

Association Between Insurance and Transfer of Injured Children From Emergency Departments

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abstract

OBJECTIVES: To determine if injured children presenting to nondesignated trauma centers are more or less likely to be transferred relative to being admitted based on insurance status.

METHODS: We conducted a cross-sectional study by using the Healthcare Cost and Utilization Project Nationwide Emergency Department Sample. Pediatric trauma patients receiving care in emergency departments (EDs) at nontrauma centers who were either admitted locally or transferred to another hospital were included. We performed logistic regression analysis adjusting for injury severity and other confounders and incorporated nationally representative weights to determine the association between insurance and transfer or admission.

RESULTS: Nine thousand four hundred and sixty-one ED pediatric trauma events at 386 nontrauma centers met inclusion criteria. EDs that treated a higher proportion of patients with Medicaid had higher odds of transfer relative to admission (odds ratio [OR]: 1.2 per 10% increase in Medicaid; 95% confidence interval [CI]: 1.1–1.4), resulting in overall higher odds of transfer among patients with Medicaid compared with patients with private insurance (OR: 1.3; 95% CI: 1.0–1.5). A patient's insurance status was not associated with different odds of transfer relative to admission within individual EDs after adjusting for the ED's proportion of patients with Medicaid (Medicaid OR: 1.0; 95% CI: 0.8–1.1).

CONCLUSIONS: Injured pediatric patients presenting to nondesignated trauma centers are slightly more likely to be transferred than admitted when the ED treats a higher proportion of Medicaid patients. In this study, ongoing concerns about inequities in the delivery of care among hospitals treating high proportions of children with Medicaid are reinforced.



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Dr Huang conceptualized and designed the study, conducted the initial analyses, and drafted the initial manuscript; Ms Kisse, Ms Dayal, and Ms Sigal assisted in the data interpretation and reviewed and revised the manuscript; Dr Wang conceptualized and designed the study and reviewed and revised the manuscript; Dr Marcin conceptualized, designed, and supervised the study, and critically reviewed and revised the manuscript; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

DOI: <https://doi.org/10.1542/peds.2016-3640>

Accepted for publication Jul 12, 2017

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

WHAT'S KNOWN ON THIS SUBJECT: Insurance status has been shown to be associated with admission and transfer decisions from the ED among injured adults at nontrauma centers. Whether insurance status is associated with transfer decisions among injured pediatric patients is unknown.

WHAT THIS STUDY ADDS: Hospitals without a trauma designation that treat a higher proportion of patients with Medicaid are slightly more likely to transfer injured children than admit them compared with hospitals that treat a lower proportion of children with Medicaid.

To cite: Huang Y, Kisse JL, Dayal P, et al. Association Between Insurance and Transfer of Injured Children From Emergency Departments. *Pediatrics*. 2017;140(4):e20163640

Trauma is the leading cause of morbidity and mortality among children in the United States.¹ Each year, >14 000 000 injury-related events among children are documented, resulting in >9 000 000 emergency department (ED) visits, 25 000 hospital admissions, 6500 deaths, and high economic costs to both families and society.^{2,3} Many EDs, however, are not fully equipped to care for the most seriously injured children and lack specialized pediatric emergency and trauma care services.⁴ To address this, regionalized trauma systems and guidelines have been developed to expedite the timely transfer of seriously injured children to designated trauma centers.⁵ Improved outcomes, such as lower mortality rates, have been documented among injured children that are transferred to designated trauma centers.^{6,7}

Although the number of trauma centers has been growing, >50% of pediatric trauma patients are cared for at one of the 87% of US hospitals that are not designated as trauma centers.² If injuries are serious, children presenting to nontrauma centers may receive delayed and/or suboptimal care if they are not expeditiously transferred to designated trauma centers. Although the decision to transfer a pediatric trauma patient from a nontrauma center should depend mainly on clinical factors and the need for specialty services, patterns observed in the medical literature in which adult trauma patients are evaluated suggest that insurance status can be an independent factor associated with transfer.⁸ This is important because the over-transfer of patients without serious injury and the under-transfer of patients with serious injury can contribute to increased morbidity, mortality, and costs of care.^{9,10} Few researchers have explored this association among injured pediatric trauma patients,

particularly those presenting to nondesignated trauma center EDs.^{11,12} Although the principles of pediatric trauma care are the same as for the adult population, there are important differences such as injury patterns, rates of occurrence, and mechanism of injuries.^{13,14}

