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Return Visit Admissions May Not Indicate Quality of Emergency Department Care for Children

Abstract

Objective: To test the hypothesis that in-hospital outcomes are worse among children admitted during a return ED visit than among those admitted during an index ED visit.

Methods: Retrospective analysis of ED visits by children age 0-17 to hospitals in Florida and New York in 2013. Children hospitalized during an ED return visit within 7 days were classified as "ED return admissions" (discharged at ED index visit and admitted at return visit) or "readmissions" (admission at both ED index and return visits). In-hospital outcomes for ED return admissions and readmissions were compared to "index admissions without return admission" (admitted at ED index visit without 7-day return visit admission).

Results: Among 1,886,053 index ED visits to 321 hospitals, 75,437 were index admissions without return admission, 7,561 were ED return admissions and 1,333 were readmissions. ED return admissions had lower intensive care unit (ICU) admission rates (11.0% versus 13.6%; adjusted odds ratio (AOR) 0.78, 95% confidence interval (CI) 0.71-0.85), longer length of stay (LOS, 3.51 vs. 3.38 days; difference 0.13 days; incidence rate ratio (IRR) 1.04; 95% CI 1.02-1.07), but no difference in mean hospital costs (($7138 vs. $7331; difference -$193; 95% CI -$479 to 93) compared to index admissions without return admission.

Conclusions: Compared with children who experienced index admissions without return admission, children who are initially discharged from the ED who then have a return visit

admission had lower severity and similar cost, suggesting that ED return visit admissions do not involve worse outcomes than do index admissions.

Introduction

Return visits to the emergency department (ED) are common among US children, with 72-hour return rates of 2.5% - 5.2% previously documented.[1] As a quality measure, ED return visits align conceptually with two of the National Quality Strategy's six priority areas:[2] safety of care—as a measure of harm caused by inadequate ED diagnosis or management[3]—and coordination of care—as a measure of deficient ED-to-outpatient transition of care.[4,5] These visits have also been recommended as a measure of the safety and quality of ED care by several systematic, modified-Delphi process reviews. [6-10] This recommendation is based on the premise that return visits may signal lower quality ED care during the index visit.[6-10] If preventable through improved care at an index ED visit, return visits present an opportunity to reduce costs, target medical errors and improve patient satsifaction.[1,11-13] Two previous studies have measured the relative clinical severity and resource utilization of ED return visits but did not focus specifically on children.[14,15] Both found that ED return visits had lower illness severity and resource use than the comparison group, suggesting that ED return visits may not reflect poor quality of care during the index ED visit.

Children represent a unique population to consider given differences in the clinical conditions for which they are commonly cared for in the ED and differences in how pediatric care is delivered. Previous work has challenged the construct validity of return visits as a measure of ED care quality for children—these include chart review studies that find the majority of ED return visits and ED return admissions are due to progression of illness or patient's noncompliance with care rather than poor quality of initial ED care,[16-18] and secondary data analyses demonstrating the poor reliability of ED return visits as a performance measure compared with other ED process measures.[19-21] Other studies have challenged the common practice of tracking only same-hospital ED return visits—these studies show that 12-32% of 72-hour return visits among adults and all-ages populations do not occur at the same hospital as the index visit.[22-24]

The primary objective of our study was to assess ED return visits as a measure of the quality of ED care for children by comparing in-hospital clinical outcomes and resource use among those admitted during an ED return visit, readmissions and index admissions without

return admission. Our secondary objective was to measure how well same-hospital ED return visits, return admissions and readmissions correlate with all-hospital return visits among children.

Methods

Study Design

We performed a retrospective analysis of ED visits in a publically available set of datasets. This study was considered not human subjects research by the Colorado Multiple Institutional Review Board because of its use of publicly available datasets.

Study Setting and Population

We performed a retrospective analysis of ED visits by children age 0-17 to hospitals in Florida and New York in 2013 using data from the Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project (HCUP), as these are the two largest state databases with shared ED and inpatient patient-level identifier (HCUP's VisitLink variable) permitting tracking patients temporally through both ED and inpatient visits. Hospital discharge records from the State Inpatient Database (SID) were linked with ED discharge records from the State Emergency Department Database (SEDD).

