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Trends in High-Turnover Stays Among Children Hospitalized in the United States, 1993–2003

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Abstract

OBJECTIVE—Brief hospitalizations for children may constitute an opportunity to provide care in an alternative setting such as an observation unit. The goal of this study was to characterize recent national trends in brief inpatient stays for children in the United States.

METHODS—Using the Nationwide Inpatient Sample from 1993–2003, we analyzed hospital discharges among children <18 years of age, excluding births, deaths, and transfers. Hospitalizations with lengths of stay of 0 and 1 night were designated as “high turnover.” Serial cross-sectional analyses were conducted to compare the proportion of high-turnover stays across and within years according to patient and hospital-level characteristics. Diagnosis-related groups and hospital charges associated with these observation-length stays were examined.

RESULTS—In 2003, there were an estimated 441 363 high-turnover hospitalizations compared with 388 701 in 1993. The proportion of high-turnover stays increased from 24.9% in 1993 to 29.9% in 1999 and has remained $\geq 30.0\%$ since that time. Diagnosis-related groups for high-turnover stays reflect common pediatric medical and surgical conditions requiring hospitalization, including respiratory illness, gastrointestinal/metabolic disorders, seizure/headache, and appendectomy. Significant increases in the proportion of high-turnover stays during the study period were noted across patient and hospital-level characteristics, including age group, payer, hospital location, teaching status, bed size, and admission source. High-turnover stays contributed \$1.3 billion (22%) to aggregate hospital charges in 2003, an increase from \$494 million (12%) in 1993.

CONCLUSIONS—Consistently since 1999, nearly one third of children hospitalized in the United States experience a high-turnover stay. These high-turnover cases constitute hospitalizations, that may be eligible for care in an alternative setting. Observation units provide 1 model for an efficient and cost-effective alternative to inpatient care, in which resources and provider interactions with patients and each other are geared toward shorter stays with more timely discharge processes.

Keywords

observation medicine; children; emergency department; hospitalization; length of stay

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Over the past 2 decades, observation units have emerged as an alternative to inpatient care. Observation units can be housed in the emergency department (ED)^{1–3} or on a hospital ward,^{4,5} blurring the line between outpatient and inpatient settings. Patients report high levels of satisfaction with observation unit stays.^{6–8} In observation units, efficient care delivery is achieved through frequent reassessment and timely discharge processes.^{1,4} With shorter length of stay (LOS), these units provide hospital-level care that is less expensive than an inpatient admission.^{2,4,9} In published reports, observation units have been shown to be safe, with low rates of return visits and readmissions.^{1,2,4,10,11}

Observation units have widespread use in adult emergency medicine, demonstrating a strong track record with shorter stays and reduced ward admission rates for common conditions such as chest pain, asthma, and cellulitis.^{12–18} Work from McConnochie et al^{19–21} in the 1990s indicated that a significant number of pediatric hospitalizations could be cared for in an alternative setting, such as an observation unit. Individual institutions have been successful in using pediatric observation units to decrease LOS,^{2,4,9,22} reduce admission rates,^{5,10,23} and control costs.^{2,9} However, little is known about the potential at the national level for children to receive care in an observation unit setting.

In this study, we used the Nationwide Inpatient Sample (NIS) over a period of 1 decade to provide national estimates of the number of US children who experience observation-length stays, the conditions for which they are receiving brief periods of inpatient care, and the charges associated with these stays. We designate hospitalizations with LOS of 0 and 1 night as “high turnover” (HTO), that is, as cases in which care could be delivered in an observation unit.

METHODS

The Nationwide Inpatient Sample (NIS) is a component of the Health Care Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality.²⁴ The HCUP contains a set of health care databases, developed through partnership among federal and state governments and health care institutions. The NIS is the largest publicly available all-payer inpatient database in the United States. It contains de-identified, patient-level clinical and resource use data included in a typical discharge abstract. The NIS is a stratified probability sample of hospitals in states that participate in the HCUP, which permits the generation of discharge-level weights in the data set that allow for inference of findings to the national level. For each year, these data reflect hospital stays from between 800 and 1000 non-federal institutions, including public hospitals, children’s hospitals, and academic medical centers, but excluding chemical dependency treatment facilities, long-term hospitals, and psychiatric hospitals. For NIS sampling purposes, the universe of US hospitals is divided into strata using 5 hospital characteristics: US census region, urban or rural location, ownership/control, bed size, and teaching status.