In the current study, we sought to investigate the relationship between a patient's insurance status and the insurance status of an ED's patient population with the odds of transfer relative to admission among injured children receiving care in nontrauma center EDs. We conducted multivariable, hierarchical logistic regression models adjusting for injury severity and other confounders and incorporated nationally representative weights to evaluate the association between insurance status and odds of transfer and to determine if differences in odds of transfer would be primarily explained by patient-level or hospital-level factors. We hypothesized that the disposition of pediatric trauma patients (admission versus transfer) presenting to nontrauma centers would be independent of insurance status at both the individual patient and hospital ED levels.

METHODS

Data Source

The population used in this study was obtained from the 2012 Nationwide Emergency Department Sample (NEDS),¹⁵ the largest all-payer ED database in the United States. NEDS contains discharge information on >31 000 000 ED visits from 950 hospitals located in 30 states and can be used to represent the ~134 000 000 ED events estimated to have occurred in the United States in 2012. Approximately 100 patient-related and hospital-related variables are collected in this database. Race and ethnicity are not included in the NEDS. Hospitals are categorized as

nontrauma centers or trauma centers by NEDS by using the trauma-level designations for hospitals from the Trauma Information Exchange Program database.¹⁶ Previous research has demonstrated that estimates from the NEDS are similar to those from other national ED databases, such as the National Hospital Ambulatory Medical Care Survey and National Electronic Injury Surveillance System-All Injury Program.¹¹

Study Population

We included all ED events at nontrauma centers for patients aged 17 years and younger who were either admitted locally ("admitted as an inpatient to this hospital") or transferred to another hospital ("transfer to another short-term hospital"). We limited the events to those with an *International Classification of Disease, Ninth Revision, Clinical Modification* of 800 to 959 in the first 3 diagnoses. ED events from nontrauma centers where all patients were transferred (transfer rate of 100%) or where all patients were admitted (admission rate of 100%) were excluded from the analyses. This was done to exclude hospitals that had no means of admitting an injured pediatric patient and hospitals that never transferred injured pediatric patients to another hospital.

We categorized insurance status ("expected primary payer") at the individual patient level into 4 groups: (1) private (eg, Blue Cross and other commercial carriers), (2) Medicaid, (3) uninsured, and (4) other insurance (eg, Title V and other government programs). Pediatric trauma patients with Medicare insurance and those categorized as having no charge were excluded.

Main Outcome Measure

The primary outcome variable of interest was the patients' admission status defined as either admitted to

the presenting facility or transferred to another acute care hospital.

Patient and Clinical Characteristics

The primary independent variable was insurance status at both the individual patient level and the hospital ED level. The insurance variable at the hospital ED level was defined as the proportion of injured children presenting to the ED who had Medicaid insurance. Other patient-level variables included age, sex, event on weekend (yes and no), and quartile of median household income based on patient's zip code as defined by NEDS ($\geq \$63\,000$, $\$48\,000$ – $\$62\,999$, $\$39\,000$ – $\$47\,999$, and $\$1$ – $\$38\,999$). Age was categorized a priori into 3 age categories: 0 to 4, 5 to 12, and 13 to 17 years. Injury-related variables also included penetrating injury (yes and no), blunt injury (yes and no), and injury severity score (ISS). The ISS was calculated by using a publicly-available Stata Program for Injury Classification, ranging from 0 to 15.¹⁷ We further categorized injury severity on the basis of the following ISS thresholds: minor injury (ISS 1–9) and moderate to severe injury (ISS ≥ 10). Moderate and severe injuries were combined because of the relatively low sample of severely injured pediatric patients who presented to nontrauma centers.¹⁸

