

The association between discharge time of day and discharge outcomes at an academic children's hospital



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Background: Pediatric hospital discharge is a complex, multi-step process. While morning discharges are operationally preferred, little is known about the optimal discharge time of day from a pediatric hospital from a safety perspective.

Objective: To investigate if discharge time of day is associated with 30-day hospital reutilization following hospitalization in pediatric patients.

Hypothesis: Pediatric patients discharged in the evening have non-inferior 30-day hospital reutilization rate compared to those discharged in the morning or afternoon.

Methods:

- **Design:** Retrospective cohort study
- **Setting:** Urban, quaternary care, academic children's hospital
- **Inclusion & exclusion criteria:** Children <18 years old, discharged between 2016/07-2019/12, excluding patients discharged from pediatric or neonatal intensive care units, transferred, or left against medical advice.
- **Variable of interest:** Time at which patient was discharged and left the hospital
 - Morning: 08:00-12:59
 - Afternoon: 13:00-17:59
 - Evening: 18:00-22:59
- **Outcomes:** all-cause 30-day hospital reutilization
 - Emergency department visits
 - Readmissions
- **Statistical analysis:** multivariable modified least-squares regression model to estimate the adjusted 30-day hospital reutilization rate differences between morning vs. evening & afternoon vs. evening, while adjusting for confounders
 - Non-inferiority test: declare non-inferiority of evening discharges if the lower bound of the 90% CI of the rate differences is less than 1.75% (power > 80%).
 - Superiority test: if non-inferiority not demonstrated, use two-sided 95% CI to test superiority.

Results:

- 24,997 discharges from 17,317 unique patients included: 6,105 (24.5%) discharges in the morning, 13,787 (55.1%) in the afternoon, 5,105 (20.3%) in the evening
- Patients discharged in the evening had more chronic complex conditions and hospitalization in the past 90 days than patients discharged in the morning, while they were similar in patients discharged in the afternoon (Table 1).

Children discharged in the morning have a lower adjusted 30-day hospital reutilization rate than children discharged in the evening.

Further study is needed to identify barriers and ensure high-quality discharges at any discharge time of day.

	Morning	Afternoon	Evening
Unadjusted 30-day hospital reutilization rate	14.1% (858/6,105)	18.2% (2,511/13,787)	19.3% (987/5,105)
Adjusted ^a 30-day hospital reutilization rate (90% CI)	6.2% (4.4%, 7.9%)	9.0% (7.3%, 10.7%)	10.1% (8.3%, 11.9%)
Adjusted ^a 30-day hospital reutilization rate difference (90% CI)	-4.0% (-5.1%, -2.9%)	-1.1% (-2.2%, -0.1%)	Ref

^aAdjusting for age, sex, insurance type, number of chronic complex conditions, hospitalization in the past 90 days, presence of a documented primary care physician, surgery, PICU stay, length of stay, unit at discharge, weekend discharge, and All Patient Refined Diagnosis Related Group relative weight.

Results:

- The adjusted 30-day hospital reutilization rate was lowest in the morning (6.2%) followed by afternoon (9.0%) and evening (10.1%) discharges. The lower bound of the 90% CI of the rate differences were larger than 1.75%. Therefore, we were unable to conclude that evening discharges were non-inferior to morning or afternoon discharges.
- With superiority testing, morning discharge was superior to evening discharge (p<0.01), while afternoon discharge was not statistically superior (p=0.06) with respect to 30-day hospital reutilization rate.

Table 1. Comparison of demographic and clinical characteristics of the study population based on discharge time.

	Morning (n=6,105)	Afternoon (n=13,787)	Evening (n=5,105)	Total (N=24,997)	P
Age at discharge, n (%)					
< 1 year	1,202 (19.7)	2,356 (17.1)	896 (17.6)	4,454 (17.8)	
1-4.9 years	2,342 (38.4)	4,509 (32.7)	1,451 (28.4)	8,302 (33.2)	<0.001 ^b
5-12.9 years	1,717 (28.1)	4,185 (30.4)	1,609 (31.5)	7,511 (30.1)	
13-17.9 years	844 (13.8)	2,737 (19.9)	1,149 (22.5)	4,730 (18.8)	
Sex, n (%)					
Male	3,503 (57.4)	7,591 (55.1)	2,779 (54.5)	13,873 (55.5)	0.002 ^c
Insurance type, n (%)					
Public	4,643 (76.1)	10,736 (77.9)	3,971 (77.8)	19,350 (77.4)	0.003 ^c
Private	1,422 (23.3)	2,927 (21.2)	1,081 (21.2)	5,430 (21.7)	
Self-pay	40 (0.7)	124 (0.9)	53 (1.0%)	217 (0.9)	
Number of chronic complex conditions, n (%)					
0	4,800 (78.6)	10,095 (73.2)	3,734 (73.1)	18,629 (74.5)	
1	1,098 (18.0)	2,800 (20.3)	1,030 (20.2)	4,928 (19.7)	<0.001 ^b
2	138 (2.3)	540 (3.9)	230 (4.5)	908 (3.6)	
3+	69 (1.1)	352 (2.6)	111 (2.2)	532 (2.1)	
Hospitalization in the past 90 days, n (%)	872 (14.3)	2,459 (17.8)	915 (17.9)	4,246 (17.0)	<0.001 ^c
PCP documented, n (%)	5,073 (83.1)	11,135 (80.8)	4,033 (79.0)	20,241 (81.0)	<0.001 ^b
Surgery, n (%)	1,322 (21.7)	2,887 (20.9)	972 (19.0)	5,181 (20.7)	0.002 ^d
PICU stay, n (%)	826 (13.5)	1,879 (13.6)	659 (12.9)	3,364 (13.5)	0.43
Length of stay, hours, median (IQR)	46.0 (28.6, 78.0)	45.4 (27.7, 83.6)	46.5 (26.4, 90.6)	45.7 (27.7, 83.4)	0.31
Unit at discharge^a, n (%)					
Unit A	1,935 (31.7)	4,557 (33.1)	1,889 (37.0)	8,381 (33.5)	
Unit B	2,882 (47.2)	6,257 (45.4)	2,200 (43.1)	11,339 (45.4)	<0.001 ^c
Unit C	1,288 (21.1)	2,973 (21.6)	1,016 (19.9)	5,277 (21.1)	
Weekend discharge, n (%)	1,540 (25.2)	3,593 (26.1)	1,009 (19.8)	6,142 (24.6)	<0.001 ^d
DRG relative weight, median (IQR)	0.601 (0.484, 0.891)	0.669 (0.496, 0.926)	0.669 (0.497, 0.938)	0.651 (0.488, 0.925)	<0.001 ^c

PCP, primary care physician; PICU, pediatric intensive care unit; IQR, interquartile range; DRG, diagnosis related group.
^a Unit A primarily admits adolescent medicine, neurology and endocrinology patients, Unit B primarily admits cardiology and gastroenterology patients; Unit C primary admits hematology, oncology, and nephrology patients. All three units admit pediatric hospital medicine and surgical patients.
^b P <0.01 in all three pair-wise comparisons.
^c P <0.01 comparing between morning vs. evening and morning vs. afternoon but P >0.05 between afternoon vs. evening.
^d P <0.01 comparing between morning vs. evening and afternoon vs. evening but P >0.05 between morning vs. afternoon.

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