We analyzed the data available from the NIS database, for the period from 1993 through 2003, to examine trends in HTO hospital stays for children. 1993 was selected as the first year of analysis, because it marks the point when at least one third of states participated in the HCUP. For each year of analysis, discharge-level weights were provided in the NIS to permit calculation of national estimates of hospitalization rates²⁴; US census data were used to standardize these estimates to concurrent national populations of children.²⁵

Case Identification

We analyzed hospital discharges among children <18 years of age. We excluded childbirth and neonates (<30 days of age) by diagnosis-related groups (DRGs) 370 to 391. Transfers were excluded because of the inability to link hospitalizations at the patient level. Discharges with fatalities were also excluded.

Definition of HTO Hospital Stays

In the NIS, LOS is calculated by subtracting the admission date from the discharge date. Although LOS is typically expressed in “days,” it is actually a count of the number of times a stay crosses midnight. Therefore, we refer to LOS in terms of “nights.” Each time a patient stays through midnight, LOS increases by 1 unit. With this measure, all same-day stays will be <24 hours in duration and are coded as LOS = 0. However, there are hospital stays of <24 hours in duration that cross midnight and are thus coded as LOS = 1. In other words, a 1-night stay could range from just 1 hour up to 47 hours in duration. Therefore, the duration of stay is not defined precisely enough to identify inpatient stays < 24 hours, and we define HTO stays as those with a LOS of 0 or 1 night. We believe HTO cases have the greatest potential to be eligible for care in an observation unit.

Analyses

We conducted serial cross-sectional analyses across years to compare discharge rates and the proportion of HTO stays among eligible pediatric discharges. Hospitalization rates are expressed as the number of hospitalizations per 100 000 children <18 years of age, as determined by concurrent year US census data.²⁵ The proportion of HTO stays was compared across years and within years according to patient, payer, and hospital characteristics. Patient characteristics included: DRG in use at discharge and age categories (0–2, 3–7, 8–12, and 13–17 years).

Expected payer was categorized as Medicaid, private, and uninsured. Hospital characteristics included: location (urban or rural), teaching status, bed size (small, medium, or large), and admission source (ED or routine). Logistic regression, with HTO stay as a dichotomous outcome, was performed to predict the proportion of HTO stays adjusting for patient, payer, and hospital characteristics.

Trends in mean and aggregate hospital charges for the top 10 ranking HTO DRGs from 2003 were secondary outcomes of interest. Linear regression, controlling for LOS, HTO stays, age, payer, and hospital characteristics, was performed to compare predicted charges according to LOS category. Analyses were repeated with log-transformed charges and charges truncated at the 1st and 99th percentiles. Charges from 1993 were inflation-adjusted to 2003 dollars based on the Consumer Price Index.²⁶

We applied sampling weights provided by the NIS for each year of data to calculate nationally representative estimates. Strata with a single sample unit were treated as certainty units to calculate standard errors and 95% confidence intervals (CIs). The authors conducted all analyses. The study was approved by the University of Michigan institutional review board. We conducted analyses by using Stata 10.0 (Stata Corp, College Station, TX) statistical software.

RESULTS

Trends in Discharge Rates and HTO Stays

Overall hospital discharge rates decreased from 2301 per 100 000 children in 1993 to 2052 per 100 000 children in 1995. Since 1995, the discharge rate had been stable at ~2000 per 100 000 children. HTO discharge rates increased from 575 per 100 000 children in 1993 to 604 per 100 000 children in 2003. Taking these 2 trends together, the proportion of HTO stays increased from 24.9% in 1993 to 29.9% in 1999 and remained ≥30.0% since that time (Fig 1). In 2003, there were an estimated 441 363 (95% CI: 385 360–497 366) HTO hospitalizations compared with 388 701 (95% CI: 348 690–428 712) in 1993.

The period from 1993 to 2003 demonstrated a decline in overall LOS, from 4.2 nights (95% CI: 4.0 – 4.4) to 3.4 nights (95% CI: 3.2–3.5). Examining this decrease according to LOS categories highlights the contribution of each group to the overall trend. The increase in HTO stays between 1993 and 2003 represents the greatest change in LOS categories (Fig 2). HTO stays increased from 24.9% (95% CI: 23.9 – 26.1) to 30.3% (95% CI: 29.1–31.6) of discharges. In contrast, discharges with LOS of 2 to 4 nights represented a stable 50% to 52% of the discharges across the study period. Stays of 5 to 7 nights decreased significantly from 12.8% (95% CI: 12.2–13.5) to 11.1% (95% CI: 10.4 – 11.8) of discharges, and stays of 8 nights or longer decreased significantly from 11.2% (95% CI: 10.3–12.1) to 7.3% (95% CI: 6.5– 8.2) of discharges. In logistic regression models adjusting for patient, payer, and hospital characteristics, predicted proportions of HTO stays were 25.4% in 1993 and 30.1% in 2003, consistent with observed results.