Hospital Characteristics

Hospital-level variables included hospital geographic region (Northeast, Midwest, South, and West), metropolitan setting, teaching status, and total number of annual ED visits. The NEDS metropolitan setting variable was categorized into metropolitan and nonmetropolitan on the basis of the county of the hospital as identified by the American Hospital Association. Hospital teaching status was defined as one having an American Medical Association–approved residency program, being a member of the

Council of Teaching Hospitals, or having a ratio of full-time–equivalent interns and residents to beds of ≥ 0.25 . Survey weight, by using American Hospital Association universe as the standard, was used to extrapolate NEDS ED trauma sample to the entire universe of ED trauma events in nontrauma centers.¹⁵

Statistical Analyses

Descriptive and univariable analyses were used to summarize ED event demographic factors, patient diagnoses, and patient dispositions. Multivariable logistic regression models incorporating survey weights and a cluster adjustment at the hospital level were used to examine the association between insurance status and the odds of transfer relative to admission. Stratums were adjusted for the complex design of the NEDS as a stratified, single-stage cluster sample.¹⁵ Other patient-level and hospital-level factors and injury-related variables were also included in our models to adjust for potential confounding. The relationship between ISS (range: 0–15) and insurance status was also evaluated among pediatric transfers and admissions separately by using the Student's *t* test. To evaluate the hospital ED–level effect of the proportion of patients with Medicaid, we included a variable for each hospital with the proportion of injured children presenting with Medicaid. To estimate the within hospital and between hospital variance, we used a hierarchical logistic regression model with random intercepts for hospitals to calculate the intraclass correlation coefficient (ICC). All analyses were conducted by using SAS version 9.4 (SAS Institute Inc, Cary, NC) and Stata version 14.2 for ICC calculations (StataCorp, College Station, TX), given $\alpha = .05$. The Institutional Review Board at the University of California, Davis approved this study.

RESULTS

The 2012 NEDS sample contains 544 767 pediatric ED trauma events from 386 nontrauma centers. After applying our selection criterion, our final study population included 9461 pediatric ED events from nontrauma centers. Of this sample, 7074 (74.8%) pediatric events resulted in patient transfer, and 2387 (25.2%) pediatric events resulted in admission to the nontrauma center (Fig 1). A total of 4374 (43.1%) of the pediatric events had private insurance, 4047 (42.8%) had Medicaid, 535 (5.7%) had no insurance, and 505 (5.3%) had other insurance.

The unweighted frequency of patient transfer and admission among the patient-level and hospital-level characteristics is represented in Table 1. Patients who were younger and those living in communities with lower median household incomes were more frequently transferred to another hospital relative to local admission. Patients were also more frequently transferred when they presented to nonteaching and nonmetropolitan hospitals and EDs with lower annual volumes. Relative to hospitals in the Northeast, children presenting to EDs in the Midwest were more likely to be transferred. When we evaluated transfer rates by the hospital ED's proportion of patients with Medicaid by using interquartile ranges, EDs treating a higher proportion of injured children with Medicaid insurance (those treating $\geq 55.9\%$) transferred slightly more frequently (82.5%) than hospitals treating a lower proportion of children with Medicaid (those treating $< 20.0\%$ Medicaid transferred 76.4% of patients, $P < .001$).

Table 2 shows the patient-level and hospital-level factors by insurance status. Compared with patients with private insurance, patients with Medicaid and those that were uninsured resided in communities with lower median household

