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Factors associated with length of stay and 30-day revisits in pediatric acute pancreatitis

Anna C. Gay, MD[1,2], **Nicolas Barreto, MPH**[3], **Sheree M. Schrager, PhD, MS**[1], and **Christopher J. Russell, MD, MS**[1,2]

[1]Division of Hospital Medicine, Children's Hospital Los Angeles, Los Angeles, California

[2]Department of Pediatrics, Keck School of Medicine, University of Southern California

[3]Claremont Graduate University, Claremont, California

Abstract

Objective—Identify factors associated with length of stay (LOS) and 30-day hospital revisit for patients hospitalized with acute pancreatitis (AP).

Method—Multicenter, retrospective cohort study using the Pediatric Health Information System database. Multilevel linear and logistic regression was used to identify factors independently associated with the primary outcome variables of LOS and 30-day hospital revisit in children aged 1–18 years discharged with a primary discharge diagnosis of AP from participating hospitals between 2008 and 2013.

Results—For the 7693 discharges, median LOS was 4 days (interquartile range 3–7 days) and 30-day revisit rate 17.6% (n=1356). Discharges were primarily female (55%), Caucasian (46%), and six years old or older (85%). On multilevel regression, factors independently associated with both longer LOS and higher revisit odds included malignant and gastrointestinal complex chronic conditions and total parenteral nutrition (TPN) use while hospitalized. Male gender was associated with both lower LOS (aLOS= −0.6 days, 95% CI= −0.8, −0.4) and decreased revisit odds (aOR 0.85; 95% CI= 0.74, 0.97). Hispanic ethnicity was associated with increased LOS (aLOS=+0.8 days, 95% CI= +0.5, +1.1) but no change in revisit odds.

Conclusions—Certain demographic and clinical factors, including gender, ethnicity, and type of complex chronic condition, were independently associated with LOS and risk of 30-day hospital revisit for pediatric AP. Children with malignant and gastrointestinal complex chronic conditions who require TPN are at highest risk for both longer LOS and hospital revisit when admitted with

Address correspondence to: Christopher J. Russell, MD, Division of Hospital Medicine, Children's Hospital Los Angeles, 4650 Sunset Blvd, Mailstop #94, Los Angeles, CA 90027, crussell@chla.usc.edu, Telephone: 323-361-6177, Fax: 323-361-8106.

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Dr. Gay conceptualized and designed the study, drafted the initial manuscript, and approved the final manuscript as submitted.

Mr. Barreto conducted the statistical analyses, drafted and revised the manuscript and approved the final manuscript as submitted.

Dr. Schrager supervised the statistical analyses, reviewed and critically revised the manuscript and approved the final manuscript as submitted.

Dr. Russell conceptualized and designed the study, critically revised the manuscript and approved the final manuscript as submitted.

AP. These patient populations may benefit from intensive care coordination when hospitalized for AP.

Introduction

Acute pancreatitis (AP) is a clinical condition in which injury to the pancreas leads to an inflammatory response either within the pancreas or nearby structures. A consensus statement published by the INSPPIRE consortium (International Study Group of Pediatric Pancreatitis: in Search for a Cure) defines AP as the presence of 2 out of 3 criteria: 1) abdominal pain suggestive of AP, 2) amylase and/or lipase elevation at least 3 times greater than the upper limit of normal, and 3) imaging findings compatible with a diagnosis of AP.[1] Recent work has demonstrated a rising incidence of AP among children,[2–4] with two large national database studies noting increased cases between 2000 and 2012.[5, 6] Pediatric AP is a costly diagnosis, leading to an estimated $200 million/year in inpatient charges, with the cost per hospitalization increasing in the first decade of this century to a median of $20,000.[5, 7, 8] AP as experienced by children is different from adults, not only in terms of etiology, but also in clinical course and outcome as severity scores used to grade adult AP have been shown to have limited applicability to children.[9–12]