HTO Stays According to Patient Characteristics

We compared the 10 most frequent DRGs for HTO stays across study years to assess for changes in the reasons children require brief periods of inpatient care. For each year analyzed, “bronchitis and asthma” was the most common DRG for HTO stays. There had been no change in the 3 most common HTO DRGs since 1995 (Table 1). The 6 most common HTO DRGs had been consistent since 1997. Each of the 10 most common DRGs in 2003 demonstrated a significant increase in the proportion of stays that were HTO compared with 1993 (Fig 3). Since 1999, the 5 most common HTO DRGs mirrored the 5 most common DRGs for pediatric stays overall. One exception was “psychoses,” which ranked fifth in overall pediatric stays since 1999 but did not enter the top 10 ranking DRGs for HTO stays during the study period.

Significant increases in proportion of HTO stays were noted by age group (Table 2). The largest increase was noted in the youngest children. Children 0 to 2 years of age experienced a 9.5% absolute increase in HTO stays between 1993 and 2003. Smaller but significant increases were observed for the 3- to 7-year-old and for the 8- to 13-year-old age groups. The oldest age group had a stable proportion of HTO stays.

HTO Stays According to Payer and Hospital Characteristics

Significant increases in the proportion of HTO stays were also noted by payer and hospital characteristics (Table 2). Between 1993 and 2003, the absolute increase in HTO stays for Medicaid and uninsured discharges were greater than the increase observed for the privately insured. Compared with other payer groups, Medicaid discharges had significantly lower proportions of HTO stays. The only discharges without a statistically significant increase in the proportion of HTO stays were those with a routine admission source. By 2003, the routine admission source group had a significantly lower proportion of HTO stays when compared with the ED admission source group. Of note, the ED was the admission source for 55.9% (95% CI: 52.9 – 59.0) of discharges in 2003, a significant increase from 46.3% (95% CI: 43.7– 48.8) in 1993.

Trends in Total Charges

To provide clinical context and consistency across time and LOS categories, charge data are presented for the top 10 ranking HTO DRGs from 2003. Results shown are from analyses of truncated charges. Similar patterns were noted in analyses of all charges and log-transformed charges. Although mean charges for HTO stays remain the lowest of all LOS categories, by 2003 these stays contributed the second largest amount to aggregate hospital charges (Table 3). HTO stays accounted for 22.0% of aggregate charges in 2003, nearly double the 11.7% contribution in 1993. The longest stays have shown a decrease in their contribution to aggregate charges.

DISCUSSION

To our knowledge, this is the first national study of trends in HTO stays and the first national estimate of the number of US children who experience these observation-length stays. Since 1999, the proportion of HTO stays has represented at least 30% of all pediatric discharges, constituting over 440 000 hospitalizations nationwide annually. The proportion of HTO stays climbed during a period of declining hospital discharges and LOS, suggesting some hospitalizations have been avoided, whereas others have been compressed into shorter treatment periods. Factors that may have contributed to the rise in HTO stays include changes in medical treatment, prospective payment systems,²⁷ utilization review,^{28,29} care delivered in the ED before admission, the hospitalist movement,^{30,31} and condition-specific treatment protocols.³²

The trends we observe in HTO stays are concurrent with a rise in the proportion of hospital stays that originate in the ED. Although pediatric observation units have been developed both within EDs and on hospital wards, the literature suggests the majority of observation care is delivered in ED-based units.^{1,23,33,34} Recognizing that, in 2003, only 17% of EDs nationwide reported the ability to admit children to a 23-hour observation unit,³⁵ it is unlikely that the growth in HTO stays is the result of observation unit care. However, care delivered in the ED or other outpatient setting could account for the decline in hospitalization rates.

HTO stays may represent an opportunity for hospitals to deliver observation care in lieu of an admission. Compared with traditional inpatient services, observation units provide families with a treatment environment that prioritizes frequent contact with health care providers and timely reassessment that promotes more rapid discharge.³³ Compared with ED settings, observation units provide more time to make decisions regarding evaluation and disposition. For adults, hospitals have realized the potential for observation units to increase patient satisfaction and avoid admissions.^{6–8,15,36–40} It follows that similar incentives could motivate hospitals to establish formal pediatric observation units. With the small number of pediatric observation units at the present time, significant potential exists for the expansion of these services.

