Pediatric Trauma Care: An Overview of Pediatric Trauma Systems and Their Practices in 18 US States

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Purpose: The aim of this study was to describe the state of pediatric trauma system development in the United States in 1997 and 1998 and to characterize the hospitalization patterns of injured children in states with different types of pediatric trauma systems. The authors also investigated the impact of sociodemographic, injury, and geographic characteristics on those hospitalization patterns.

Methods: The authors combined statewide hospital discharge data on hospitalized trauma patients less than 15 years old with data from the American Hospital Association, the Area Resource File, the Office of Management and Budget, the states' Departments of Health, and the US Census. Besides conducting descriptive analyses, the authors evaluated the role of several parameters in determining the likelihood of treatment in trauma and nontrauma centers using multivariate multinomial logistic regression models.

Results: There were 15 states with adult and pediatric trauma designation systems; 9 of them had statewide hospital discharge data available. In these 9 states, 77% of the discharges were from trauma centers with no pediatric designation. More severely injured children and children with injuries to the head, face, thorax, and abdomen were more likely to be discharged from trauma centers, although large percentages of these children were treated in nontrauma centers. Older children and children with commercial insurance were less likely to be treated at trauma centers, even when injury severity, body region injured, and other factors were accounted for.

Conclusions: Even in states with trauma systems, a large proportion of severely injured children are treated in nontrauma center facilities.
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INDEX WORDS: Pediatric trauma, trauma services, trauma systems.

EVERY YEAR, there are 14 million episodes of injuries to children less than 15 years old in the United States, resulting in approximately 9 million emergency room visits, 250,000 hospital admissions,[1] and about 6,500 deaths.[2] Injuries remain the leading cause of death among US children between the ages of 1 and 14 and are one of the leading causes or short-term and long-term physical and psychological morbidity.[3-4] In 1999, it was estimated that the cost of childhood injuries was $347 billion,[5] or 3.8% of the gross domestic product GDP.[6]

Following the example of care for adult trauma patients, a tiered system of resources and commitment to pediatric trauma care has been initiated. A number of states now have developed systems that include "designation" of pediatric trauma care centers.[7] Similar to the adult trauma system, pediatric trauma designation is granted either through a state- (or county-) specific evaluation that may incorporate some of the American College of Surgeons Committee on Trauma "verification" criteria[8] and that varies from state to state (or county to county).[9] There is variability also regarding actual stage of development of the system.[9] Some states have a simple categorical designation of pediatric trauma centers, whereas others subclassify them further (eg, level I, II, III), depending on resources available.

Although a few reports have investigated the impact of designation level on in-hospital pediatric mortality and a few other outcomes,[10-18] currently, there is no literature describing the extent of development and practices of pediatric trauma systems in the United States. Our objective in this report, therefore, is to provide a description of pediatric trauma care across the country in the late 1990s. We also investigated demographic, injury, or geographic factors that may have influenced the likeli-

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hood of an injured child being discharged from hospitals of different levels.

MATERIALS AND METHODS

Data

Hospital discharges of patients less than 15 years of age who had at least one diagnosis of trauma as defined by the International Classification of Diseases 9th revision Clinical Modification (ICD-9-CM) codes 800-959 were included for analysis. Exclusion criteria were having single trauma diagnoses of late effects (905-909), burns (930-949), or early complications (958) and being discharged from a hospital that the American Hospital Association (AHA) indicated was a rehabilitation hospital, an institution for the mentally retarded, a substance-abuse treatment institution, or a hospital for which the AHA had no information on the hospital type. Hospitalizations also were excluded if they were identified as being discharged to another short-term health care facility to avoid double counting. A more detailed description of the data sources used is presented below.