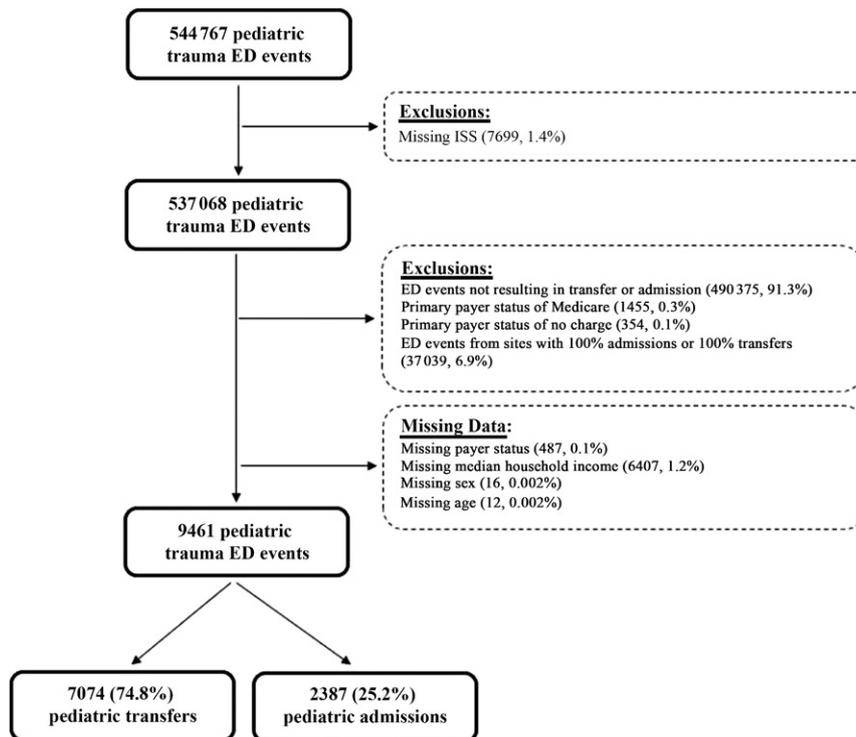


FIGURE 1
Inclusion and exclusion criteria.

income. Overall, there were slightly higher unadjusted transfer rates among patients with Medicaid (76.5%) than patients with private insurance (73.5%) relative to admission ($P = .001$). The mean ISS among injured children with private insurance that were admitted from the ED was significantly higher (5.0, SD = 4.5) than those with Medicaid that were transferred to another hospital (4.2, SD = 4.1, $P < .001$).

In the adjusted multivariable model when the proportion of patients with Medicaid is not included in the analysis (Supplemental Table 4), patients with Medicaid insurance had overall higher odds of transfer relative to admission compared with patients with private insurance (odds ratio [OR]: 1.3; 95% confidence interval [CI]: 1.0–1.5); however, this finding was the result of higher transfer rates at hospital EDs that treated a higher proportion of Medicaid patients. That is, in the multivariable model that adjusts for the proportion of

patients with Medicaid, the overall adjusted transfer rates for patients with private insurance, Medicaid insurance, those uninsured, and those with other insurance were: 73.6% (95% CI: 73.1%–74.1%), 75.6% (95% CI: 75.0%–76.1%), 78.5% (95% CI: 77.0%–80.0%), and 73.1% (95% CI: 71.3%–75.0%), respectively. Patients treated at hospitals with a higher proportion of Medicaid patients had higher odds of transfer relative to admission (OR: 1.2 per 10% increase in Medicaid; 95% CI: 1.1–1.4). Once adjusted for hospital effects or proportion of patients with Medicaid at presenting EDs, we found no discernable difference in adjusted odds of transfer of individual patients within EDs on the basis of insurance status (Table 3); for example, within individual hospital EDs, the odds of transfer of a patient with Medicaid was similar to the odds of transfer of a patient with private insurance (OR: 1.0; 95% CI: 0.8–1.1). This was true for the uninsured children as well compared with children with private

insurance (OR: 1.1; 95% CI: 0.9–1.3). The ICC for this analysis suggested that 70.5% of the variance in the odds of transfer among patients with Medicaid insurance was explained by between hospital variance (or hospital effects), leaving 29.5% of the variance in odds of transfer explained by within hospital variance (or individual patient insurance effects).

Finally, we conducted a post hoc analysis to evaluate whether the association between the proportion of Medicaid patients and patient transfer or admission was modified by injury severity. The interaction terms were not significant, suggesting that hospitals with higher proportions of Medicaid patients tended to transfer more injured children regardless of the injury severity.

