

## ORIGINAL RESEARCH

## Prevalence and Predictors of Return Visits to Pediatric Emergency Departments

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**OBJECTIVE:** To determine the rate of return visits to pediatric emergency departments (EDs) and identify patient- and visit-level factors associated with return visits and hospitalization upon return.

**DESIGN AND SETTING:** Retrospective cohort study of visits to 23 pediatric EDs in 2012 using data from the Pediatric Health Information System.

**PARTICIPANTS:** Patients <18 years old discharged following an ED visit.

**MEASURES:** The primary outcomes were the rate of return visits within 72 hours of discharge from the ED and of return visits within 72 hours resulting in hospitalization. Results: 1,415,721 of the 1,610,201 ED visits to study hospitals resulted in discharge. Of the discharges, 47,294 patients (3.3%) had a return visit. Of these revisits, 9295 (19.7%) resulted in hospitalization. In multivariate analyses, the odds of having a revisit were higher for patients with a

chronic condition (odds ratio [OR]: 1.91, 95% confidence interval [CI]: 1.86-1.96), higher severity scores (OR: 1.42, 95% CI: 1.40-1.45), and age <1 year (OR: 1.32, 95% CI: 1.22-1.42). The odds of hospitalization on return were higher for patients with higher severity (OR: 3.42, 95% CI: 3.23-3.62), chronic conditions (OR: 2.92, 95% CI: 2.75-3.10), age <1 year (1.7-2.5 times the odds of other age groups), overnight arrival (OR: 1.84, 95% CI: 1.71-1.97), and private insurance (OR: 1.47, 95% CI: 1.39-1.56). Sick cell disease and cancer patients had the highest rates of return at 10.7% and 7.3%, respectively.

**CONCLUSIONS:** Multiple patient- and visit-level factors are associated with revisits. These factors may provide insight in how to optimize care and decrease avoidable ED utilization. *Journal of Hospital Medicine* 2014;9:779-787. © 2014 Society of Hospital Medicine

Returns to the hospital following recent encounters, such as an admission to the inpatient unit or evaluation in an emergency department (ED), may reflect the natural progression of a disease, the quality of care received during the initial admission or visit, or the quality of the underlying healthcare system.<sup>1-10</sup> Although national attention has focused on hospital readmissions,<sup>3-7,11,12</sup> ED revisits are a source of concern to emergency physicians.<sup>8,9</sup> Some ED revisits are medically necessary, but revisits that may be managed

in the primary care setting contribute to ED crowding, can be stressful to patients and providers, and increase healthcare costs.<sup>10-12</sup> Approximately 27 million annual ED visits are made by children, accounting for over one-quarter of all ED visits in the United States, with a reported ED revisit rate of 2.5% to 5.2%.<sup>2,13-20</sup> Improved understanding of the patient-level or visit-level factors associated with ED revisits may provide an opportunity to enhance disposition decision making at the index visit and optimize site of and communication around follow-up care.

Previous studies on ED revisits have largely been conducted in single centers and have used variable visit intervals ranging between 48 hours and 30 days.<sup>2,13,16,18,21-25</sup> Two national studies used the National Hospital Ambulatory Medical Care Survey, which includes data from both general and pediatric EDs.<sup>13,14</sup> Factors identified to be associated with increased odds of returning were: young age, higher acuity, chronic conditions, and public insurance. One

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Additional Supporting Information may be found in the online version of this article.

Received: June 28, 2014; Revised: September 10, 2014; Accepted: October 3, 2014

2014 Society of Hospital Medicine DOI 10.1002/jhm.2273

Published online in Wiley Online Library (Wileyonlinelibrary.com).

national study identified some diagnoses associated with higher likelihood of returning,<sup>13</sup> whereas the other focused primarily on infectious disease–related diagnoses.<sup>14</sup>

The purpose of this study was to describe the prevalence of return visits specifically to pediatric EDs and to investigate patient-level, visit-level, and healthcare system–related factors that may be associated with return visits and hospitalization at return.

## METHODS

### Study Design and Data Source

This retrospective cohort study used data from the Pediatric Health Information System (PHIS), an administrative database with data from 44 tertiary care pediatric hospitals in 27 US states and the District of Columbia. This database contains patient demographics, diagnoses, and procedures as well as medications, diagnostic imaging, laboratory, and supply charges for each patient. Data are deidentified prior to inclusion; encrypted medical record numbers allow for the identification of individual patients across all ED visits and hospitalizations to the same hospital. The Children’s Hospital Association (Overland Park, KS) and participating hospitals jointly assure the quality and integrity of the data. This study was approved by the institutional review board at Boston Children’s Hospital with a waiver for informed consent granted.