Hospital discharge data. Patient-level hospital discharge databases were obtained from 18 states for which statewide data were available in 1999: Arizona, California, Colorado, Florida, Illinois, Indiana, Iowa, Oregon, Maryland, Massachusetts, Michigan, New Jersey, New York, North Carolina, Pennsylvania, Virginia, Washington, and Wisconsin. The data were for either 1997 or 1998, depending on the state. These datasets provided us with information on the demographic characteristics of the patient, insurance coverage, injury diagnoses, procedures, and discharge disposition. ICDMAP,[19] a computer algorithm, of which validity for pediatric patients has been recently validated,[20] was used to derive Abbreviated Injury Severity (AIS) scores,[21] and Injury Severity Scores (ISS).[22]

Presence of comorbidities was determined using the ICD-9-CM codes and the Morris et al criteria.[23] ICD-9-CM procedural codes were used to determine whether any procedure had been performed during the hospitalization, because CPT codes[24] were not available.

Hospital and state characteristics. We obtained 1998 data from the AHA regarding hospital type and ZIP code.[25] Regional characteristics were obtained from the 1998 Area Resource File.[26] Information on the Metropolitan Statistical Areas (MSAs) was derived from the US Office of Management and Budget, based on the ZIP codes of the hospitals.[27] MSAs are a classification of geographical areas, according to whether a large population center exists, surrounded by other communities with which it is economically and socially integrated. To be an MSA, the population center must have at least 50,000 inhabitants. However, the exact size of this population center allows for classification of MSAs into different levels: D, if population is 50,000 to 99,999; C, if 100,000 to 249,999; B, if 250,000 to just below 1 million; and A, if 1 million or greater.[28]

The states' status regarding pediatric trauma system development were directly gathered from state authorities, most often the Bureau of Emergency Medical Services in the state government, and confirmed with other references in the literature.[29-30] For our analyses, we categorized states as: (1) adult-pediatric trauma system states, states with both adult and pediatric trauma care designation processes in place; (2) adult-only trauma system states, states with no pediatric trauma center designation but with adult trauma care designation; and (3) nontrauma system states, or states with no formal designation process. We then categorized individual hospitals as (1) pediatric-only trauma centers, which are hospitals that have no adult trauma designation but have a pediatric trauma designation as level I or II*; (2) adult-pediatric trauma centers, hospitals with adult trauma level I or II designation, plus a pediatric trauma designation as level I or II*; (3) adult-only trauma centers, hospitals with only adult level I or II designation; and (4) Nontrauma Centers, which includes hospitals that have no trauma designation or are designed as adult trauma centers level III or IV or pediatric trauma center level III.

State child population. Information on the number and age distribution of the children by state was derived from projections for 1997 or 1998 Census data and available in the CDC WONDER.[31]

Analysis

First, we investigated the states designation status. Then, we characterized the number, distribution, and characteristics of the injured children and the hospitals discharging them together with the distributions of injured children by hospital level and state trauma system. Last, and for children discharged from states with adult-pediatric trauma systems, we evaluated their distribution and characteristics by type of hospital. Multivariable, multinomial logistic regression techniques[32] were used to quantify the likelihood of a child being admitted to each of the 4 types of hospitals under evaluation (pediatric-only, adult-pediatric, adult-only, or nontrauma center) while controlling for covariates that were found to have a significant effect at the univariate level.

Throughout the analyses, statistical significance was defined at the $P \leq .05$ level. Data management and analysis were performed using Stata 6.0[33] and SAS 8.0.[34]

RESULTS

Pediatric Trauma Care Designation Status

Fifteen states in the United States specifically designate both adult and pediatric trauma centers: California, Colorado, Connecticut, District of Columbia, Florida, Georgia, Maryland, Massachusetts, Missouri, Nevada, New Jersey, New York, Pennsylvania, Utah, and Washington. We had hospital discharge data for 9 of these 15 states: California, which designates 2 levels of pediatric trauma centers (level I or II); Washington, which designates 3 levels (level I, II, or III); and Colorado, Florida, Maryland, Massachusetts, New Jersey, New York, and Pennsylvania that have a simple categorical designation for pediatric trauma centers. Of the other 9 states for which statewide hospital discharge data were available, 4 are adult-only trauma systems (Illinois, North Carolina, Oregon, and Virginia), and the remaining 5 (Arizona, Indiana, Iowa, Michigan, and Wisconsin) do not have formal designation trauma systems in place.