DISCUSSION

In our national study of 9461 pediatric trauma-related events at 386 nontrauma centers, we found that hospital EDs that treat a higher proportion of patients with Medicaid tend to transfer patients more frequently than admit patients, even after adjusting for case mixing and confounders. The implication of this resulted in the finding that patients with Medicaid insurance had 1.3 times the odds of being transferred relative to being admitted compared with those patients with private insurance. This association was relatively modest in absolute terms. Nonetheless, we found this association among a cohort of hospitals that admitted at least some pediatric trauma patients during the study period and were therefore presumably at least capable of admitting injured children. We also found that children with Medicaid insurance transferred to another inpatient hospital, on average, were less severely injured than those children with private insurance that were admitted to the

TABLE 1 Patient-Level and Hospital-Level Characteristics by Admission and Transfer Status

Patient, Hospital-Level Variables	Frequency (%)		Odds of Transfer (95% CI)
	Admission, N = 2387	Transfer, N = 7074	
Age, y			
13–17	998 (34.4)	1907 (65.7)	Reference
5–12	772 (22.1)	2727 (77.9)	1.9 (1.4–2.4)
0–4	617 (20.2)	2440 (79.8)	2.0 (1.3–3.1)
Sex			
Male	1467 (24.9)	4429 (75.1)	Reference
Female	920 (25.8)	2645 (74.2)	1.0 (0.9–1.1)
Primary payer status			
Private insurance	1158 (26.5)	3216 (73.5)	Reference
Medicaid	950 (23.5)	3097 (76.5)	1.2 (0.9–1.7)
Uninsured	125 (23.4)	410 (76.6)	1.1 (0.7–1.6)
Other	154 (30.5)	351 (69.5)	0.9 (0.6–1.4)
Admission on weekend			
No	1616 (25.8)	4645 (74.2)	Reference
Yes	771 (24.1)	2429 (75.9)	1.1 (1.0–1.2)
Penetrating			
No	1942 (25.2)	5755 (74.8)	Reference
Yes	445 (25.2)	1319 (74.8)	1.0 (0.8–1.4)
Blunt			
No	1311 (24.8)	3978 (75.2)	Reference
Yes	1076 (25.8)	3096 (74.2)	0.9 (0.8–1.1)
ISS			
Minor (1–9)	2227 (25.0)	6691 (75.0)	Reference
Moderate to severe (≥10)	160 (25.0)	383 (70.5)	0.7 (0.4–1.3)
Median household income, US 2012 dollars			
1–38 999	436 (23.1)	1451 (76.9)	Reference
39 000–47 999	642 (18.3)	2862 (81.7)	1.7 (0.8–3.7)
48 000–62 999	642 (28.5)	1612 (71.5)	0.8 (0.5–1.1)
≥63 000	667 (36.7)	1149 (63.3)	0.5 (0.3–0.9)
Hospital region			
Northeast	293 (29.2)	711 (70.8)	Reference
Midwest	342 (8.6)	3659 (91.5)	5.4 (2.3–12.6)
South	1246 (45.1)	1514 (54.9)	0.4 (0.2–1.3)
West	506 (29.8)	1190 (70.2)	1.0 (0.4–2.3)
Teaching status			
Nonteaching	1267 (17.5)	5989 (82.5)	Reference
Teaching	1120 (50.8)	1085 (49.2)	0.2 (0.1–0.5)
Metropolitan setting			
Nonmetropolitan	97 (8.2)	1090 (91.8)	Reference
Metropolitan	2290 (27.7)	5984 (72.3)	0.3 (0.1–0.6)
Percentage of Medicaid			
<20%	400 (23.6)	1297 (76.4)	Reference
20%–43.8%	499 (25.6)	1454 (74.5)	0.9 (0.8–1.0)
43.9%–55.8%	1161 (29.4)	2783 (70.6)	0.7 (0.6–0.8)
≥55.9%	327 (17.5)	1540 (82.5)	1.5 (1.2–1.7)

Frequencies unweighted. ORs from logistic regression models adjusted for cluster, weight, and stratum.

local nondesignated trauma hospital. Although we found similar patterns among pediatric patients without insurance, the associations were not statistically significant (OR 1.4; 95% CI: 0.97–2.0). Our findings, in the context of previous research, suggest that hospitals treating a disproportionate number of patients with Medicaid tend to transfer relatively more patients, and this

results in a continued systematic bias toward admitting injured children with private or commercial insurance as well as transferring those with Medicaid insurance.