### Study Population and Protocol

To standardize comparisons across the hospitals, we included data from 23 of the 44 hospitals in PHIS; 7 were excluded for not including ED-specific data. For institutions that collect information from multiple hospitals within their healthcare system, we included only records from the main campus or children’s hospital when possible, leading to the exclusion of 9 hospitals where the data were not able to be segregated. As an additional level of data validation, we compared the hospital-level ED volume and admission rates as reported in the PHIS to those reported to a separate database (the Pediatric Analysis and Comparison Tool). We further excluded 5 hospitals whose volume differed by >10% between these 2 data sources.

Patients <18 years of age who were discharged from these EDs following their index visit in 2012 formed the eligible cohort.

### Key Outcome Measures

The primary outcomes were return visits within 72 hours of discharge from the ED, and return visits resulting in hospitalization, including observation status. We defined an ED revisit as a return within 72 hours of ED discharge regardless of whether the patient was subsequently discharged from the ED on the return visit or hospitalized. We assessed revisits within 72 hours of an index ED discharge, because

return visits within this time frame are likely to be related to the index visit.<sup>2,13,16,21,22,24–26</sup>

### Factors Associated With ED Revisits

A priori, we chose to adjust for the following patient-level factors: age (<30 days, 30 days–<1 year, 1–4 years, 5–11 years, 12–17 years), gender, and socioeconomic status (SES) measured as the zip code–based median household income, obtained from the 2010 US Census, with respect to the federal poverty level (FPL) (<1.5 × FPL, 1.5–2 × FPL, 2–3 × FPL, and >3 × FPL).<sup>27</sup> We also adjusted for insurance type (commercial, government, or other), proximity of patient’s home zip code to hospital (modeled as the natural log of the geographical distance to patient’s home address from the hospital), ED diagnosis-based severity classification system score (1 = low severity, 5 = high severity),<sup>28</sup> presence of a complex chronic condition at the index or prior visits using a validated classification scheme,<sup>15,29–31</sup> and primary care physician (PCP) density per 100,000 in the patient’s residential area (modeled as quartiles: very low, <57.2; low, 57.2–67.9; medium, 68.0–78.7; high, >78.8). PCP density, defined by the Dartmouth Atlas of Health Care,<sup>32–34</sup> is the number of primary care physicians per 100,000 residents (PCP count) in federal health service areas (HSA). Patients were assigned to a corresponding HSA based on their home zip code.

Visit-level factors included arrival time of index visit (8:01 AM–4:00 PM, 4:01 PM–12:00 AM, 12:01 AM–8 AM representing day, evening, and overnight arrival, respectively), day of the week, season, length of stay (LOS) in the ED during the index visit, and ED crowding (calculated as the average daily LOS/yearly average LOS for the individual ED).<sup>35</sup> We categorized the ED primary diagnosis for each visit using the major diagnosis groupings of a previously described pediatric ED-specific classification scheme.<sup>36</sup> Using International Classification of Diseases, Ninth Revision (ICD-9) codes, we identified the conditions with the highest ED revisit rates.

### Statistical Analyses

Categorical variables describing the study cohort were summarized using frequencies and percentages. Continuous variables were summarized using mean, median, and interquartile range values, where appropriate. We used 2 different hierarchical logistic regression models to assess revisit rates by patient- and visit-level characteristics. The initial model included all patients discharged from the ED following the index visit and assessed for the outcome of a revisit within 72 hours. The second model considered only patients who returned within 72 hours of an index visit and assessed for hospitalization on that return visit. We used generalized linear mixed effects models, with hospital as a random effect to account for the presence of correlated data (within hospitals),