Discharging Hospitals and Discharged Injured Children

The 60,175 analyzed discharges were from 2,010 facilities in the 18 states, representing a discharge rate of 164 per 100,000 population. The median number of discharges per facility was 13, and the mean 30 (SD = 63); the proportion of pediatric discharges for each type of facility and type of state varied as shown in Table 1.

In states with trauma systems (whether adult-pediatric or adult-only), approximately 45% of all injury-related pediatric discharges were from nontrauma centers

* Note that level 1 is applied to those hospitals with the highest level of resources for the care of trauma patients.

Table 1. Hospitals Providing Care to Injured Children Less Than 15 Years in 18 US States by Hospital Level, 1997 or 1998 (n = 2,010 Hospitals, and 60,175 Discharges)

State Trauma System	Pediatric-Only Trauma Centers	Adult-Pediatric Trauma Centers	Adult-Only Trauma Centers	Nontrauma Centers	All Hospitals
Adult-pediatric*					
Number of hospitals	13 (1%)	26 (2%)	135 (11%)	1,022 (86%)	1,196 (100%)
Annual trauma discharges	5,551 (13%)	4,298 (10%)	12,557 (30%)	19,086 (47%)	41,492 (100%)
Discharge rate (per 100,000 pop.)	N/A	N/A	N/A	N/A	178
Median discharges per hospital	478	149	69	11	13
Hospital MSA location					
A	92%	62%	70%	53%	55%
B	8%	35%	19%	21%	21%
C or D	0%	0%	8%	9%	8%
Non-MSA	0%	3%	4%	17%	15%
Adult only‡					
Number of hospitals	N/A	N/A	86 (23%)	292 (77%)	378 (100%)
Annual trauma discharges	—	—	5,306 (59%)	3,645 (41%)	8,951 (100%)
Discharge rate (per 100,000 pop.)	N/A	N/A	N/A	N/A	125
Median discharge per hospital	—	—	32	8	11
Hospital MSA location					
A	—	—	59%	35%	40%
B	—	—	17%	11%	13%
C or D	—	—	16%	5%	8%
Non-MSA	—	—	7%	48%	34%
None§					
Number of hospitals	N/A	N/A	N/A	436 (100%)	436 (100%)
Annual trauma discharges	—	—	—	9,732 (100%)	9,732 (100%)
Discharge rate (per 100,000 pop.)	N/A	N/A	N/A	N/A	157
Median discharge per hospital	—	—	—	7	7
Hospital MSA location					
A	—	—	—	24%	24%
B	—	—	—	20%	20%
C or D	—	—	—	12%	12%
Non-MSA	—	—	—	43%	43%
Total number of hospitals	13 (<1%)	26 (1%)	221 (11%)	1,750 (87%)	2,010 (100%)
Total number of annual trauma discharges	5,551 (9%)	4,298 (7%)	17,878 (30%)	32,463 (54%)	60,175 (100%)

Abbreviation: N/A, Not applicable

*CA, CO, FL, MA, MD, NJ, NY, PA, WA. Hospitals may have obtained ACS verification as adult and/or pediatric trauma centers and this is not reflected here.

†Metropolitan Statistical Area: Level A indicates population center has 1 million inhabitants or more; B indicates center between 250,000 and 999,999; C or D between 50,000 and 249,999; and Non-MSA is a location with a population center with less than 50,000 inhabitants.

‡IL, NC, OR, VA. Hospitals may have obtained ACS verification as adult pediatric trauma centers and this is not reflected here.

§AZ, IA, IN, MI, WI. Hospitals may have obtained ACS verification as adult or pediatric trauma centers and this not reflected here.

(weighted average of 47% for nontrauma centers in states with adult-pediatric systems and 41% for nontrauma centers in adult-only system states in Table 1). For the other approximately 55% of children who were discharged from some type of designated trauma center, 35% (weighted average of 30% and 59% in Table 1) were discharged from hospitals with no pediatric designation.