Each SID includes encounter-level data for all hospitalizations regardless of admission source, whereas the SEDD contains similar information on treat-and-release ED visits (i.e., discharges). To identify admissions that originated in the ED, the dataset was limited to inpatient records in the SID with evidence of ED-level services, including ED revenue code, ED CPT code, ED charge or ED source of admission. We then excluded records for elective or scheduled admissions, admissions for deliveries, neonatal admissions from a source other than the ED, and records for transfers in-from or out-to another short-term hospital. Once admissions that originated in the ED were identified, they were combined with ED discharge records in the SEDD, creating a complete dataset of all ED visits within the year.

Study Protocol

Patient identifiers and time variables were used to track return visits across the SID and SEDD. To characterize ED admissions into 3 return visit cohorts, we first identified distinct

episodes of emergency care, which included an index visit plus any 7-day return visit. An index visit was defined as the first ED visit for a unique patient or any successive ED visits where the patient had no prior ED visit or hospital admission in the preceding 30 days. Therefore, one patient may have multiple episodes available for analysis. We excluded visits in which the patient died (n=390) or left against medical advice (n=19,783) during their index visit, ED visits in which the patient was transferred out of the ED to another hospital (because we could not ascertain whether the patient was subsequently admitted to another hospital, n=20,559), records missing a return visit variable (n=986,922) and index visits in the months of December and January because it was not possible to assess prior visits and return visits; (New York only; Florida does not specify visit month; n=218,820). The remaining index ED visits were followed for any ED return visits within 7 days.[25]

Patients with the main exposure--a 7-day ED return visit that resulted in hospital admission--were stratified into two groups based on the outcome of their previous index ED visit: "ED return admissions" (patients discharged from the ED at their index visit with hospital admission during their 7-day return visit) and "readmissions" (patients admitted to the hospital on both their index visit and 7-day ED return visit). For consistency of comparison, we limited our analysis to the first return visit after an index visit. For patients in the readmission cohort with more than one readmission, only initial readmission outcomes were assessed. We compared in-hospital clinical outcomes and resource use for patients in the exposure group—those with ED return admissions or readmissions--versus outcomes for the control group: patients admitted during their index visit who did not have a 7-day return inpatient visit ("index admissions without return admission"). Designation of this as our control group assumes that this group approximates the average inpatient admission because most children who are hospitalized on an index ED visit do not have a return visit. Identification of the 3 return visit cohorts is shown in Figure 1.

Measures:

We measured two clinical outcomes—in-hospital mortality and ICU admission—and two measures of inpatient resource use—total hospital costs and length of stay (LOS). Studies of ED return visits for children have studied timeframes from 48 hours to 3 months, with 72 hours the most common window.[24,26,27] We selected 7 days as the primary timeframe but included a

sensitivity analysis of three additional timeframes—72 hours, 14 days and 30 days--for two reasons: (1) based on time to event analyses of ED return visits that showed a pattern of rapid accrual of ED return visits up to 30 days,[25,28] and, (2) because 30 days is the most common window for measuring pediatric hospital readmissions, one of the outcomes in our analysis.[29,30] Patients who died in the ED on a return visit were counted as having died in hospital. ICU admission was chosen to capture patients with a severe clinical course and was identified by critical care UB-92 revenue codes (0200-0209, 0210-0219). Total costs were assessed by applying HCUP cost-to-charge ratios provided for the SID.

Data Analysis

Statistical analyses were performed using Stata version 13 (StataCorp). To evaluate adjusted differences in outcomes and resource utilization between the return visit cohorts, a series of multivariable generalized linear models were developed controlling for known risk factors for recurrent ED utilization in children: age, sex, race, complex chronic conditions[31] and primary payer.[1,32,33] We utilized the logit-link for the dichotomous outcomes of mortality and ICU admission. Both total costs and LOS were highly right-skewed. For the analysis of total costs we applied a log-link with gamma distribution and applied a negative binomial distribution for LOS. Regression diagnostics were performed to assess for model fit. Patients who died during their admission were excluded from the modeling of costs and LOS.[30] To account for within-hospital correlation of patient outcomes, clustered standard errors were utilized. To avoid bias from low volume hospitals we excluded hospitals with <25 pediatric admissions in 2013.[24]

Results

Return Visit Rates

Among the 1,886,053 index ED visits to 321 hospitals experienced by 1,442,154 unique pediatric patients, 1,809,283 (95.9%) were discharged and, of these, 106,221 (5.9%) had an ED return visit and 7,561 (0.71% of all discharged patients and 7.1% of all ED return visits) had an ED return admission. Of the 76,770 (4.1%) index ED visit admissions, 72,432 (94.3%) did not have a 7-day ED return visit (included in the index admission without return admission cohort). Of the 4,338 index admissions with an ED return visit, 1,333 (30.7%) were readmitted (the

readmissions cohort) and 3,005 (69.3%) were not readmitted (included in the index admission without return admission cohort). (Figure 1).