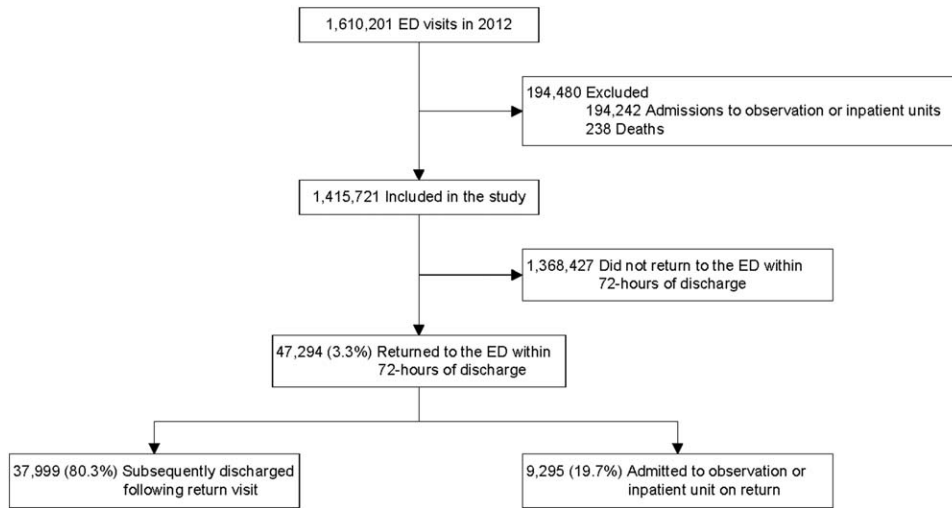


FIG. 1. Patient disposition from the emergency departments of study hospitals (n = 23) in 2012.

nonconstant variability (across hospitals), and binary responses. Adjusted odds ratios with 95% confidence intervals were used as summary measures of the effect of the individual adjusters. Adjusters were missing in fewer than 5% of patients across participating hospitals. Statistical analyses were performed using SAS version 9.3 (SAS Institute Inc., Cary, NC); 2-sided  $P$  values  $<0.004$  were considered statistically significant to account for multiple comparisons (Bonferroni-adjusted level of significance = 0.0038).

## RESULTS

### Patients

A total of 1,610,201 patients  $<18$  years of age evaluated across the 23 PHIS EDs in 2012 were included in the study. Twenty-one of the 23 EDs have academic affiliations; 10 are located in the South, 6 in the Midwest, 5 in the West, and 2 in the Northeast region of the United States. The annual ED volume for these EDs ranged from 25,090 to 136,160 (median, 65,075; interquartile range, 45,280–85,206). Of the total patients, 1,415,721 (87.9%) were discharged following the index visit and comprised our study cohort. Of these patients, 47,294 (revisit rate: 3.3%) had an ED revisit within 72 hours. There were 4015 patients (0.3%) who returned more than once within 72 hours, and the largest proportion of those returned with infection-related conditions. Of those returning, 37,999 (80.3%) were discharged again, whereas 9295 (19.7%) were admitted to the hospital (Figure 1). The demographic and clinical characteristics of study participants are displayed in Table 1.

### ED Revisit Rates and Revisits Resulting in Admission

In multivariate analyses, compared to patients who did not return to the ED, patients who returned within 72

hours of discharge had higher odds of revisit if they had the following characteristics: a chronic condition, were  $<1$  year old, a higher severity score, and public insurance. Visit-level factors associated with higher odds of revisits included arrival for the index visit during the evening or overnight shift or on a Friday or Saturday, index visit during times of lower ED crowding, and living closer to the hospital. On return, patients were more likely to be hospitalized if they had a higher severity score, a chronic condition, private insurance, or were  $<30$  days old. Visit-level factors associated with higher odds of hospitalization at revisit included an index visit during the evening and overnight shift and living further from the hospital. Although the median SES and PCP density of a patient's area of residence were not associated with greater likelihood of returning, when they returned, patients residing in an area with a lower SES and higher PCP densities ( $>78.8$  PCPs/100,000) had lower odds of being admitted to the hospital. Patients whose index visit was on a Sunday also had lower odds of being hospitalized upon return (Table 2).

### Diagnoses Associated With Return Visits

Patients with index visit diagnoses of sickle cell disease and leukemia had the highest proportion of return visits (10.7% and 7.3%, respectively). Other conditions with high revisit rates included infectious diseases such as cellulitis, bronchiolitis, and gastroenteritis. Patients with other chronic diseases such as diabetes and with devices, such as gastrostomy tubes, also had high rates of return visits. At return, the rate of hospitalization for these conditions ranged from a 1-in-6 chance of hospitalization for the diagnoses of a fever to a 1-in-2 chance of hospitalization for patients with sickle cell anemia (Table 3).