Of the 60,175 discharges, 41,492 were from the 9 states with adult-pediatric trauma systems (Table 1). These discharges were from 13 pediatric-only trauma centers; 26 adult-pediatric trauma centers; 135 adult-only trauma centers; and 1,022 non-trauma centers. Fifty-five percent of all hospitals were in heavily populated urban areas. In fact, all pediatric-only trauma centers were in MSA levels A or B, as were 89% of adult-pediatric trauma centers, whereas non-MSAs had 3% of adult-pediatric trauma centers, 4% of adult-only trauma centers, and 17% of the nontrauma centers. Even in MSA levels A and B, only 13% of the injured children were discharged from pediatric-only trauma centers, whereas 46% were discharged from nontrauma centers.

Characteristics of the discharged injured children in states with adult-pediatric trauma systems. A closer analysis of the characteristics of these 41,492 discharges revealed multiple differences by hospital level. Table 2 summarizes them by showing the percent distribution of sociodemographic and injury characteristics of the children within hospital level (ie, column percents) as well as whether any of those differences are statistically signif-

Table 2. Child, Injury, and Hospital Stay Characteristics by Hospital Level

	Pediatric-Only Trauma Centers	Adult-Pediatric Trauma Centers	Adult-Only Trauma Centers	Nontrauma Centers	
Number of discharges	5,551	4,298	12,557	19,086	
% Male	64%	65%	67%	66%	*
Mean Age (SD)	6.8 (4.2)	7.3 (4.4)	7.6 (4.4)	7.9 (4.3)	*
Has preexisting condition coded	4%	6%	5%	4%	*
Payor:					
Medicaid	29%	26%	33%	24%	*
Self/No-pay	10%	17%	13%	14%	*
Commercial	55%	54%	50%	58%	*
Other	6%	3%	4%	4%	*
Single injury:	62%	50%	60%	75%	*
Head/Neck	18%	17%	14%	10%	*
Face	2%	2%	2%	2%	*
Chest	<1%	<1%	<1%	<1%	*
Abdomen/Pelvis	3%	3%	2%	3%	*
Extremities	33%	22%	33%	52%	*
External	6%	6%	8%	8%	*
Multiple injuries/one region	15%	16%	15%	13%	*
Single injuries/multiple regions	10%	13%	11%	6%	*
Multiple injuries/regions	14%	21%	15%	6%	*
Mean ISS (SD)	6.3 (5.9)	7.3 (7.2)	5.9 (5.7)	4.8 (3.9)	*
ISS Scores					
1-8	71%	65%	74%	84%	*
9-12	18%	19%	16%	12%	*
13-15	3%	4%	3%	<1%	*
16-24	6%	8%	5%	2%	*
25-75	3%	4%	2%	1%	*
Admissions by referral or transfer	23%	21%	14%	19%	*
At least one procedure	78%	73%	79%	81%	*
Mean length of stay (SD)	3.3 (6.1)	3.3 (4.9)	3.6 (3.9)	2.7 (4.4)	*
Died	1%	2%	1%	<1%	*
Discharge to SNF/ICF/home care	2%	6%	3%	3%	*
Median hospital charges (US$)	$6,501	$7,412	$ 6,303	$ 4,901	*

NOTE. Selected states with adult pediatric-trauma systems (CA, CO, FL, MA, MD, NJ, NY, PA, WA), 1997 or 1998. (n = 1,196 hospitals, and 41,492 discharges).

*$P < .05$ (i e, statistically significant differences within hospital levels—column percents).

icant. For example, children in adult-pediatric trauma centers with single injuries are less common (50%) than in other centers (60% to 75%), which is probably related to children in adult-pediatric trauma centers having the highest death rates (2% *v* 1%) and being more likely to be discharged to some form of special care (6% *v* 3% or 2%). Children from adult-only trauma centers also had the highest hospital charges.

A comparison of the distribution of these characteristics across hospital types (ie, row percents, numbers not shown) leads to other interesting findings. For example, only 26% of children with preexisting conditions were treated in pediatric-only or adult-pediatric trauma centers. Of the children whose most severe injuries were to the head or neck, 32% were discharged from pediatric-only or adult-pediatric centers, with another 32% discharged from adult-only trauma centers and the remaining 36% discharged from nontrauma centers. Similarly, only 27% of the children whose most severe injury was to the abdomen were treated in pediatric-only or adult-pediatric facilities. Among the children with multiple injuries to multiple body regions, 35% were treated in pediatric-only or adult-pediatric centers, 40% in adult-only facilities, and the remaining 25% in nontrauma centers. Only 40% of children with ISS between 25 and 75 were treated in pediatric or adult-pediatric facilities.