Better characterization of the natural history of AP in children is thus needed. Previous research has utilized single-center studies and focused on epidemiological trends, while few studies have looked at the natural history of the disease in children or used large, national databases.[5, 6, 8, 13, 14] Length of stay (LOS) and 30-day readmission rates are widely used quality metrics, and as noted above, both the incidence and cost of hospitalizations for pediatric AP are rising. A recent study in adults demonstrated higher mortality among patients readmitted with within 30 days after acute pancreatitis admission.[15] Similarly, a recent study in children has shown rates of acute recurrent pancreatitis in children higher than previously appreciated.[8] To our knowledge, no previous studies have identified risk factors contributing to these metrics among pediatric patients hospitalized with AP. Therefore, this study sought to identify factors associated with: 1) LOS, and 2) all-cause revisits within 30 days in children hospitalized with AP utilizing a large database containing administrative and financial data from a majority of children's hospitals across the United States.

Methods

Study Design and Data Source

We conducted a retrospective cohort study utilizing administrative data from hospitals contributing to the Pediatric Health Information System (PHIS) database between 2008 and 2013. The PHIS database is maintained by the Children's Hospital Association (Overland Park, KS) and includes clinical and resource utilization data from inpatient, emergency, ambulatory surgery, and observation units at more than 45 tertiary-care children's hospitals in the United States. The data are subject to numerous validity and reliability checks before incorporation into the database. Data warehouse function is provided by Truven Health Analytics (Ann Arbor, MI). Data are de-identified at the time of submission to PHIS, and every hospital and patient is assigned a unique identifier, allowing for longitudinal tracking

of patients over time. The study was reviewed and granted an exemption per 45 CFR 46.101[b][4] by the Institutional Review Board at Children's Hospital Los Angeles.

Study Population

Children discharged from all PHIS hospitals between January 1, 2008 and December 31, 2013 with the following characteristics were identified: 1) age 1–18 years, 2) discharged from inpatient status, 3) primary discharge diagnosis of AP as defined by the International Classification of Disease 9 (*ICD-9-CM*) code 577.0 (which is the sole code for this condition). We excluded children admitted under an observation status code, transferred from an inpatient status at an outside hospital to a PHIS-participating hospital, and 34 children who died during the index admission.

Outcome Variables

The primary outcomes were LOS and 30-day all-cause revisit. We defined revisit as any urgent hospital reutilization, including readmission to an inpatient unit, observation unit, or emergency department. We chose to examine all-cause revisits, rather than hospital readmission or AP-specific readmission, because it represents resource utilization even if not tied to original hospitalization for AP and because it is difficult to assess if the revisit was related to the index hospitalization using administrative data alone. If a patient had >1 revisit in ≤30 days, only the first revisit was considered for analysis.

Covariates

Demographic covariates of interest included sex, age (categorized as preschool, 1–5 years; school age, 6–13 years; and adolescent, 14–18 years), race/ethnicity (categorized as non-Hispanic white, non-Hispanic black, Hispanic, and other), payer status (categorized as private, public, and self-pay/other), and census region (categorized as Northeast, South, Midwest, and West). Medical characteristics included type of complex chronic condition (CCC) based on the classification system defined by Feudtner et al,[16] treatment in an intensive care unit (ICU), use of total parental nutrition (TPN), and performance of a diagnostic or therapeutic procedure related to AP during index hospitalization (e.g. cholecystectomy (CCY), endoscopic retrograde pancreatectomy (ERCP); see Supplemental Table for a list of procedures included in the analysis). Additionally, for the 30-day revisit model, we included LOS.