## DISCUSSION

In this nationally representative sample of free-standing children's hospitals, 3.3% of patients

**TABLE 1.** Characteristics of Patients Who Returned Within 72 Hours of ED Discharge to the Study EDs

	Index Visit, n = 1,415,721, n (%)	Return Visits Within 72 Hours of Discharge, n = 47,294, 3.3%	
		Return to Discharge, n (%)	Return to Admission, n (%)
Gender, female	659,417 (46.6)	17,665 (46.5)	4,304 (46.3)
Payor			
Commercial	379,403 (26.8)	8,388 (22.1)	3,214 (34.6)
Government	925,147 (65.4)	26,880 (70.7)	5,786 (62.3)
Other	111,171 (7.9)	2,731 (7.2)	295 (3.2)
Age			
<30 days	19,217 (1.4)	488 (1.3)	253 (2.7)
30 days to <1 year	216,967 (15.3)	8,280 (21.8)	2,372 (25.5)
1 year to 4 years	547,083 (38.6)	15,542 (40.9)	3,187 (34.3)
5 years to 11 years	409,463 (28.9)	8,906 (23.4)	1,964 (21.1)
12 years to 17 years	222,991 (15.8)	4,783 (12.6)	1,519 (16.3)
Socioeconomic status*			
<1.5 times FPL	493,770 (34.9)	13,851 (36.5)	2,879 (31.0)
1.5 to 2 times FPL	455,490 (32.2)	12,364 (32.5)	2,904 (31.2)
2 to 3 times FPL	367,557 (26.0)	9,560 (25.2)	2,714 (29.2)
>3 times FPL	98,904 (7.0)	2,224 (5.9)	798 (8.6)
Primary care physician density per 100,000 patients			
Very low	351,798 (24.9)	8,727 (23.0)	2,628 (28.3)
Low	357,099 (25.2)	9,810 (25.8)	2,067 (22.2)
Medium	347,995 (24.6)	10,186 (26.8)	2,035 (21.9)
High	358,829 (25.4)	9,276 (24.4)	2,565 (27.6)
CCC present, yes	125,774 (8.9)	4,446 (11.7)	2,825 (30.4)
Severity score			
Low severity (0,1,2)	721,061 (50.9)	17,310 (45.6)	2,955 (31.8)
High severity (3,4,5)	694,660 (49.1)	20,689 (54.5)	6,340 (68.2)
Time of arrival			
Day	533,328 (37.7)	13,449 (35.4)	3,396 (36.5)
Evening	684,873 (48.4)	18,417 (48.5)	4,378 (47.1)
Overnight	197,520 (14.0)	6,133 (16.1)	1,521 (16.4)
Season			
Winter	384,957 (27.2)	10,603 (27.9)	2,844 (30.6)
Spring	367,434 (26.0)	9,923 (26.1)	2,311 (24.9)
Summer	303,872 (21.5)	8,308 (21.9)	1,875 (20.2)
Fall	359,458 (25.4)	9,165 (24.1)	2,265 (24.4)
Weekday/weekend			
Monday	217,774 (15.4)	5,646 (14.9)	1,394 (15)
Tuesday	198,220 (14.0)	5,054 (13.3)	1,316 (14.2)
Wednesday	194,295 (13.7)	4,985 (13.1)	1,333 (14.3)
Thursday	191,950 (13.6)	5,123 (13.5)	1,234 (13.3)
Friday	190,022 (13.4)	5,449 (14.3)	1,228 (13.2)
Saturday	202,247 (14.3)	5,766 (15.2)	1,364 (14.7)
Sunday	221,213 (15.6)	5,976 (15.7)	1,426 (15.3)
Distance from hospital in miles, median (IQR)	8.3 (4.6–14.9)	9.2 (4.9–17.4)	8.3 (4.6–14.9)
ED crowding score at index visit, median (IQR)	1.0 (0.9–1.1)	1.0 (0.9–1.1)	1.0 (0.9–1.1)
ED LOS in hours at index visit, median (IQR)	2.0 (1.0–3.0)	3.0 (2.0–5.0)	2.0 (1.0–3.0)

NOTE: Abbreviations: CCC, complex chronic condition; ED, emergency department; FPL, federal poverty level; IQR, interquartile range; LOS, length of stay.