Evaluating factors that determine hospital type. The multivariable, multinomial regression model included those demographic, insurance, and injury-related covariates that had shown a significant effect at the univariate level. This analysis was restricted to patients discharged from adult-pediatric trauma system states and from facilities located in MSA levels A or B, because in less-populated areas there are no pediatric-only trauma centers and very few other trauma centers. The model uses as the reference case a 7-year-old boy with commercial insurance and no preexisting conditions who sustained a single moderate injury to the extremity (eg, a nondisplaced closed lower extremity fracture), an ISS of 4, and who was treated in an MSA level A. The results of the

Table 3. Adjusted Odds Ratios from Multinomial Logistic Regression Model Evaluating Discharge by Hospital Level

	Pediatric-Only Trauma Centers	Adult-Pediatric Trauma Centers	Adult-Only Trauma Centers
Gender (female)	1.07	1.01	0.97
Age (1-year increase)	0.95*	0.98*	0.99*
Presence of preexisting conditions	1.00	1.40*	1.16*
Medicaid	1.20*	1.20*	1.68*
Self-pay/Nopay	0.85*	1.40*	1.23*
Other payor	2.61*	1.41*	1.61*
ISS (1-point increase)	1.05*	1.05*	1.03*
Head/face injuries	2.30*	3.08*	2.26*
Thoraco/abdominal injuries	1.89*	2.44*	1.88*
Extremity injuries (lack of)†	0.97	0.93	0.88*
External injuries	1.78*	2.22*	2.16*
MSA (Level B)	0.06*	1.02	0.55*

NOTE. Selected states with Adult-pediatric trauma systems (CA, CO, FL, MA, MD, NJ, NY, PA, WA); discharges from metropolitan statistical areas level A and B; 1997 or 1998. (n = 914 hospitals, 37,540 discharges) Reference case: 7-year-old boy with no preexisting conditions, commercial insurance, single injury in extremity region with AIS of 2 (thus ISS of 4) and discharged from a MSA level A area nontrauma center.

*$P < .05$

†This covariate is needed to evaluate the effect of changing the only injury our reference case has.

model confirmed the significant impact of age, preexisting conditions, insurance status, injury number, location, and severity on the likelihood of discharge by different types of hospitals (Table 3). For example, a 1-year increase in age was associated with a significant decrease in the probabilities of being admitted to a pediatric-only, adult-pediatric, or adult- only trauma centers if everything else remained constant (adjusted Odds Ratios [OR] 0.95, 0.98, and 0.99, respectively). In contrast, sustaining an injury to the head significantly increased the probabilities of being admitted to a pediatric-only, adult-pediatric trauma center, or to an adult-only trauma center (adjusted ORs 2.30, 3.08, and 2.26, respectively). Being covered by Medicaid significantly increased the adjusted ORs of being admitted to a trauma center (1.20 for pediatric-only and adult-pediatric, 1.68 for adult-only trauma center); whereas being self-paid or uninsured decreased the likelihood of being discharged from a pediatric-only trauma center (adjusted OR 0.85) and increased the likelihood of being discharged from an adult-pediatric or an adult-only trauma center (adjusted ORs 1.40 and 1.23, respectively). Having head, facial, or thoraco-abdominal injuries significantly increased the likelihood of going to a trauma center, with adjusted ORs ranging from 1.88 for thoraco-abdominal injuries discharged from adult-only trauma centers to 3.08 for head or facial injuries being discharged from an adult-pediatric level I or II. Figure 1 summarizes the implications of these findings by illustrating the probability of being discharged from different types of hospital for 4 plausible injury cases as predicted by the model. These 4 hypothetical children were (1) our reference case (eg, a sports-related injury); (2) a Medicaid-covered 1-year-old girl with no preexisting conditions who needs treatment in an MSA level B for her multiple injuries to the head (eg, a playground injury); (3) a 3-year-old girl with private insurance and no preexisting conditions who needs treatment in a MSA level B area for her multiple injuries to multiple body regions (eg, a car crash); and (4) an uninsured 14-year-old boy with no preexisting conditions in a MSA level A area who sustains 2 single injuries in multiple body regions (eg, a gunshot victim). In these hypothetical cases, the probabilities of *not being* discharged from pediatric-only or adult-pediatric trauma centers ranged from 43% in our 3 year old (from a hypothetical motor vehicle crash) to 99% in our reference case.