Statistical Analysis

Multilevel regression analyses were used to examine all relationships between individual risk factors and outcome measures. These relationships were first examined via bivariate multilevel linear regression examining LOS via unadjusted estimates measured in number of days and bivariate logistic regression predicting revisit within 30 days through unadjusted odds ratios. LOS was non-normally distributed and was transformed using a natural logarithm. For all analyses, the natural logarithm of LOS was used, but was converted back when reporting results. 95% confidence intervals (CI) were calculated for all estimated coefficients. Multilevel multiple regression analyses subsequently incorporated all risk factors that were significantly associated with one or both outcome measures in the bivariate

analyses while adjusting for all covariates. A three-level multilevel model was initially examined (discharge, patient, and hospital); however, very low variance was observed at the hospital level (3.5%), and so the final model was reduced to two levels (discharges nested within patient). The discharge level included conditions unique to a patient's discharge or that changed over time (e.g. patient age, CCC as patients may develop more CCCs over time, performance of a procedure during index hospitalization hospitalization), and the patient level included demographic factors that were the same over time within the same patient (e.g. race/ethnicity). Outcomes are reported as change in adjusted LOS in days and adjusted odds ratios (aOR) for hospital revisit. All analyses used two-tailed tests with an a priori significance level of $\alpha = 0.05$. Data analyses were performed with SAS software (version 9.4; SAS Institute, Inc, Cary, NC).

Results

The sample consisted of 5507 unique patients and 7693 discharges in the time period studied (Table 1). The median LOS for the entire cohort was 4 days (interquartile range (IQR) 3–7). Based on the intra-class correlation for the multilevel, multivariate linear regression model for LOS, 41.4% of the variance in LOS was at the patient level. There was a 30-day all cause revisit rate of 17.6% (n=1356; 95% CI 16.7%, 18.5%), and 76% of revisits were admitted to either an inpatient or observation unit. The median time-to-revisit was 11 days (IQR 5–19). Of these revisits, 22.4% (n=490) were for acute pancreatitis; the median time-to-pancreatitis revisit was 12 days (IQR 5–19). For acute pancreatitis readmissions, median length of stay was 5 days (IQR 3–8) and median costs $10,700 (IQR $6,700–$22,500). In the multilevel, multivariate logistic regression model for 30-day all-cause revisit, variability attributable to the patient level was 31%.

Demographic Variables

The median age of patients discharged with a primary diagnosis of AP was 12 years (IQR 8–15). A majority of discharges were female (55.0%, n=4230) and a plurality white/non-Hispanic (45.8%, n=3526). Payer type was divided between public (48.9%, n=3757) and private (43.9%, n=3379) insurance. In our multilevel, multivariate analysis of factors associated with LOS (Table 2) and 30-day revisit (Table 3), male sex was the only patient-level variable significantly associated with both outcomes of interest. Male sex was independently associated with both a decreased LOS (aLOS −0.52; 95% C.I −0.71, −0.32) and decreased odds of 30-day revisit (aOR 0.85; 95% C.I. 0.74, 0.97). Hispanics had an increased LOS (aLOS +0.6 days; 95% C.I. 0.34, 0.93) but no change in revisit odds (aOR 0.89; 955 C.I. 0.74, 1.07).

Complex Chronic Conditions

Complex chronic conditions were common with 42% (n=3257) having one or more CCC; the most frequent CCCs included gastrointestinal, metabolic, and neurologic CCCs (Table 1). All CCCs were associated with an increased LOS (Table 2), but only some CCCs impacted 30-day revisit odds (Table 3). Children with malignancies had the longest LOS (aLOS +1.89; 95% C.I 1.4–2.4) followed by children with neuromuscular conditions (aLOS +1.73; 95% C.I. 1.26, 2.22; Table 2). Similarly, children with malignancies had the highest

odds of 30-day revisit (aOR 3.15; 95% C.I. 2.57, 3.88) and children with GI CCCs (aOR 1.6; 95% C.I. 1.33, 1.88) had the second highest odds (Table 3).

