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Direct Admission to Hospitals Among Children in the United States

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While a decade of research and policy interventions has begun to transform hospital discharge processes, research focused on hospital admissions is lacking. Emergency departments (EDs) are increasingly serving as portals of hospital admission, contributing to national concerns about ED volumes, wait times, and discontinuity of care.[1]Despite this, there is a paucity of research examining other options for hospital admission.

Direct admission, defined as admission to a hospital without receiving care in the hospital's ED, is 1 alternative. Although direct admission has potential benefits for patients and health care systems, little is known about its use or effectiveness. To our knowledge, only 1 study has examined outcomes associated with pediatric direct admissions and there are no national statistics about the characteristics of this admission approach.[2] To address this gap, we used a nationally representative data set to determine pediatric direct admission rates, characteristics, and costs relative to admission through EDs and characterize variation in direct admission rates across diagnoses and hospitals.

Methods

We analyzed the Agency for Healthcare Research and Quality's 2009 Kids' Inpatient Database, including nonneonatal, nonmaternal, and nonelective pediatric hospitalizations in

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children younger than 18 years.[3] Our study received institituional review board approval from the Baystate Medical Center and was deemed exempt from participation consent. Interhospital transfers, including transfers to or from a different hospital or health care facility, were excluded as a result of our inability to accurately assess total hospital costs. Reasons for hospitalization were categorized using All Patient Refined Diagnostic Related Groups.[4]Weighted direct admission frequencies, proportions, and hospital-level variation in direct admission rates were calculated for each All Patient Refined Diagnostic Related Group. For the 10mostcommon All Patient Refined Diagnostic Related Groups, we assessed differences between children admitted directly and those admitted through EDs using Rao-Scott χ^2 tests for categorical variables and weighted *t* tests for continuous variables. Hierarchical generalized linear models with a random effect for hospitals were developed to assess differences in total hospital costs between children admitted directly and through EDs, using cost-to-charge ratios provided by the Kids' Inpatient Database and controlling for the characteristics shown in the Table.[6]

Results

Of 1.47 million nonelective pediatric hospitalizations, 24.6% occurred via direct admission. The 10 most common diagnoses accounted for 49.2% of these hospitalizations (Figure). Among children with these diagnoses, children admitted directly were more likely to be white, privately insured, and had lower disease severity compared with children admitted through EDs (Table). There was substantial variation in direct admission rates across conditions, ranging from 8.9% for appendectomy to 38.0% for bipolar disorder (Figure). Similarly, we observed considerable hospital-level variation, with appendectomy showing the least variation and bipolar disorder showing the greatest variation in direct admission rates. In models adjusting for patient and hospital characteristics and disease severity, direct admissions were associated with 5% to 31% lower costs than ED admissions.

Discussion

Direct admissions represent approximately 1 in 4 unscheduled pediatric hospitalizations nationally, with characteristics of children admitted directly aligning with those more likely to have a medical home, including white race/ethnicity and private health insurance coverage.[7] The substantial variation in direct admission practices across hospitals and conditions may be influenced by disparities in access to timely outpatient acute care as well as differences in hospitals' and referring physicians' capacities to facilitate admissions without ED involvement.

While the differences in costs between direct and ED admissions were striking, we acknowledge that our findings may have been influenced by residual confounding and we were unable to draw definitive conclusions about quality, safety, and effectiveness. In addition, direct admission points of origin were not reflected in these analyses. Nevertheless, our results suggest that increasing access to direction admissions may be a means to reduce ED volumes and health care costs. To accomplish this, research is needed to better understand key stakeholders' admission preferences, the drivers of these cost differences, and conditions and procedures best suited for this admission approach.

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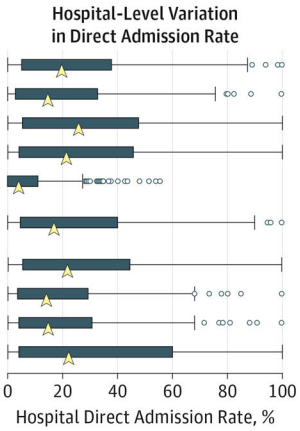
Reason for Hospitalization	Admissions, No.	Direct Admission Rate, %	Hospitals, No.
Pneumonia	125 902	21.9	1037
Asthma	111 380	15.7	726
Bronchiolitis	98 997	25.0	763
Gastroenteritis	75 089	25.2	660
Appendectomy	67 955	8.9	590
Upper respiratory tract infection	64 433	22.6	515
Cellulitis	55 065	23.7	428
Seizures	42 420	20.0	289
Urinary tract infection	41 598	20.2	369
Bipolar disorder	30 888	38.0	199