With this study, we are the first researchers (to our knowledge) to investigate rates of admission and transfer among injured children presenting to nontrauma centers at a national level. Similar findings

have been documented by other investigators who used combined adult and pediatric trauma registry data. For example, Nathens et al,¹⁹ found that trauma patients without commercial insurance were 2.4 times more likely to be transferred from lower-level trauma centers to tertiary care trauma centers compared with those patients with commercial insurance. Similarly, Delgado et al⁸ found that among injured adults presenting to nontrauma centers, patients without insurance were 1.9 times more likely to be transferred compared with those with private insurance. However, other researchers using a single state database did not find that pediatric trauma patient's insurance status was associated with transfer decisions. Tarima et al²⁰ found that among pediatric trauma patients in the state of Ohio, insurance status was independent of transfer, including those from a nontrauma center to any level trauma centers, those from a Level III to a Level I or II trauma center, and those from a Level II trauma center to a Level I trauma center. One potential reason that these researchers did not find associations between insurance status and transfer is that their analyses were conducted by using a statewide trauma registry that would not include injured patients who were never transferred to a designated trauma center.

The finding that nontrauma center EDs treating a higher proportion of patients with Medicaid are more likely to conduct an interfacility transfer is noteworthy given that nontrauma centers frequently lack critical resources for trauma care, which could impact patient outcomes.^{7,21–23} This possibility could be paradoxical, given the fact that designated pediatric trauma centers have been shown to have better outcomes. However, it is difficult to determine if our findings reflect a hospital ED's over-transfer

TABLE 2 Patient-Level and Hospital-Level Characteristics by Insurance Status

Patient, Hospital-Level Variables	Private, N = 4374	Medicaid, N = 4047	P	Uninsured, N = 535	P	Other, N = 505	P
Age, y							
13–17	1747 (39.9)	1392 (34.4)	<.0001	186 (34.8)	<.0001	174 (34.5)	.00
5–12	1026 (23.5)	1682 (41.6)		198 (37.0)		151 (29.9)	
0–4	1601 (36.6)	973 (24.0)		151 (28.2)		180 (35.6)	
Sex							
Male	2782 (63.6)	2474 (61.1)	.02	355 (66.4)	.21	285 (56.4)	.002
Female	1592 (36.4)	1573 (38.9)		180 (33.6)		220 (43.6)	
Disposition status							
Admission	1158 (26.5)	950 (23.5)	.001	125 (23.4)	.12	154 (30.5)	.05
Transfer	3216 (73.5)	3097 (76.5)		410 (76.6)		351 (69.5)	
Admission on weekend							
No	2850 (65.2)	2726 (67.4)	.03	335 (62.6)	.25	350 (69.3)	.06
Yes	1524 (34.8)	1321 (32.6)		200 (37.4)		155 (30.7)	
Penetrating							
No	3520 (80.5)	3334 (82.4)	.02	429 (80.2)	.87	414 (82.0)	.42
Yes	854 (19.5)	713 (17.6)		106 (19.8)		91 (18.0)	
Blunt							
No	2354 (53.8)	2377 (58.7)	<.0001	296 (55.3)	.51	262 (51.9)	.41
Yes	2020 (46.2)	1670 (41.3)		239 (44.7)		243 (48.1)	
ISS							
Minor (1–9)	4123 (94.3)	3832 (94.7)	.39	493 (92.2)	.05	470 (93.1)	.28
Moderate to severe (≥10)	251 (5.7)	215 (5.3)		42 (7.9)		35 (6.9)	
Median household income, US 2012 dollars							
1–38 999	516 (11.8)	1146 (28.3)	<.0001	134 (25.1)	<.0001	91 (18.0)	<.0001
39 000–47 999	1422 (32.5)	1707 (42.2)		171 (32.0)		204 (40.4)	
48 000–62 999	1129 (25.8)	852 (21.1)		135 (25.2)		138 (27.3)	
≥63 000	1307 (29.9)	342 (8.5)		95 (17.8)		72 (14.3)	
Hospital region							
Northeast	578 (13.2)	329 (8.1)	<.0001	63 (11.8)	<.0001	34 (6.7)	<.0001
Midwest	1859 (42.5)	1748 (43.2)		175 (32.7)		219 (43.4)	
South	972 (22.2)	1432 (35.4)		176 (32.9)		180 (35.6)	
West	965 (22.1)	538 (13.3)		121 (22.6)		72 (14.3)	
Teaching status							
Nonteaching	3556 (81.3)	2942 (72.7)	<.0001	391 (73.1)	<.0001	367 (72.7)	<.0001
Teaching	818 (18.7)	1105 (27.3)		144 (26.9)		138 (27.3)	
Metropolitan setting							
Nonmetropolitan	617 (14.1)	443 (11.0)	<.0001	68 (12.7)	.38	59 (11.7)	.14
Metropolitan	3757 (85.9)	3604 (89.1)		467 (87.3)		446 (88.3)	
Percentage of Medicaid							
<20%	1277 (29.2)	209 (5.2)	<.0001	103 (19.3)	<.0001	108 (21.4)	<.0001
20%–43.8%	1151 (26.3)	591 (14.6)		123 (23.0)		88 (17.4)	
43.9%–55.8%	1476 (33.7)	2015 (49.8)		184 (34.4)		269 (53.3)	
≥55.9%	470 (10.8)	1232 (30.4)		125 (23.4)		40 (7.9)	