DRGs with the highest proportions of HTO stays fit with conditions that could be expected to require brief treatments. Some represent “high-stakes” conditions for young children at the time of admission (eg, fever). Others represent conditions that can respond to brief periods of high-intensity treatment or monitoring (eg, asthma or ingestion). Many of these DRGs represent conditions that have been cared for successfully in existing pediatric observation units.^{1,23,34,41}

The differences in HTO stays according to age are consistent with overall pediatric hospitalization patterns. Children <5 years of age undergo hospitalization at rates 3 times higher than older children⁴² and represent the majority of stays in established observation units.^{1,5} Our results suggest that, for observation units to reach the full spectrum of children, they will need to be structured to care for young pediatric patients.

Noteworthy differences in HTO stays were observed according to insurance status. Medicaid discharges accounted for the smallest proportion of HTO stays across time. Perhaps differences in disease severity or comorbid conditions account for this result. At the same time, Medicaid and uninsured discharges realized the greatest absolute increase in HTO stays. Smaller, although significant, increases in HTO stays were observed for privately insured discharges. It is possible that private payers were promoting shorter stays before 1993 and our observations reflect a lag in realizing HTO stays for other payer groups.

DRG-based reimbursement seems to promote hospital admissions over observation stays. For adults, reimbursement is more favorable for inpatient admission when compared with cases “under observation.”⁴³ Therefore, reimbursement may deter the development of observation units for children. Adequate reimbursement for observation services could promote the expansion of this model of care. In addition, shifting HTO stays to lower-cost observation settings could significantly affect aggregate hospital charges for children nationally.

As more hospitalizations fall into the HTO-stay category, they contribute more to the total charges for inpatient care. Although we observed the greatest absolute increase in mean charges for stays >4 days, these stays constituted only 12.1% of aggregate charges in 2003. With fewer stays entering these long-stay categories, there is less potential for savings to be realized. In adult hospitalizations, the first 3 days contribute considerably to overall expenses, and decreasing LOS beyond 4 days does not significantly affect the cost of inpatient care.⁴⁴ Delivering care for HTO stays in an observation unit represents an opportunity to achieve cost-savings at the start of an inpatient stay.

There are limitations to the ability to characterize HTO stays with the NIS database. First, the LOS counts, expressed in incremental calendar days, do not offer the detail necessary to determine if a 1-night stay lasted 20 or 40 hours. Despite this limitation, we believe our estimates capture the majority of children who may be eligible for observation unit care.

Second, data reported to HCUP are collected from discharge abstracts. The data set does not include the admission diagnosis. DRGs are assigned after a discharge diagnosis has been determined. Therefore, final billing diagnoses may not accurately capture the reason for an inpatient stay. Discharges that are assigned a DRG have most likely met admission criteria and are less likely to be under observation status. Some hospitals and payers consider patients under observation to have outpatient care, even if that occurs on a hospital ward. These cases may not be included in this inpatient data set. In 2002, HCUP found significant variation in the use of observation status codes within and across states in their databases.⁴⁵ Inpatient discharges with documented observation services ranged from 0.5% to 6.2% per year. Thus, our results may underestimate the true prevalence of HTO stays, because there is likely to be an unmeasured group receiving services under outpatient observation status.

A third limitation to the NIS is that it does not permit linkage at the individual level across discharges; therefore, readmission rates cannot be assessed. The large proportion of HTO stays raises questions about an unintended consequence of rapid discharges—the need for readmission. Safeguards need to be in place to ensure that HTO stays are not resulting in compromised care, including readmissions or return ED visits.

CONCLUSIONS

Brief inpatient stays have historically been labeled as unnecessary, inappropriate, or avoidable,^{29,46–48} yet consistently since 1999 nearly one third of children hospitalized in the United States have experienced a HTO stay. Assessing hospitalizations as inappropriate should be based on whether more appropriate care settings are available. We must adopt a more sophisticated view of hospital-based care, recognizing that some pediatric conditions will require <24 hours of treatment. These children need services that are more intensive than can be delivered in the home in a timely fashion within the current US health care system.

There is unlikely to be a one-size-fits-all answer to the care delivery for HTO stays. However, observation units, housed in either EDs or inpatient wards, provide 1 model for an efficient and cost-effective alternative to inpatient care, in which resources and provider interactions with patients and each other are geared toward shorter stays with more timely discharge processes.