Hospitalization Characteristics

The largest proportion of discharges were from hospitals in the Midwest (38%, n=2935). Discharge from a Midwest hospital was associated with a 0.6 day decreased adjusted LOS (95% CI −0.95, −0.32). Just over 17% of discharges in the cohort received TPN (n=1332), 6% received treatment in an ICU setting (n=464), and 8.5% underwent a procedure or operation during their index hospitalization (n=650). Treatment in an ICU setting, TPN use, and performance of a procedure during index hospitalization were associated with large, multi-day increases in LOS. While ICU care was not associated with increased odds of a revisit in 30 days, TPN use was (aOR: 1.59; 95% CI: 1.33, 1.91). Conversely, undergoing a procedure decreased 30-day revisits odds (aOR 0.62; 95% CI 0.47, 0.83). Each one day increase in LOS conferred only a slight increase in the odds of 30-day revisit (aOR: 1.01; 95% CI 1.00, 1.02).

Discussion

To our knowledge, this is the first study to use a large, national database to investigate factors associated with LOS and 30-day all cause revisits in pediatric patients hospitalized with AP. Our study builds upon recent work characterizing epidemiological trends in acute and acute recurrent pancreatitis in pediatric patients hospitalized in the US in that it uses multilevel regression analysis to study a large number of risk factors.[5, 6, 8] We have demonstrated that certain demographic and clinical factors were independently associated with increased LOS and higher odds of 30-day all-cause revisit. We found that children with AP had a median LOS of 4 days and that AP was more common in older children and adolescents, consistent with previous work.[5, 6] Just under a quarter of patients in our cohort (22.4%) were re-hospitalized for acute pancreatitis within 30 days. This proportion is lower than the 42% found in a recent study by Pant et al using the PHIS database, although not contradictory due to different follow-up times.[8] Our findings of associations between Hispanic ethnicity, neuromuscular complex chronic conditions, AP-related procedures and differential outcomes are unique contributions to the literature.

We found that Hispanic patients had a longer LOS with no difference in 30-day revisit odds. Hispanic pediatric patients have higher prevalence of overweight and obesity[17–20] with increasing incidence in Hispanic females[21] which may explain the increased odds for biliary pancreatitis (e.g., obstruction of the common bile duct due to gallstones, sludge, etc.)[22] found in Hispanic pediatric patients. This form of pancreatitis may be associated with higher rates of procedural intervention to remove gallstones or perform sphincterotomy (e.g., ERCP, CCY) which, in our study, was independently associated with increased LOS but lower hospital revisits as the procedure treats the underlying pancreatitis cause. Indeed, CCY has been shown to lower readmission rates in adult patients in numerous studies,[23, 24] as well as a recent single center study focused on pediatric patients,[25] and CCY during index hospitalization is endorsed by the American College of Gastroenterology.[26]Additional causes of longer LOS in Hispanic patients may be due to delayed diagnosis, concerns about

post-discharge follow-up, differences in clinical conditions (e.g. pain control, feeding tolerance) or other unmeasured factors. Although previous studies have noted an increase in readmissions in Hispanic pediatric patients,[27, 28] our study found no difference in risk of readmission in Hispanic patients.

We found that malignancy and neurologic CCCs were associated with the longest LOS and highest revisit rates. These findings are consistent with previous literature showing that children with neurological impairment (NI) have longer LOS both in general and for specific clinical conditions when compared to other CCCs.[29, 30] There are several potential explanations for these findings with respect to pediatric AP. First, AP is a known adverse effect of certain anti-epileptic agents and chemotherapeutic agents, especially valproic acid and aspariginase.[31, 32] Second, it is plausible that children with malignancies or NI may have higher illness severity or prolonged recovery times compared to peers with other CCCs. In the case of children with malignancies, this may be due to fever and neutropenia induced by chemotherapeutic medications or sepsis due to immunosuppression. For children with NI, prolonged recovery or higher illness severity could be attributed to their neurologic dysfunction and perhaps GI dysfunction secondary to their NI. Additionally, children with NI may experience higher rates of adverse events because of communication challenges. Clinicians could have difficulty accurately assessing the resolution of acute pancreatitis in children with NI who are unable to effectively communicate pain and may rely on biomarker improvement (e.g., lipase), leading to longer LOS. Related to this, clinicians may approach pain management or dietary advancement differently in this population which again may be reflected in longer LOS. The higher odds of revisit seen in children with malignancies may be a reflection of the frequency of fever and neutropenia or sepsis in these children compared to the larger population, or it could be a reflection of scheduled chemotherapy visits as our analysis did not identify the diagnoses prompting the revisit.