\*Socioeconomic status is relative to the federal poverty level for a family of 4.

discharged from the ED returned to the same ED within 72 hours. This rate is similar to rates previously published in studies of general EDs.<sup>11,15</sup> Of the returning children, over 80% were discharged again, and 19.7% were hospitalized, which is two-thirds more than the admission rate at index visit (12%). In accordance with previous studies,<sup>14,16,25</sup> we found higher disease severity, presence of a chronic condition, and younger age were strongly associated with both the odds of patients returning to the ED and of being hospitalized at return. Patients who were hospi-

talized lived further away from the hospital and were of a higher SES. In this study, we show that visit-level and access-related factors are also associated with increased risk of return, although to a lesser degree. Patients seen on a weekend (Friday or Saturday) were found to have higher odds of returning, whereas those seen initially on a Sunday had lower odds of hospitalization at return. In this study, we also found that patients seen on the evening or night shifts at the index presentation had a significant association with return visits and hospitalization at return.

**TABLE 2.** Multivariate Analyses of Factors Associated With ED Revisits and Admission at Return

Characteristic	Adjusted OR of 72-Hour Revisit (95% CI), n = 1,380,723	P Value	Adjusted OR of 72-Hour Revisit Admissions (95% CI), n = 46,364	P Value
Gender				
Male	0.99 (0.97–1.01)	0.2809	1.02 (0.97–1.07)	0.5179
Female	Reference		Reference	
Payor				
Government	1.14 (1.11–1.17)	<0.0001	0.68 (0.64–0.72)	<0.0001
Other	0.97 (0.92–1.01)	0.1148	0.33 (0.28–0.39)	<0.0001
Private	Reference		Reference	
Age group				
30 days to <1 year	1.32 (1.22–1.42)	<0.0001	0.58 (0.49–0.69)	<0.0001
1 year to 5 years	0.89 (0.83–0.96)	0.003	0.41 (0.34–0.48)	<0.0001
5 years to 11 years	0.69 (0.64–0.74)	<0.0001	0.40 (0.33–0.48)	<0.0001
12 years to 17 years	0.72 (0.66–0.77)	<0.0001	0.50 (0.42–0.60)	<0.0001
<30 days	Reference		Reference	
Socioeconomic status*				
% <1.5 times FPL	0.96 (0.92–1.01)	0.0992	0.82 (0.74–0.92)	0.0005
% 1.5 to 2 times FPL	0.98 (0.94–1.02)	0.2992	0.83 (0.75–0.92)	0.0005
% 2 to 3 times FPL	1.02 (0.98–1.07)	0.292	0.88 (0.79–0.97)	0.01
% >3 times FPL	Reference		Reference	
Severity score				
High severity, 4, 5, 6	1.43 (1.40–1.45)	<0.0001	3.42 (3.23–3.62)	<0.0001
Low severity, 1, 2, 3	Reference		Reference	
Presence of any CCC				
Yes	1.90 (1.86–1.96)	<0.0001	2.92 (2.75–3.10)	<0.0001
No	Reference		Reference	
Time of arrival				
Evening	1.05 (1.03–1.08)	<0.0001	1.37 (1.29–1.44)	<0.0001
Overnight	1.19 (1.15–1.22)	<0.0001	1.84 (1.71–1.97)	<0.0001
Day	Reference		Reference	
Season				
Winter	1.09 (1.06–1.11)	<0.0001	1.06 (0.99–1.14)	0.0722
Spring	1.07 (1.04–1.10)	<0.0001	0.98 (0.91–1.046)	0.4763
Summer	1.05 (1.02–1.08)	0.0011	0.93 (0.87–1.01)	0.0729
Fall	Reference		Reference	
Weekday/weekend				
Thursday	1.02 (0.982–1.055)	0.3297	0.983 (0.897–1.078)	0.7185
Friday	1.08 (1.04–1.11)	<0.0001	1.03 (0.94–1.13)	0.5832
Saturday	1.08 (1.04–1.12)	<0.0001	0.89 (0.81–0.97)	0.0112
Sunday	1.02 (0.99–1.06)	0.2054	0.81 (0.74–0.89)	<0.0001
Monday	1.00 (0.96–1.03)	0.8928	0.98 (0.90–1.07)	0.6647
Tuesday	0.99 (0.95–1.03)	0.5342	0.93 (0.85–1.02)	0.1417
Wednesday	Reference		Reference	
PCP ratio per 100,000 patients				
57.2–67.9	1.00 (0.96–1.04)	0.8844	0.93 (0.84–1.03)	0.1669
68.0–78.7	1.00 (0.95–1.04)	0.8156	0.86 (0.77–0.96)	0.0066
>78.8	1.00 (0.95–1.04)	0.6883	0.82 (0.73–0.92)	0.001
<57.2	Reference		Reference	
ED crowding score at index visit <sup>†</sup>				
2	0.92 (0.90–0.95)	<0.0001	0.96 (0.88–1.05)	0.3435
1	Reference		Reference	
Distance from hospital <sup>‡</sup>				
3.168, 23.6 miles	0.95 (0.94–0.96)	<0.0001	1.16 (1.12–1.19)	<0.0001
2.168, 8.7 miles	Reference		Reference	
ED LOS at index visit <sup>†</sup>				
3.7 hours	1.003 (1.001–1.005)	0.0052	NA	
2.7 hours	Reference			