Values are n (%). P values were derived from χ^2 tests comparing category proportions between the Medicaid, Uninsured or Other group and the Private insurance group.

of patients with a high proportion of Medicaid insurance, a hospital ED's under-transfer of patients with a high proportion of private insurance, or a combination of both given the fact that data demonstrate that both delays in transfers and unnecessary transfers contribute to increased morbidity, mortality, and costs of care.^{9,10} Over-triage among children has been estimated to range between 24% and 49%, depending on the definitions used.^{24,25} In our study,

however, we are not able to evaluate if those patients with Medicaid that are transferred to another hospital could be considered over-triaged.

Another potential explanation for our finding that hospital EDs treating a higher proportion of children with Medicaid insurance tend to transfer injured children more often could be related to financial and economic reasons. It is well known that physician and hospital payments for treating patients with Medicaid

insurance tend to be lower than payments for patients with private and/or commercial insurance. It has been reported that nationwide the cost recovery ratio (the ratio of collected revenue to costs) for trauma patients with Medicaid is 60% lower than privately insured patients.^{19,26,27} Therefore, the preferential transfer of patients with Medicaid and/or the admitting of patients with private insurance might reflect an effort to maximize hospital

TABLE 3 Adjusted Odds of Transfer to Another Hospital Versus Admission

Patient, Hospital-Level Variables (N = 9461)	Adjusted Odds of Transfer (95% CI)
Age, y	
13–17	Reference
5–12	2.4 (1.9–2.9)
0–4	3.2 (2.4–4.4)
Sex	
Male	Reference
Female	0.8 (0.7–0.96)
Primary payer status	
Private insurance	Reference
Medicaid	1.0 (0.8–1.1)
Uninsured	1.1 (0.9–1.3)
Other	0.9 (0.6–1.1)
Admission on weekend	
No	Reference
Yes	1.1 (1.0–1.3)
Penetrating	
No	Reference
Yes	1.1 (0.9–1.4)
Blunt	
No	Reference
Yes	1.0 (0.8–1.2)
ISS	
Minor (1–9)	Reference
Moderate to severe (≥10)	0.9 (0.7–1.2)
Total no. ED visits (/1000)	0.99 (0.97–0.998)
Hospital region	
Northeast	Reference
Midwest	4.2 (1.7–10.4)
South	1.3 (0.6–2.7)
West	0.8 (0.3–2.1)
Teaching status	
Nonteaching	Reference
Teaching	0.6 (0.3–1.3)
Metropolitan setting	
Nonmetropolitan	Reference
Metropolitan	1.4 (0.6–3.5)
Proportion of Medicaid in each hospital ED	5.9 (1.8–19.6)