Of the 106,211 patients with an ED return visit, 78.4% returned to the same ED as the index visit. Of those returning to the same ED, 5.8% were admitted; of those returning to another ED, 11.9% were admitted. In contrast to return visit admissions, of the 4,338 ED return visits of patients discharged from a hospital after an inpatient stay, 70.6% returned to the same hospital's ED. Of those returning to the same hospital, 38.9% were admitted and of those returning to another hospital's ED, 11.1% were admitted. Overall, 21.6% of return ED visits, 36.2% of return visit admissions and 10.6% of readmissions occurred at another hospital. (Figure 1)

In sensitivity analyses, 2.5%, 8.1% and 12.1% of patients initially discharged had an ED return visit in 72 hours, 14 days and 30 days, respectively; of these, 7.5%, 6.3% and 5.4% were admitted. Among those initially admitted, 2.2%, 8.3% and 13.1% returned within 72 hours, 14 days and 30 days, and of these 28.6%, 32.5% and 32.8% were readmitted.

We compared patients in the study cohort to those excluded from the study cohort because of missing revisit linking variables, based on the characteristics from Table 1. The only significant differences were that excluded patients were younger (5.3 vs. 7.3 years), less likely to have any comorbid condition (3.3% vs 6.8%), more likely to be uninsured (4.4% vs. 3.5%) and less likely to have Medicaid insurance (59.8% vs 64.9%) than those in the analytic cohort.

Characteristics of Cohorts

Table 1 lists the characteristics of our study cohorts. Patients who were high utilizers of the ED (≥4 visits/year) were more likely to experience an ED return visit and comprised 22.6% of the total sample, but accounted for 21.4% of ED return admissions and 28.2% of readmissions.[32] Patients who experienced any return visit with admission (either ED return admission or readmission) were more likely to be female and have public insurance compared with index admissions without return admission. In addition, patients in the readmission cohort had substantially more comorbid conditions than those in ED return admission and the index admission without return admission cohorts (18.8% vs. 4.2% vs. 5.7%, respectively).

Among patients with a 7-day return visit, the most common diagnoses—grouped using the Healthcare Cost and Utilization Project's Clinical Classification Software[34]—were other

aftercare (mostly post-procedure care for incisions and other openings), upper respiratory infections, fever of unknown origin and viral infections. (Table 2) Of those hospitalized on their return visit, the most common conditions were pneumonia, asthma, acute bronchitis and skin and subcutaneous tissue infections. (Table 2) The most common of these, pneumonia, totaled only 721 hospitalizations, and thus we were precluded from diagnosis-specific analyses by small sample within each diagnosis.

Outcomes by Cohort

Results of our multivariable regression are presented in Tables 3 and 4. After adjusting for patient case-mix, when compared to index admissions without return admission, ED return admissions had lower intensive care unit (ICU) admission rates (11.0% versus 13.6%; adjusted odds ratio (AOR) 0.78, 95% confidence interval (CI) 0.71-0.85), slightly longer length of stay (LOS, 3.51 vs. 3.38 days; difference 0.13 days; incidence rate ratio (IRR) 1.04; 95% CI 1.02-1.07), and similar mean hospital costs (($7138 vs. $7331; difference -$193; 95% CI -$479 to $93). In contrast, when compared to index admissions without return admission, readmissions had similar rates of ICU admission 12.9% versus 13.6% (AOR 0.94, 95% 95% CI 0.82-1.08), similar costs ($8037 vs. $7331; difference $706; 95% CI -$17 to $1429) and longer LOS (4.18 vs. 3.38 days; difference of 0.80 days; IRR 1.24; 95% CI 1.15-1.33).