DISCUSSION

This report presents the status of pediatric trauma care designation in the United States in 1997 and 1998 in 18 states for which statewide hospital discharge data were available. Few of the children hospitalized because of their injuries are treated in designated pediatric-only or adult-pediatric trauma centers. In states with adult-pediatric trauma systems, pediatric-only and adult-pediatric trauma centers discharge 13% and 10% of the injured children, respectively. This was true also for children in more densely populated areas in which hospitals of different levels are more readily available. The large percent of trauma children seen in nontrauma centers may seem to contradict a previous report that most injured children were treated at pediatric-only or adult-pediatric trauma centers.[17] However, that study used Trauma Registry data, which did not include children seen in nontrauma center hospitals.

Whereas some investigators have expressed concern that injured children treated in adult-only trauma centers will do worse than if treated in pediatric trauma centers,[12,17-18] the available data are largely inconclu-

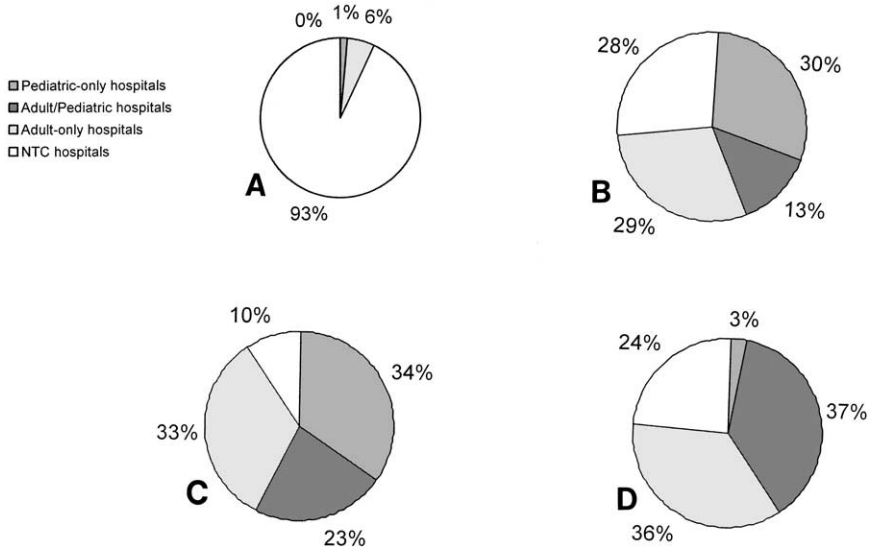

Fig 1. Predicted probabilities of discharge from different hospital types in selected states with adult-pediatric trauma systems (CA, CO, FL, MA, MD, NJ, NY, PA, WA) controlling for age, gender, presence of pre-existing conditions, insurance status, number and body region of injuries, injury severity as measured by ISS, and MSA level of the area in which the discharging facility is located. Restricted to MSA Level A and B only. (A) Reference case. A hypothetical boy, age 7, with no preexisting conditions and a single injury to the lower extremity that has an AIS score of 2 (therefore, ISS of 4), who is covered by commercial insurance, and is treated at a hospital in MSA level A. (For example, a sport-related injury.) (B) A hypothetical girl, age 1, with no preexisting conditions and 2 injuries to the head that have AIS scores of 3 and 1 (therefore, ISS of 9), who is covered by Medicaid, and is treated at a hospital in MSA Level B. (For example, a playground injury.) (C) A hypothetical girl, age 3, with no preexisting conditions and 2 injuries to the head that have AIS scores of 3 and 2, one injury to the abdomen that has an AIS score of 3, and another injury to the lower extremity with AIS score of 2 (therefore, ISS of 22), who is covered by commercial insurance, and is treated at a hospital in MSA level B. (For example, a motor vehicle occupant injury.) (D) A hypothetical young man, age 14, with no preexisting conditions and one injury to the head that has an AIS score of 4, and another injury to the chest with AIS score of 2 (therefore, ISS of 20), who has no insurance, and is treated at a hospital in MSA level A. (For example, a gunshot victim.)