Children discharged from Midwestern hospitals had shorter LOS compared to children discharged from hospitals in other parts of the country without an effect on 30 day revisit rates. Treatment approaches may vary regionally and could possibly explain this finding; studying national variations in care should be an area of future research. It is not surprising that care in an ICU setting and/or TPN use result in LOS as these are proxy markers for illness severity.

Our study had several limitations. First, it is a retrospective, observational study that can only assess for association and cannot determine causality. The findings are limited to the sociodemographic, temporal, and health status variables available in PHIS, and it is possible that not all hospitals in our sample contributed complete data. Certain additional variables that we were unable to study, such as number of doses of specific medications administered or use of tube feeding, may have affected our outcomes. We could only study patients cared for by hospitals participating in the PHIS database, and thus may have inadvertently missed children cared for at community hospitals excluded from the PHIS database or children's hospitals who do not contribute to PHIS, affecting the generalizability of our results. Additionally, we were unable to track revisits to non-PHIS hospitals; therefore, we may not be capturing all revisits for our studied cohort if they re-presented to non-PHIS hospitals. While the PHIS database employs stringent quality control measures, the administrative data

contained therein depends on accurate coding and translation of existing data and our inclusion criteria may miss patients who were hospitalized for AP but who at discharge were not assigned the representative *ICD-9-CM* code.

Despite these limitations, our study has several important implications. Although the identified risk factors are largely non-modifiable, they help to identify pediatric patients hospitalized with acute pancreatitis that are at increased risks for poorer outcomes. In particular, children with certain CCCs (e.g., gastrointestinal, hematologic, and oncologic) and TPN use are at risk for both increased LOS and 30-day revisits. This argues for lower index of suspicion of an acute pancreatitis diagnosis, identifying strategies to maximize nutritional support (e.g., transpyloric nasojejunal feedings) and maximizing pain management. Further, this population may benefit from heightened care coordination during hospitalizations to mitigate hospital revisit.

In conclusion, we have identified specific factors associated with longer LOS and increased odds for 30-day hospital revisit in pediatric patients admitted with acute pancreatitis. We have identified that pediatric patients with neuromuscular disease or malignancy and who require TPN are at the highest risk of longer LOS and revisits when hospitalized with AP. These patient populations may benefit from intensive care coordination when hospitalized for AP. Future research should focus on: (1) development of evidence-based clinical practice guidelines for management of children hospitalized with AP, and (2) development of interventions for specific populations (children with complex chronic conditions, children receiving TPN) to minimize post-discharge urgent hospital reutilization.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

AP	acute pancreatitis
aLOS	adjusted length of stay
aOR	adjusted odds ratio
CCC	complex chronic condition
CCY	cholecystectomy

CI	confidence interval
ERCP	endoscopic retrograde pancreatectomy
ICD	International Classification of Diseases
ICU	intensive care unit
IQR	interquartile range
LOS	length of stay
PHIS	Pediatric Health Information System
TPN	total parenteral nutrition

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What is Known

- Acute pancreatitis (AP) is an increasingly common and costly diagnosis in pediatric patients.
- The etiology and risk factors for AP in the pediatric population differ from adults.
- There are no standard guidelines for the management of pediatric AP.

What is New

- The all-cause 30-day ED/hospital revisit rates after AP discharge was 17.6%.
- Male gender was associated with both lower length of stay (LOS) and decreased revisit odds
- AP-associated surgical/endoscopic procedures were associated with increased length of stay and decreased revisit odds
- Patients with underlying malignancies who require total parenteral nutrition were at highest risk for these outcomes.