In-hospital mortality was similar across the 3 return visit cohorts with wide adjusted odds ratio CI reflecting the rarity of death among hospitalized children.[35] We found overall associations among clinical outcomes and inpatient resource use to be similar for patients returning within 72 hours, 14 days and 30 days in our sensitivity analyses (Tables 3 and 4). In adjusted analyses using the three timeframes, when compared to index admissions without return admission, ED return admissions had lower rates of ICU admission and longer LOS, without difference in mortality. In contrast to the analyses using the shorter timeframes, at the 30-day timeframe we found a small difference in inpatient costs of ED return admissions when compared to index admission ($7000 vs. $7283; difference -$283; 95% CI -$509- -$58).

Discussion

To our knowledge, this is the first study to assess in-hospital outcomes among children experiencing an ED return visit admission. Patients who are discharged from the ED and are hospitalized on a return visit are a less sick cohort relative to other admissions (both patients who were admitted on the initial visit and those who were admitted both on the initial and repeat) We found that patients who experienced an ED return admission had lower rates of ICU admission compared to the index admissions without return admission cohort. While this group also had slightly longer LOS, total hospital costs were similar between the groups, suggesting that the small LOS difference is unlikely to be clinically significant. In contrast, readmissions among patients with ED return visits had similar clinical outcomes and slightly longer LOS during the readmission compared to the index admissions without return admission cohort. In hospital mortality was similar across the 3 cohorts. Results were largely consistent for patients returning to the ED within 72 hours, 14 and 30 days of their initial ED visit. In this large dataset, we were unable to detect evidence that return visit admissions are associated with an increased need for ICU resources or increased hospital costs. These findings suggest that ED return admissions for children may not adequately discriminate among children with high versus low quality of care delivered during an ED visit in hospital administrative datasets.

Numerous studies have challenged the construct validity of ED return visits and return visit admissions as measures of ED care quality, including three studies of adults or all-ages populations that, like our study, measured the clinical severity and resource utilization of ED return visits.[14,15,24] Of these three studies, our findings most closely approximate those of a recent study that found that return ED admissions in adults, when compared with index admissions, had lower in-hospital mortality, ICU admission rates, and in-hospital costs and LOS.[15] Our current study differs from this adult study in that we found no difference in mortality reflecting the rarity of death among children in the ED (0.03%)[36] and hospitalized children (0.39%).[35] The adult study also found that patients with ED return admissions had slightly longer LOS, despite having lower total costs. In contrast, we find no difference in costs, likely because our study was underpowered to examine this outcome. One explanation for this may be that patients with ED return admissions are kept in the hospital longer because of the largely unbilled resources used to address social factors, despite being less sick than index admissions without return admission.[1,32,33] The other two studies compared severity and ED resource use in ED return visits to index ED visits. Both found lower severity in ED return visits when compared to index ED

visits, although one found 18% higher 30-day ED visit costs albeit 30% lower 3-day costs for those with return visits,[24] and the other found lower resource use among those with return visits.[14]

A major reason ED return visits have been suggested as a quality measure is that they are presumed to reflect a population of inappropriate discharges from the ED, such as patients who had potential errors in diagnosis or disposition made during their ED visit. This may be especially true if the patient is sick enough to require hospitalization on their return visit. In fact, our data show that after age, sex, and comorbidity adjustment, these patients have similar outcomes to patients admitted on an index visit who do not have a return visit.

Our study complements the findings of prior studies that have attempted to assess the quality of care leading to a ED return visit and found the majority of ED return visits were related to *patient factors* such as noncompliance with ED discharge instructions, *illness factors* including progression of the condition diagnosed at the index ED visit and *healthcare environment factors* including poor access to post-discharge care, with a small minority of return visits related to poor quality of ED care or unsafe discharge practices.[16,17] The most common diagnoses previously reported at ED return visits—fever, respiratory infections, and gastroenteritis—are all self-limited acute medical conditions commonly treated in outpatient as well as ED settings, and thus appropriate for a trial of outpatient management. Our findings are also consistent with pediatric studies that have found poor reliability of ED return visits as a performance measure in its lack of correlation with other ED process measures such as rate of radiographic study utilization and physician treatment time.[19-21]