sive,[13-16] with the possible exception of blunt injuries, particularly to the head or the abdomen.[10,11,17] Our findings show that even though children with injuries in these body regions are more likely to go to trauma centers, a large percentage do not. For example, only 19% of children with their most severe injury to the head are treated in pediatric-only trauma centers, with another 14% of them being discharged from adult-pediatric trauma centers, 32% from adult trauma centers, and the remaining 35% from centers with no trauma designation. This may be an indication of suboptimal admission and discharge patterns, but it also suggests that there may not be a sufficient number of pediatric trauma centers in the United States to care for more than a minority of all pediatric trauma.

Injury severity or body region injured is not the only characteristic determining where children were hospitalized for their injuries. Significant differences were discovered in demographic characteristics and insurance status by hospital type. Some of these differences were anticipated, such as the fact that discharges from pediatric trauma care facilities (whether pediatric-only or adult-pediatric) tended to have a higher percent of admissions by referral or transfer compared with discharges from adult-only or nontrauma centers.[35] It was also somewhat anticipated that preexisting conditions would increase the likelihood of being treated at trauma centers, although this was only statistically significant for adult-pediatric trauma center discharges. In contrast, other differences were not anticipated. Older children (even one year differences) were less likely to be admitted to a facility with pediatric trauma care designation than younger children, even when controlling for injury severity. Insurance status too was a determinant of discharge, even when controlling for possible confounders. For example, children with commercial insurance were more likely to be discharged from nontrauma centers. Children under Medicaid were statistically significantly more likely to be discharged from trauma centers, as were children with other types of insurance. Children with no insurance were more likely to be discharged from adult and pediatric trauma facilities; however, they were less likely to be discharged from a pediatric-only trauma center. We believe these differences in child and injury characteristics to be extremely important for future evaluations of the effectiveness of pediatric trauma centers versus adult-only trauma centers or nontrauma centers.

These findings should be interpreted with caution for a number of reasons. For example, we could only include states with statewide hospital discharge data sets available; as a result, our 18 states encompass 21.7% of all

children less than 15 years old in the United States in 1997 and 1998.[31] Interestingly, the overall discharge rate shown in these states is lower than rates reported by other investigators.[35-36] However, discharge rates have been decreasing for the past 25 years, and our findings may be a reflection of this trend. We also acknowledge our limited ability to control for injury severity because of the absence of any physiologic information in the discharge data that would have allowed us to evaluate the role of other measures, such as the Pediatric Trauma Score or the Revised Trauma Score. The absence of data on mechanism of injury also prevented us from evaluating the impact that this factor may have on determining hospital of discharge. An exploratory analysis of the 20% of the cases with E codes showed that in adult-pediatric trauma system states, motor vehicle crash pediatric victims are 3.7 times more likely than non–motor vehicle crash victims to be discharged from adult or pediatric trauma centers while controlling for all other factors (ie, insurance status, age, injury severity).

Finally, we relied on state (or county) designation processes to classify the hospitals' level, thus, inheriting great variability in that classification.[8] However, regardless of the criteria used to designate them, the point of our analysis is that few injured children are being discharged from facilities supposedly better equipped to treat them.

Our study does not evaluate the effectiveness of different hospital levels on the outcomes of injured children. Moreover, this study does not provide a representative view of US discharge patterns for injured children. However, this study provides a cross-sectional view of the available data of the development of pediatric trauma system development in the United States in the late 1990s. The study highlights the fact that very severely injured children were being treated in nontrauma center facilities, even in states with pediatric trauma designation systems in place. It shows that older children were more likely to be treated at nontrauma center facilities, even when controlling for injury severity and that insurance status was playing a role in discharge patterns and hospital admission.

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