NOTE: Effects of continuous variables are assessed as 1-unit offsets from the mean. Abbreviations: CCC, complex chronic condition; CI, confidence interval; ED, emergency department; FPL, federal poverty level; LOS, length of stay; OR, odds ratio, NA, not applicable.

\*Socioeconomic status is relative to the FPL for a family of 4.

<sup>†</sup>ED crowding score and LOS are based on index visit. ED crowding score is calculated as the daily LOS (in hours)/overall LOS (in hours). Overall average across hospitals = 1; a 1-unit increase translates into twice the duration for the daily LOS over the yearly average ED LOS.

<sup>‡</sup>Modeled as the natural log of the patient geographic distance from the hospital based on zip codes. Number in parentheses represents the exponential of the modeled variable.

**TABLE 3.** Major Diagnostic Subgroups With the Highest ED Revisit and Admission at Return Rates

Major Diagnostic Subgroup	No. of Index ED Visit Discharges*	72-Hour Revisit, % (95% CI)	Admitted on Return, % (95% CI)
Sickle cell anemia	2,531	10.7 (9.5–11.9)	49.6 (43.7–55.6)
Neoplastic diseases, cancer	536	7.3 (5.1–9.5)	36 (21–51)
Infectious gastrointestinal diseases	802	7.2 (5.4–9.0)	21 (10–31)
Devices and complications of the circulatory system†	1,033	6.9 (5.3–8.4)	45 (34–57)
Other hematologic diseases†	1,538	6.1 (4.9–7.3)	33 (24–43)
Fever	80,626	5.9 (5.7–6.0)	16.3 (15.2–17.3)
Dehydration	7,362	5.4 (5.2–5.5)	34.6 (30.1–39)
Infectious respiratory diseases	72,652	5.4 (5.2–5.5)	28.6 (27.2–30)
Seizures	17,637	5.3 (4.9–5.6)	33.3 (30.3–36.4)
Other devices and complications†	1,896	5.3 (4.3–6.3)	39.0 (29.4–48.6)
Infectious skin, dermatologic and soft tissue diseases	40,272	4.7 (4.5–5)	20.0 (18.2–21.8)
Devices and complications of the gastrointestinal system†	4,692	4.6 (4.0–5.2)	24.7 (18.9–30.4)
Vomiting	44,730	4.4 (4.2–4.6)	23.7 (21.8–25.6)
Infectious urinary tract diseases	17,020	4.4 (4.1–4.7)	25.9 (22.7–29)
Headache	19,016	4.3 (4.1–4.6)	28.2 (25.1–31.3)
Diabetes mellitus	1,531	4.5 (3.3–5.3)	29 (18–40)
Abdominal pain	39,594	4.2 (4–4.4)	24.8 (22.7–26.8)
Other infectious diseases†	647	4.2 (2.6–5.7)	33 (16–51)
Gastroenteritis	55,613	4.0 (3.8–4.1)	20.6 (18.9–22.3)

NOTE: Abbreviations: CI, confidence interval; ED, emergency department; NOS, not otherwise specified.

\*Diagnoses with <50 index visits (ie, <2 visits per month across the 23 hospitals) or <30 revisits within entire study cohort excluded from analyses.