Our study also adds to prior work by capturing return visits outside the index hospital for ED return visits, ED return admissions and readmissions through the ED. Focusing solely on return visits to the same hospital would have missed 21.6% of return ED visits, 36.2% of return visit admissions and 10.6% of readmissions through the ED. Our findings are similar to the one pediatric study that captured all-hospital readmissions and found 13.9% occurred at other hospitals.[37] Although adult population studies used a shorter, 72-hour timeframe, they found similar proportions of return visits returning to other hospitals: 12-32%.[22-24] It is likely that using only same-hospital return visit data will under-estimate the actual, all-hospital return rate, suggesting that same-hospital return visit data may not be a reliable comparative quality measure.[23]

Patients discharged from the ED who return to another ED were more likely to be admitted than those returning to the same ED. Without the records from the ED for the index visit, the other ED's providers may lower their admission threshold solely based on the recurrent visit. Return visits that occur at another hospital may have special clinical and financial implications as they raise the potential for fragmentation of care and the associated risk of duplication of services and other care coordination concerns.[38]

Thus, our findings support those of other studies in demonstrating ED return visit admissions do not reflect poor quality of ED care. Were we to base performance measures on ED return visits or return admissions, especially if tied to reimbursement penalties, we run the risk of penalizing hospitals for factors largely outside their control. This is likely to disproportionately penalize hospitals serving vulnerable populations, particularly patients with limited access to healthcare elsewhere.[32,39] Another potential unintended consequence is that penalizing ED return visits might encourage ED physicians to admit more patients to reduce return visits. Despite the lack of evidence supporting ED return visits and ED return admissions as measures of ED care quality, our findings do not challenge the potential value of these measures as internal quality assurance screening tools for identifying potential quality issues.[26]

Limitations

This study should be interpreted with the following limitations. First, the retrospective analysis of a secondary data set was limited the hospital-based outcomes that could be measured that were relevant to our all-condition focus. For example, we did not study condition-specific indicators, such as occurrence of specific procedures (e.g., appendectomy) or diagnoses (e.g., meningitis) that could have indicated diagnoses missed during the index visit. Thus, although all-condition return visits do not accurately reflect deficits in ED care quality, condition-specific measures are likely to have better construct validity and would need to be explored in future studies. Second, our conclusions are predicated, in part, on the assumption that poor quality of care during an ED visit will be reflected in disease severity sufficiently worsened to result in increased probability of admission to an ICU or in increased hospital costs on a return ED visit admission when compared to an index admission. However, it is only in some cases of poor ED care that one would expect deterioration in the clinical condition of the patient sufficient to require admission to the ICU or that would result in increased hospital length of stay. This

assumption may have resulted in type 1 error. Third, the hospital-based data sets did not permit us to assess mortality among children who died outside the hospital. However, death outside the hospital shortly after ED discharge is rare among children, occurring in less than 0.02% of discharges, and thus this likely did not bias our findings.[40] Fourth, there may be additional unmeasured confounders that accounts for differences in outcomes observed between groups that were not adjusted for. Some of these additional patient factors, such as medical severity indicators and hospital factors are likely to account for differences among return visit cohorts and would need to be explored in future studies. Fifth, our methods may have led us to underestimate ED return visits. We excluded return visits after the initial ED return visit, direct admissions and visits for patients transferred in or transferred out, recognizing that some may be return visits. Limited evidence suggests including these additional visits would not have changed the direction of our findings.[32] Sixth, we had to exclude ED visits in the months of January and December to ensure accurate accounting of ED return visits. This may have induced bias into our results due to seasonal differences in ED clinical presentations. Finally, our cost estimates only included hospital costs and did not include the other costs associated with a return visit to the hospital, including missed wages.

Conclusion

Compared with children who experienced index admissions without return admission, those initially discharged who then experienced a ED return visit within 7 days that resulted in admission had similar outcomes, suggesting that admissions associated with ED return visits may not reflect poor quality emergency care for children.