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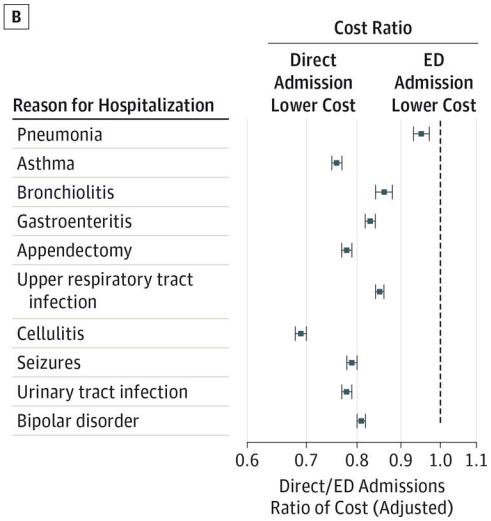

Figure.

Variation in Direct Admission Rates Across Conditions and Hospitals and Associated Adjusted Costs of Direct Admission Relative to Admissions Originating in Emergency Departments (EDs).

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Table

Patient and Hospital Characteristics Associated With Direct and ED Admissions Among Children Hospitalized for the 10 Most Common Indications Weighted to Reflect National Estimates[a]

Characteristics	Direct Admission, No. (SD Weighted Frequency) [%]	ED Admission, No. (SD Weighted Frequency) [%]	*P* Value
Patient			
Age, y	1.8	2.1	<.01
Female	68 316 (2983)[45.3]	248 463 (8224)[44.2]	<.001
Race/ethnicity			
White	67 801 (2920)[44.9]	214 282 (8115)[38.1]	<.001
Black	15 694 (1141)[10.4]	99 185 (7048)[17.6]	
Hispanic	29 298 (3293)[19.4]	131 068 (8520)[23.3]	
Other	10 170 (663)[6.7]	43 928 (3305)[7.8]	
Missing	28 010 (3019)[18.6]	74 292 (8806)[13.2]	
Insurance status			
Public	75 600 (4161)[50.1]	306 304 (11 485)[54.4]	<.001
Private	66 573 (2602)[44.1]	215 290 (7930)[38.3]	
Uninsured	3231 (260) [2.1]	23 010 (1881)[4.1]	
No charge/other/unknown	5569 (567) [3.7]	18 151 (1154)[3.2]	
Comorbid complex chronic condition[b]	14 062 (865)[9.3]	52 007 (2643)[9.2]	.06
APR-DRG disease severity			
1 (Lowest)	90 015 (4060)[59.6]	329 248 (10 709)[58.5]	.04
2	51 301 (2375)[34.0]	198 331 (7136)[35.2]	
3	8841 (583) [5.9]	31 767 (1677)[5.6]	
4 (Highest)	815 (88) [0.5]	3409 (254) [.6]	
Hospital[c]			
Geographic region			
Northeast	16 865 (1490)[11.2]	127 032 (12 105)[22.6]	<.001
Midwest	37 289 (3178)[24.7]	109 547 (10 175)[19.5]	
South	61 227 (4250)[40.6]	214 214 (14 651)[38.1]	
West	35 592 (4539)[23.6]	111 961 (10 702)[19.9]	
Bed size			
Small	14 254 (1363)[9.4]	62 696 (8566)[11.1]	.51
Medium	38 420 (3984)[25.5]	131 823 (10 806)[23.4]	
Large	87 936 (5250)[58.3]	321 592 (16 949)[57.2]	
Rural	29 248 (1833)[19.4]	60 147 (1803)[1.7]	<.001
Hospital type, No. (%)			
Children's[d]	16 954 (4179)[11.2]	89 765 (12 722)[16.0]	.17
Teaching	63 489 (5230)[42.1]	303 483 (17 484)[53.9]	<.001
Hospital control			

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Characteristics	Direct Admission, No. (SD Weighted Frequency) [%]	ED Admission, No. (SD Weighted Frequency) [%]	*P* Value
Public	20 844 (1994)[13.8]	71 769 (6365)[12.8]	.33
Private			
Nonprofit	99 782 (5632)[66.1]	385 077 (17 956)[68.4]	
Investor-owned	19 983 (2693)[13.2]	59 266 (6884)[1.5]	

Abbreviations: APR-DRG, All Patient Refined Diagnostic Related Group; ED, emergency department.

[a] The 10 most common reasons for hospitalization (APR-DRGs) included pneumonia, asthma, bronchiolitis, gastroenteritis, appendectomy, upper respiratory tract infection, seizures, urinary tract infection, and bipolar disorder.

[b] Identified using Feudtner complex chronic conditions algorithm.[5]

[c] Characteristics missing for 8%of cohort for all variables except geographic region.

[d] Freestanding children's hospital according to the National Association of Children's Hospitals and Related Institutions indicator.