,700)	Hispanic (n =81,393)	Other Race/ Ethnicity (n =38,013)	Missing Race (n=10,161)
Age, y, mean (SD)	6.5 (5.3)	7.1 (5.5)	6.5 (5.3)	6.1 (5.1)	5.6 (5.0)	4.4 (4.9)
Female sex, n (%)	213,994 (47.7%)	64,653 (47.8%)	88,294 (48.1%)	38,549 (47.4%)	17,638 (46.4%)	4,860 (47.8%)
Triage acuity level, n, (%)						
Level 1 Immediate	1,667 (0.4%)	452 (0.4%)	697 (0.4%)	271 (0.3%)	205 (0.6%)	42 (0.5%)
Level 2 Emergent	61,166 (15.2%)	26,352 (22.7%)	19,877 (12.0%)	8,136 (10.3%)	5,821 (17.1%)	980 (11.5%)
Level 3 Urgent	117,995 (29.3%)	45,181 (38.9%)	39,965 (24.2%)	20,092 (25.5%)	10,312 (30.3%)	2,445 (28.6%)
Level 4 Semi-urgent	173,266 (43.0%)	37,058 (31.9%)	77,363 (46.8%)	40,521 (51.5%)	14,252 (41.9%)	4,072 (47.6%)
Level 5 Non-urgent	48,571 (12.1%)	7,007 (6.0%)	27,486 (16.6%)	9,664 (12.3%)	3,403 (10.0%)	1,011 (11.8%)
Insurance status, n, (%)						
Private insurance	125,319 (28.9%)	76,463 (56.9%)	25,007 (14.4%)	8,557 (11.0%)	12,021 (32.4%)	3,271 (33.4%)
Public insurance	281,067 (64.9%)	51,219 (38.1%)	137,102 (78.8%)	64,407 (82.6%)	22,949 (61.9%)	5,390 (55.1%)
Self-pay	22,530 (5.2%)	3,972 (3.0%)	11,161 (6.4%)	4,567 (5.9%)	1,818 (4.9%)	1,012 (10.3%)
Other	4,159 (1.0%)	2,658 (2.0%)	665 (0.4%)	425 (0.5%)	304 (0.8%)	107 (1.1%)

SD = Standard deviation.

[a]Data are based on patient visits to sites in the PECARN Registry from January 1, 2016 through December 31, 2016.

[b]Because of rounding and exclusion of missing data, percentages may not total 100.