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Tables

Table 1. Characteristics of the Study Cohort: Three Return Visit Cohorts

	Index Admission without Return Admission n=75,437	***Return Visit Within 7 Days***	
		ED Return Admission n=7,561	Readmission n=1,333
Patient Characteristics			
Age, %			
< 1 year	14.8	16.1	15.1
1 - 4 years	27.6	30.5	24.8
5- 12 years	30.3	28.2	28.0
13- 17 years	27.4	25.2	32.1
Female, %	45.5	47.9	46.7
Race, %			
White	33.6	34.9	37.9
Black	27.6	26.8	27.2
Hispanic	27.0	27.0	23.2
Asian/Pacific Islander	2.5	2.4	1.8
Native American	0.2	0.2	0.2
Other	9.1	8.6	9.8
Primary Payer, %			
Medicare	0.1	0.2	0.3
Medicaid	61.8	65.3	61.6
Private	31.6	27.2	32.0
Uninsured	2.7	2.9	1.7
Other	3.9	4.5	4.4
Comorbidities, %			
Neuromuscular	5.1	4.3	11.8
Cardiovascular	3.2	2.7	6.6

	Index Admission	***Return Visit Within 7 Days***	

Table 2: Characteristics of return visits and return visit admissions by diagnoses most likely to result in a return visit (using the Healthcare Cost and Utilization Project's Clinical Classification Software (CCS)[35] categories)

		ED Return Admission n=7,561	Readmission n=1,333
Respiratory	1.8	1.4	6.2
Renal	1.6	1.2	2.9
Gastrointestinal	4.5	3.7	15.2
Heme-Immune	5.4	5.0	10.7
Metabolic	1.9	1.7	4.8
Congenital/Genetic	2.7	2.4	6.2
Malignancy	1.9	1.1	5.6
Neonatal	0.5	0.4	1.3
Technology Dependent	5.1	3.8	17.6
Transplant	0.7	0.5	1.9
Any Comorbidity	*5.7*	*4.2*	*18.8*
High ED Utilizer, %	8.6	21.4	28.2

Return Visit Within 7 Days	n	% Total ED visits		Hospitalized on Return Visit Within 7 days	n	% Total ED Visits	% Total ED Admissions
Other Aftercare* (257)	9301	0.9		Pneumonia (122)	721	1.3	7.1
Upper Respiratory Infections (126)	9264	11.4		Asthma (128)	605	3.8	10.8
Fever of Unknown Origin (246)	5352	3.9		Acute Bronchitis (125)	555	1.8	6.5
Viral Infection (7)	5251	4.8		Skin & Subcutaneous Tissue Infections (197)	491	2.1	3.9
Otitis Media & Related Conditions (92)	4499	4.6		Fluid & Electrolyte Disorders (55)	482	0.5	3.7
Skin & Subcutaneous Tissue Infections (197)	3640	2.1		Mood Disorders (657)	390	0.9	5.7
Abdominal Pain (251)	3512	2.6		Intestinal Infection (135)	283	0.6	1.9
Asthma (128)	3455	3.8		Urinary Tract Infections (159)	282	1.4	2.6
Other Gastrointestinal Disorders (155)	2973	2.1		Epilepsy; Convulsions (83)	269	1.0	4.0
Allergic Reactions (253)	2836	2.4		Viral Infection (7)	259	4.8	1.8
Nausea & Vomiting (250)	2731	2.4		Appendicitis (142)	244	0.4	4.4
Superficial Injuries (239)	2729	5.7		Upper Respiratory Infections (126)	210	11.4	2.4
Noninfectious Gastroenteritis (154)	2709	2.1		Sickle Cell Anemia (61)	202	0.2	2.3
Pneumonia (122)	2667	1.3		Complications of Surgical	167	0.2	1.1

				Procedures/Medical Care (238)			
Acute Bronchitis (125)	2429	1.8		Noninfectious Gastroenteritis (154)	145	2.1	0.9

Table 3. Multivariable regression results for ED return admissions and readmissions*

	Adjusted Odds Ratio (95% CI)			
	In-Hospital Mortality	ICU Admission	LOS IRR (95% CI)	Cost Difference (Range), $^
≤ 72 hours				
ED Return Admission vs. Index Admission without Return Admission	0.87 (0.45-1.67)	**0.77 (0.71-0.85)****	1.03 (1.00-1.06)	-309 (-628 to 10)
Readmission vs. Index Admission without Return Admission	0.74 (0.24-2.28)	0.91 (0.77-1.09)	**1.15 (1.07-1.23)****	46 (-450 to 544)
≤ 7 days				
ED Return Admission vs. Index Admission without Return Admission	0.83 (0.43-1.58)	**0.78 (0.71-0.85)****	**1.04 (1.02-1.07)****	-193 (-479 to 93)
Readmission vs. Index Admission without Return Admission	0.80 (.26-2.41)	0.94 (0.82-1.08)	**1.24 (1.15-1.33)****	706 (-17 to 1429)