What's Known on This Subject

ED and inpatient settings are experiencing pressures because of limited capacity and crowding. Previous studies have indicated that a significant number of hospitalized pediatric patients could be cared for in an alternative setting such as an observation unit.

What This Study Adds

Consistently since 1999, nearly one third of children hospitalized in the United States experience HTO stays. These cases constitute a population of children who may be eligible for care in an observation unit.

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Abbreviations

ED	emergency department
HTO	high turnover
NIS	Nationwide Inpatient Sample
HCUP	Health Care Cost and Utilization Project
DRG	diagnosis-related group
LOS	length of stay
CI	confidence interval

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FIGURE 1.
Trends in HTO stays and discharge rates, 1993–2003.

FIGURE 2.
Change in LOS categories, 1993–2003.

FIGURE 3.

Increase in proportion of HTO stays since 1993 by the top 10 HTO DRGs in 2003. URI indicates upper respiratory infection.

TABLE 1
Rank Order of Top 10 DRGs for Pediatric HTO Stays From 1993 to 2003

DRG	1993	1995	1997	1999	2001	2003
Bronchitis and asthma	1	1	1	1	1	1
Nutritional and miscellaneous metabolic disorders	6	3	3	3	3	2
Esophagitis, gastroenteritis, and digestive disorders	2	2	2	2	2	3
Simple pneumonia and pleurisy	7	5	4	4	5	4
Appendectomy without complications	14	8	6	6	4	5
Seizure and headache	5	6	5	5	6	6
Otitis media and upper respiratory infection	12	11	12	11	11	7
Lower extremity and humerus procedures	9	9	9	7	7	8
Poisoning and toxic effects of drugs	4	4	7	8	8	9
Viral illness and fever of unknown origin	13	12	10	10	9	10

Excludes transfers, deaths, and birth-related and neonatal DRGs.

TABLE 2
Change in Proportion of HTO Stays According to Patient, Payer, and Hospital Characteristics

	1993: Unweighted <i>n</i> = 293 216; Weighted <i>n</i> = 1 555 716		2003: Unweighted <i>n</i> = 303 936; Weighted <i>n</i> = 1 457 247		Absolute Difference in Proportions
	%	95% CI	%	95% CI	
Age, y					
0–2	23.0	21.7–24.3	32.5	30.7–34.2 ^a	9.5
3–7	26.9	25.3–28.5	32.8	31.3–34.3 ^a	5.9
8–13	25.4	24.2–26.6	29.4	27.8–31.0 ^b	4.0
14–17	24.6	23.3–25.8	26.8	25.6–28.1	2.2
Payer					
Medicaid	19.8	18.4–21.2	26.3	24.7–27.4 ^a	6.5
Private	28.2	27.0–29.3	32.9	31.6–34.1 ^a	4.7
Uninsured	26.9	25.4–28.3	33.1	31.4–34.8 ^a	6.2
Location					
Rural	23.3	21.6–25.0	32.8	30.5–35.1 ^a	9.5
Urban	25.4	24.1–26.7	29.9	28.5–31.3 ^b	4.5
Teaching status					
Teaching	24.7	22.7–26.8	30.0	28.2–31.8 ^b	5.3
Nonteaching	25.2	23.9–26.5	30.7	28.9–32.4 ^a	5.5
Bed size					
Small	24.8	21.4–28.3	32.2	29.5–35.0 ^a	7.4
Medium	26.6	24.8–28.4	32.3	29.6–35.0 ^a	5.7
Large	24.3	22.8–25.8	29.0	27.3–30.7 ^b	4.7
Admission source					
ED	25.2	23.8–26.5	32.7	31.3–34.0 ^a	7.5
Routine	24.8	23.3–26.3	27.3	25.6–28.9	2.5

Significant differences between 1993 and 2003:

^a *P* < .001

^b *P* < .01.

TABLE 3

Mean and Aggregate Hospital Charges for Top 10 HTO DRGs, According to LOS Category

	Mean Charges, 1993, \$ ^a	Mean Charges, 2003, \$	Aggregate Hospital Charges, 1993 (Millions \$) ^a	Aggregate Hospital Charges, 2003 (Millions \$)
0–1 nights (HTO)	3187	5345	494	1300
2–4 nights	6227	10 045	2700	3900
5–7 nights	9707	14 218	651	502
≥8 nights	17 352	22 237	384	213
Overall	6238	8745	4230	5920

Controlling for LOS, HTO stays, patient age, payer, and hospital characteristics.

^aInflation adjusted to 2003 dollars.