Table 1

Demographic characteristics of pediatric acute pancreatitis discharges in the study population, stratified by 30-day revisit (n=5507 unique patients)

		Hospital Revisit within 30 days		
Variable	**Total Sample**	**No**	**Yes**	**p-value**
N (%)	7693 (100%)	6337 (82.4%)	1356 (17.6%)	
Discharge-level variables				
Age				
1–5 yr	1145 (14.9%)	918 (14.5%)	236 (17.4%)	
6–13 yr	3433 (44.6%)	2841 (44.8%)	592 (43.7%)	0.01
14–18 yr	3106 (40.3%)	2578 (40.7%)	528 (38.9%)	0.01
Complex Chronic Conditions				
Cardiovascular	324 (4.2%)	241 (3.8%)	83 (6.1%)	<0.001
GI	1520 (19.5%)	1156 (18.2%)	364 (26.8%)	<0.001
Hematologic	373 (4.8%)	267 (4.2%)	106 (7.8%)	<0.001
Oncologic (Malignancy)	578 (7.5%)	367 (5.8%)	211 (15.6%)	<0.001
Metabolic/genetic	803 (10.4%)	639 (10.1%)	164 (12.1%)	0.03
Neurologic	666 (8.7%)	478 (7.5%)	188 (13.9%)	<0.001
Renal	310 (4%)	231(3.6%)	79 (5.8%)	<0.001
Respiratory	306 (4%)	245 (3.9%)	61 (4.5%)	0.28
Congenital	438 (5.7%)	337 (5.3%)	101 (7.4%)	0.002
Insurance				
Public	3757 (48.9%)	3084 (48.6%)	673 (49.6%)	
Private	3379 (43.9%)	2786 (44%)	593 (43.7%)	0.69
Self-pay/other	557 (7.2%)	467 (7.4%)	90 (6.7%)	0.31
Severity Markers				
ICU stay	464 (6%)	331 (5.2%)	133 (9.8%)	<0.001
TPN use	1332 (17.3%)	966 (15.2%)	366 (27%)	<0.001
Procedure				
Yes	650 (8.5%)	569 (9.0%)	81 (6.0%)	
No	7043 (91.6%)	5768 (91.0%)	1275 (94.0%)	<0.001
Patient-level variables				
Sex				
Female	4230 (55%)	3475 (54.8%)	755 (55.7%)	
Male	3463 (45%)	2862 (45.2%)	601 (44.3%)	0.57
Race				
White (non-Hispanic)	3526 (45.8%)	2884 (45.5%)	642 (47.3%)	

		Hospital Revisit within 30 days		
Variable	**Total Sample**	**No**	**Yes**	**p-value**
Black (non-Hispanic)	887 (11.5%)	709 (11.2%)	178 (13.1%)	0.14
Hispanic	2125 (27.6%)	1788 (28.2%)	337 (24.9%)	0.03
Other/missing (non-Hispanic)	1155 (15.1%)	956 (15.1%)	199 (14.7%)	0.60
Hospital-level variables				
Census Region				
Northeast	2048 (26.6%)	1702 (26.9%)	346 (25.5%)	
South	1089 (14.2%)	916 (14.4%)	173 (12.8%)	0.47
Midwest	2935 (38.2%)	2406 (38%)	529 (39%)	0.30
West	1621 (21%)	1313 (20.7%)	308 (22.7%)	0.10

Table 2

Multilevel, multivariate analysis linear regression of factors associated with length of stay for pediatric patients admitted with acute pancreatitis