≤ 14 days				
ED Return Admission vs. Index Admission without Return Admission	0.75 (0.42-1.36)	**0.78 (0.72-0.83)****	**1.04 (1.02-1.07)****	-212 (-468 to 44)
Readmission vs. Index Admission without Return Admission	0.67 (0.3-1.50)	0.97 (0.84-1.11)	**1.26 (1.18-1.34)****	489 (-87 to 1067)
≤ 30 days				
ED Return Admission vs. Index Admission without Return Admission	0.62 (0.36-1.07)	**0.82 (0.76-0.87)****	**1.04 (1.02-1.07)****	**-283 (-509 to -58)****
Readmission vs. Index Admission without Return Admission	0.75 (0.43-1.30)	1.00 (0.87-1.14)	**1.24 (1.18-1.30)****	**499 (22 to 975)****

*All models adjusted for age, sex, race, Feudtner comorbidities, primary payer. Control group: index admissions without a return visit admission.

**These outcome differences are statistically significant.

^Hospital costs reported in mean difference in whole dollars rather than the exponentiated coefficient for ease of interpretation.

Abbreviations: CI = confidence interval; ICU = intensive care unit; LOS = length-of-stay; IRR = incidence rate ratio

Table 4. Adjusted in-hospital mortality, ICU admission, length of stay, and inpatient costs (95% CI) for ED return admissions and readmissions*

		Control	*Exposure: Return Visit Admission*	
		Index Admission without Return Admission	**ED Return Admission**	**Readmission**
≤ 72 hours	In-Hospital Mortality	0.20% (0.17-0.25)	0.18% (0.07-0.29)	0.16% (0.00-0.32)
	ICU Admission	13.5% (11.6-15.3)	11.0% (9.3-12.6)	12.5% (9.8-15.2)
	Mean LOS	3.37 days (3.18-3.55)	3.45 days (3.25-3.66)	3.87 days (3.25-4.21)
	Mean Costs	$7299 (6597 – 8001)	$6890 (6334-7646)	$7345 (6371-8319)
≤ 7 days	In-Hospital Mortality	0.21% (0.17-0.25)	0.18% (0.07-0.28)	0.17% (0.00-0.35)
	ICU Admission	13.6% (11.6-15.5)	11.0% (9.3-12.8)	12.9% (10.3-15.5)
	Mean LOS	3.38 days (3.19-3.57)	3.51 days (3.32-3.74)	4.18 days (3.79-4.57)
	Mean Costs	$7331 (6612-8050)	$7138 (6470-7807)	$8037 (6879-9195)
≤ 14 days	In-Hospital Mortality	0.21% (0.17-0.26)	0.17% (0.08-0.25)	0.15% (0.03-0.27)
	ICU Admission	13.6% (11.6-15.5)	11.1% (9.4-12.7%)	13.2% (10.6-15.8)

	Mean LOS	3.36 (3.17-3.55)	3.50 (3.30-3.71)	4.23 (3.85-4.61)
	Mean Costs	$7301 (6592-8009)	$7089 (6441-7737)	7790 (6770-8811)
≤ 30 days	In-Hospital Mortality	0.23% (0.18-0.27)	0.14% (0.07-0.21)	0.17% (0.09-0.26)
	ICU Admission	13.6% (11.6-15.5)	11.5% (9.8-13.3)	13.5% (11.0-16.1%)
	Mean LOS	3.35 (3.16-3.54)	3.49 (3.26-3.72)	4.13 (3.82-4.44)
	Mean Costs	$7283 (6573-7993)	$7000 (6364-7635)	$7782 (6822-8742)

*All models adjusted for age, sex, race, Feudtner comorbidities, primary payer.

Figure Legends

Figure 1. Identification of Return Visit Cohorts

Derivation of the three study cohorts is shown, including the two exposure subgroups—ED Return Admission and Readmission—and the control group--Index Admission without Return Admission.

Figure 1. Identification of Return Visit Cohorts