†Most prevalent diagnoses as identified by International Classification of Diseases, Ninth Revision codes within specified major diagnostic subgroups: devices and complications of the circulatory system, complication of other vascular device, implant, and graft; other hematologic diseases, anemia NOS, neutropenia NOS, or thrombocytopenia NOS; other devices and complications, hemorrhage complicating a procedure; devices and complications of the gastrointestinal system, gastrostomy; other infectious diseases, perinatal infections.

Additionally, we found that although PCP density was not associated with the odds of returning to the ED, patients from areas with a higher PCP density were less likely to be admitted at return. In addition, by evaluating the diagnoses of patients who returned, we found that many infectious conditions commonly seen in the ED also had high return rates.

As previously shown,<sup>23</sup> we found that patients with complex and chronic diseases were at risk for ED revisits, especially patients with sickle cell anemia and cancer (mainly acute leukemia). In addition, patients with a chronic condition were 3 times more likely to be hospitalized when they returned. These findings may indicate an opportunity for improved discharge planning and coordination of care with subspecialty care providers for particularly at-risk populations, or stronger consideration of admission at the index visit. However, admission for these patients at revisit may be unavoidable.

Excluding patients with chronic and complex conditions, the majority of conditions with high revisit rates were acute infectious conditions. One national study showed that >70% of ED revisits by patients with infectious conditions had planned ED follow-up.<sup>13</sup> Although this study was unable to assess the reasons for return or admission at return, children with infectious diseases often worsen over time (eg, those with bronchiolitis). The relatively low admission rates at return for these conditions, despite evidence that providers may have a lower threshold for admission when a patient returns to the ED shortly after dis-

charge,<sup>24</sup> may reflect the potential for improving follow-up at the PCP office. However, although some revisits may be prevented,<sup>37,38</sup> we recognize that an ED visit could be appropriate and necessary for some of these children, especially those without primary care.

Access to primary care and insurance status influence ED utilization.<sup>14,39–41</sup> A fragmented healthcare system with poor access to primary care is strongly associated with utilization of the ED for nonurgent care. A high ED revisit rate might be indicative of poor coordination between ED and outpatient services.<sup>9,39,42–46</sup> Our study's finding of increased risk of return visit if the index visit occurred on a Friday or Saturday, and a decreased likelihood of subsequent admission when a patient returns on a Sunday, may suggest limited or perceived limited access to the PCP over a weekend. Although insured patients tend to use the ED less often for nonemergent cases, even when patients have PCPs, they might still choose to return to the ED out of convenience.<sup>47,48</sup> This may be reflected in our finding that, when adjusted for insurance status and PCP density, patients who lived closer to the hospital were more likely to return, but less likely to be admitted, thereby suggesting proximity as a factor in the decision to return. It is also possible that patients residing further away returned to another institution. Although PCP density did not seem to be associated with revisits, patients who lived in areas with higher PCP density were less likely to be admitted when they returned. In this study, there was a

stepwise gradient in the effect of PCP density on the odds of being hospitalized on return with those patients in areas with fewer PCPs being admitted at higher rates on return. Guttman et al.,<sup>40</sup> in a recent study conducted in Canada where there is universal health insurance, showed that children residing in areas with higher PCP densities had higher rates of PCP visits but lower rates of ED visits compared to children residing in areas with lower PCP densities. It is possible that emergency physicians have more confidence that patients will have dedicated follow-up when a PCP can be identified. These findings suggest that the development of PCP networks with expanded access, such as alignment of office hours with parent need and patient/parent education about PCP availability, may reduce ED revisits. Alternatively, creation of centralized hospital-based urgent care centers for evening, night, and weekend visits may benefit both the patient and the PCP and avoid ED revisits and associated costs.

Targeting and eliminating disparities in care might also play a role in reducing ED revisits. Prior studies have shown that publicly insured individuals, in particular, frequently use the ED as their usual source of care and are more likely to return to the ED within 72 hours of an initial visit.<sup>23,39,44,49,50</sup> Likewise, we found that patients with public insurance were more likely to return but less likely to be admitted on revisit. After controlling for disease severity and other demographic variables, patients with public insurance and of lower socioeconomic status still had lower odds of being hospitalized following a revisit. This might also signify an increase of avoidable hospitalizations among patients of higher SES or with private insurance. Further investigation is needed to explore the reasons for these differences and to identify effective interventions to eliminate disparities.