Variable	Change in LOS in days (95% CI)	p-value
Discharge-level variables		
Age		
1–5 yr	Ref	N/A
6–13 yr	−0.19 (−0.51, 0.14)	0.26
14–18 yr	0.14 (−0.20, 0.49)	0.434
Complex Chronic Conditions		
Cardiovascular	0.95 (0.44, 1.51)	<0.001
Congenital	0.52 (0.07, 0.99)	0.02
GI	0.61 (0.35, 0.88)	<0.001
Hematologic	1.25 (0.73, 1.81)	<0.001
Malignancy (Oncologic)	1.89 (1.40, 2.40)	<0.001
Metabolic	1.11 (0.73, 1.50)	<0.001
Neuromuscular	1.73 (1.26, 2.22)	<0.001
Renal	1.25 (0.69, 1.87)	<0.001
Respiratory	1.04 (0.44, 1.69)	<0.001
Insurance		
Public	Ref	N/A
Private	−0.02 (−0.26, 0.22)	0.87
Self-pay/other	0.33 (−0.10, 0.79)	0.13
Severity Markers		
ICU stay	3.31 (2.74, 3.92)	<0.001
TPN use	7.71 (7.22, 8.22)	<0.001
Procedure		
No	Ref	
Yes	2.53 (2.08, 3.00)	<0.001
Patient-level variables		
Sex		
Female	Ref	N/A
Male	−0.52 (−0.71, −0.32)	<0.001
Race/Ethnicity		
White (non-Hispanic)	Ref	N/A
Black (non-Hispanic)	0.30 (−0.04, 0.65)	0.09
Hispanic	0.63 (0.34, 0.93)	<0.001
Other/missing (non-Hispanic)	0.18 (−0.12, 0.48)	0.25

Variable	Change in LOS in days (95% CI)	p-value
Hospital-level variables		
Census Region		
West	Ref	N/A
Northeast	0.04 (−0.33, 0.43)	0.85
South	0.12 (−0.17, 0.42)	0.43
Midwest	−0.64 (−0.95, −0.32)	<0.001

Table 3

Multilevel, multivariate logistic regression of factors associated with 30-day all-cause hospital revisit for pediatric patients admitted with acute pancreatitis.

Variable	Adjusted 30-Day Revisit Odds(95% CI)	p-value
Discharge-level variables		
Age		
1–5 yr	1	N/A
6–13 yr	0.92 (0.76, 1.11)	0.37
14–18 yr	0.91 (0.74, 1.11)	0.33
Complex Chronic Conditions		
Cardiovascular	1.32 (0.97, 1.78)	0.06
Congenital	0.98 (0.74, 1.30)	0.91
GI	1.6 (1.33, 1.88)	<0.001
Hematologic	1.41 (1.08, 1.85)	0.01
Malignancy (Oncologic)	3.15 (2.57, 3.88)	<0.001
Metabolic	0.96 (0.78, 1.19)	0.71
Neuromuscular	1.25 (0.98, 1.60)	0.07
Renal	1.21 (0.89, 1.64)	0.23
Respiratory	0.90 (0.63, 1.26)	0.51
Insurance		
Public	1	N/A
Private	1.11 (0.95, 1.29)	0.18
Self-pay/other	1.07 (0.81, 1.40)	0.65
Severity Markers		
LOS (per day)	1.01 (1.00, 1.02)	0.02
ICU stay	1.05 (0.80, 1.37)	0.74
TPN use	1.59 (1.33, 1.91)	<0.001
Procedure		
No	1	N/A
Yes	0.62 (0.47, 0.83)	0.001
Patient-level variables		
Sex		
Female	1	N/A
Male	0.85 (0.74, 0.97)	0.02
Race/Ethnicity		
White (non-Hispanic)	1	N/A
Black (non-Hispanic)	1.08 (0.87, 1.35)	0.49

Variable	Adjusted 30-Day Revisit Odds(95% CI)	p-value
Hispanic	0.89 (0.74, 1.07)	0.23
Other/missing (non-Hispanic)	0.95 (0.78, 1.17)	0.65
Hospital-level variables		
Census Region		
West	1	N/A
Northeast	1.01 (0.80, 1.27)	0.96
South	1.08 (0.90, 1.29)	0.41
Midwest	1.15 (0.93, 1.41)	0.2