From logistic regression models adjusted for age, sex, hospital region, teaching status, metropolitan setting, total number of ED visits, admission on weekend, mechanism of injury, ISS, proportion of Medicaid in each hospital ED, cluster, weight, and stratum.

revenue. This finding, although disconcerting, is consistent with studies revealing that physicians are often reluctant to accept or provide care to patients with insurance plans providing lower reimbursement.^{28–31} Moreover, injured children tend to have higher reimbursement rates compared with injured adults,^{32,33} which may also be driving differences specific to each population in relation to insurance status. In addition, given that most trauma centers are publicly owned and located in metropolitan areas, it might also be possible that injured pediatric patients and their families with private insurance in nontrauma centers located in the

nonmetropolitan area are less willing to be transferred, sometimes longer distances, to a designated trauma center. However, relatively little is known about patient preference. This possibility, however, is not supported by previous studies^{34,35} in which it is demonstrated that patient preference is not typically considered to be a significant factor among interhospital transfers.

Several limitations should be considered when interpreting our findings. First, as a retrospectively collected administrative database, NEDS might be affected by inaccurate or incomplete coding.

However, as noted,¹⁵ this database is rigorously monitored and audited for coding accuracy to represent a reasonably reliable panorama of trauma ED population characteristics. We also excluded events from hospitals where all injured children were either transferred or admitted. Under this circumstance, misclassification and selection bias must be considered. Additionally, there is a possibility of misclassification of patients' insurance status such that in the ED, patients could have been classified as uninsured as a default, but after transfer or admission, the insurance status would be updated. Second, we were unable to fully account for all factors related to transfer decisions in nontrauma centers. For example, the database lacked information on other possible influencing factors such as bed availability, distance between EDs, and the willingness of hospitals to accept a patient. Third, the database also lacked information on whether injured patients presenting to a nontrauma center ED were transferred from another ED. Another consideration is that some of our statistically significant findings may not be clinically important, such as the lower ISS among those patients transferred with Medicaid insurance (ISS mean: 4.2) compared with those patients transferred with private insurance (ISS mean: 5.0). Lastly, NEDS is an ED event-level and not a patient-level database. Without unique patient identifiers, we could not link pretransfer and posttransfer events to confirm if the destinations of these transfers were to trauma centers. Thus, we made the assumption that transfers are done to a higher level of care. Although our study revealed differing transfer odds by insurance status, we could not determine if injured pediatric patients with Medicaid ultimately

received better or worse care than those with private insurance.

Our findings reinforce ongoing concerns about inequities in the delivery of trauma care and adherence to the Emergency Medical Treatment and Active Labor Act requiring hospitals to make decisions on patients' transfer or admission independent of their insurance status.^{36,37} Potential policy solutions should be considered to address differential treatments at a hospital and individual patient levels. For example, real-time monitoring of under-triage and over-triage with financial penalties or establishing incentives for more appropriate admission and transfer decisions could result in higher quality and more cost-effective care.

CONCLUSIONS

We found that injured children presenting to nontrauma centers serving a disproportionate share of children with Medicaid insurance are more likely to be transferred than admitted and that for every 10% increase in the ED Medicaid population, there was a 20% increase in odds of transfer relative to admission. We did not find any evidence that injured children are transferred at different rates within individual hospital EDs because of their insurance status. The implications of the different transfer rates between hospitals results in 30% higher odds of transfer relative to admission among injured children with Medicaid insurance compared with injured children with private

insurance. Further surveillance of nontrauma centers' rates of transfer should be monitored to validate our findings and to ensure the appropriateness of patient transfers. Additional research is needed to evaluate the impact of admission and transfer decisions on pediatric trauma patient outcomes and costs of care.

ABBREVIATIONS

CI: confidence interval
ED: emergency department
ICC: intraclass correlation coefficient
ISS: injury severity score
NEDS: Nationwide Emergency Department Sample
OR: odds ratio

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FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: No external funding.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

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Pediatrics 2017;140;

DOI: 10.1542/peds.2016-3640 originally published online September 19, 2017;

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