Our findings have implications for emergency care, ambulatory care, and the larger healthcare system. First, ED revisits are costly and contribute to already overburdened EDs.<sup>10,11</sup> The average ED visit incurs charges that are 2 to 5 times more than an outpatient office visit.<sup>49,50</sup> Careful coordination of ambulatory and ED services could not only ensure optimal care for patients, but could save the US healthcare system billions of dollars in potentially avoidable healthcare expenditures.<sup>49,50</sup> Second, prior studies have demonstrated a consistent relationship between poor access to primary care and increased use of the ED for non-urgent conditions.<sup>42</sup> Publicly insured patients have been shown to have disproportionately increased difficulty acquiring and accessing primary care.<sup>41,42,47,51</sup> Furthermore, conditions with high ED revisit rates are similar to conditions reported by Berry et al.<sup>4</sup> as having the highest hospital readmission rates such as cancer, sickle cell anemia, seizure, pneumonia, asthma, and gastroenteritis. This might suggest a close relationship between 72-hour ED revisits and 30-day hos-

pital readmissions. In light of the recent expansion of health insurance coverage to an additional 30 million individuals, the need for better coordination of services throughout the entire continuum of care, including primary care, ED, and inpatient services, has never been more important.<sup>52</sup> Future improvements could explore condition-specific revisit or readmission rates to identify the most effective interventions to reduce the possibly preventable returns.

This study has several limitations. First, as an administrative database, PHIS has limited clinical data, and reasons for return visits could not be assessed. Variations between hospitals in diagnostic coding might also lead to misclassification bias. Second, we were unable to assess return visits to a different ED. Thus, we may have underestimated revisit frequency. However, because children are generally more likely to seek repeat care in the same hospital,<sup>3</sup> we believe our estimate of return visit rate approximates the actual return visit rate; our findings are also similar to previously reported rates. Third, for the PCP density factor, we were unable to account for types of insurance each physician accepted and influence on return rates. Fourth, return visits in our sample could have been for conditions unrelated to the diagnosis at index visit, though the short timeframe considered for revisits makes this less likely. In addition, the crowding index does not include the proportion of occupied beds at the precise moment of the index visit. Finally, this cohort includes only children seen in the EDs of pediatric hospitals, and our findings may not be generalizable to all EDs who provide care for ill and injured children.

We have shown that, in addition to previously identified patient level factors, there are visit-level and access-related factors associated with pediatric ED return visits. Eighty percent are discharged again, and almost one-fifth of returning patients are admitted to the hospital. Admitted patients tend to be younger, sicker, chronically ill, and live farther from the hospital. By being aware of patients' comorbidities, PCP access, as well as certain diagnoses associated with high rates of return, physicians may better target interventions to optimize care. This may include having a lower threshold for hospitalization at the initial visit for children at high risk of return, and communication with the PCP at the time of discharge to ensure close follow-up. Our study helps to provide benchmarks around ED revisit rates, and may serve as a starting point to better understand variation in care. Future efforts should aim to find creative solutions at individual institutions, with the goal of disseminating and replicating successes more broadly. For example, investigators in Boston have shown that the use of a comprehensive home-based asthma management program has been successful in decreasing emergency department visits and hospitalization rates.<sup>53</sup> It is possible that this approach could be spread to other

institutions to decrease revisits for patients with asthma. As a next step, the authors have undertaken an investigation to identify hospital-level characteristics that may be associated with rates of return visits.

### Acknowledgements

The authors thank the following members of the PHIS ED Return Visits Research Group for their contributions to the data analysis plan and interpretation of results of this study: Rustin Morse, MD, Children's Medical Center of Dallas; Catherine Perron, MD, Boston Children's Hospital; John Cheng, MD, Children's Healthcare of Atlanta; Shabnam Jain, MD, MPH, Children's Healthcare of Atlanta; and Amanda Montalbano, MD, MPH, Children's Mercy Hospitals and Clinics. These contributors did not receive compensation for their help with this work.

Disclosures: A.T.A. and A.M.S. conceived the study and developed the initial study design. All authors were involved in the development of the final study design and data analysis plan. C.W.T. collected and analyzed the data. A.T.A. and C.W.T. had full access to all of the data and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors were involved in the interpretation of the data. A.T.A. drafted the article, and all authors made critical revisions to the initial draft and subsequent versions. A.T.A. and A.M.S. take full responsibility for the article as a whole. The authors report no conflicts of interest.

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