RESEARCH ARTICLE

The Impact of Payer Source on Trauma Outcomes in a Pediatric Population

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ABSTRACT

OBJECTIVES: Determine if there were differences in conclusions drawn regarding disparities in trauma outcomes based on literature-derived payer source definitions in a pediatric population.

PATIENTS AND METHODS: Retrospective registry review of admitted pediatric trauma patients (≤17 years of age) at a level II pediatric trauma facility. Eligible patients were categorized into 3 payer source definitions: definition 1: commercially insured, Medicaid, uninsured; definition 2: insured, uninsured; definition 3: commercially insured, underinsured. Logistic regression was used to determine the influence of payer source on outcomes.

RESULTS: Payer source was not significant in definition 1, 2, or 3 for intensive care unit length of stay (LOS), hospital LOS, medical consults, or mortality. For hospital disposition, payer source was significant in definition 1, the uninsured were 90% less likely than commercially insured to be discharged to continued care. In definition 2, the uninsured were 88% less likely than insured to be discharged to continued care. In definition 3, the underinsured were 57% less likely than commercially insured to be discharged to continued care.

CONCLUSIONS: Differences between the literature-derived definitions were not observed and therefore conclusions drawn did not differ across definitions. The investigation demonstrated payer source was not associated with in-hospital outcomes (intensive care unit LOS, hospital LOS, medical consults, and mortality), but was with posthospital outcomes. Findings warrant future examinations on the categorization of payer source in pediatric patients and hospital disposition to gain a greater understanding of disparities related to payer source in pediatric trauma, specifically in terms of posthospital care.

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In 2014, 6.2% of US children were without any form of health insurance.[1] An additional 42.6% were governmentally (publicly) insured either through federal programs (Medicare, Medicaid) or state health plans.[1] Despite passing the Emergency Medical Treatment and Labor Act, several studies have associated publicly insured and uninsured pediatric trauma patients with poorer outcomes, including treatment delay,[2] method of treatment,[3] discharge location,[4] readmission rates,[5] and increased rates of mortality.[4,6–12]

Trauma outcome disparities in the pediatric population have been attributed to differences in care,[6,11] including timeliness[8,9] and access[5,9]; and patient characteristics, such as race[7] and markers of socioeconomic status including payer source.[2,9,12,13] However, Berg et al[14] demonstrated in an adult trauma population that conclusions drawn regarding disparities can be influenced depending on the categorization of payer source. When payer source was redundantly categorized into 4 literature-derived definitions, statistical significance fluctuated and subsequent interpretations of findings differed based on the definition used. Multiple definitions of payer source evaluating outcome disparities also have been used in the pediatric trauma literature (Table 1). Therefore, the purpose of this study was to determine if there were differences in conclusions drawn regarding disparities in trauma outcomes based on literature-derived definitions of payer source in a pediatric population.

PATIENTS AND METHODS

This was a retrospective trauma registry cohort study of all admitted pediatric trauma patients (≤17 years of age) between 2005 and 2014 at an urban level II pediatric trauma facility (within an adult-verified level I facility) in a predominantly rural state. This facility is licensed for 760 beds, but operates 522 adult beds, 30 pediatric beds, and 16 PICU beds. Approval for this study was obtained from all appropriate institutional review boards. Exclusion criteria included adult trauma patients (aged ≥18 years), patients who were dead on arrival, burn patients, and patients transferred to another acute care facility before 1 week due to final outcomes being absent from the registry. Pediatric patients with missing ($n = 88$) and "other" ($n = 9$) insurance also were excluded. Medicare insurance ($n = 1$) was excluded due to sample size and the significant comorbidities associated with enrollment.[9]

Demographic and clinical data, including age, sex, race, payer source, mechanism of injury (MOI), Injury Severity Score (ISS), Glasgow Coma Scale (GCS), procedures, medical consults, hospital and ICU length of stay (LOS), mortality (in-hospital death), complications, and hospital disposition (home, continued care, nonhome) were extracted from the registry and reviewed.

Payer Source Definitions

Based on the literature, 3 definitions of categorization were identified (Table 1). For comparison purposes, the study sample was redundantly categorized into each definition. Definition 1: commercially insured (commercial, military, auto, workers' compensation), versus Medicaid, versus uninsured (self-pay).[5,6,8,9,12,15,16] Definition 2: insured (commercially insured and Medicaid) versus uninsured (self-pay).[10] Definition 3: commercially insured versus underinsured (Medicaid, uninsured).[2,13] Other definitions were identified in the literature; however, were either state-specific (eg, Medi-Cal) or not available within our data set.[3,7,11,17,18]

Statistical Analysis

Descriptive statistics were summarized by using frequencies (percentages) and means (SDs). Differences in study variables were compared according to payer source and evaluated by χ^2 statistics, Kruskal-Wallis, and Mann-Whitney tests, using the Bonferroni technique for multiple comparisons. Logistic regression was used for multivariate analysis. Medical factors known to be associated with trauma outcomes (age, sex, MOI, ISS, and GCS)[19,20] were adjusted for in addition to race and physiologic complications, with ICU and hospital LOS, medical consults, hospital disposition, and mortality as the outcome variables. The influence of payer source was the variable of interest. Logistic regression models were analyzed based on the 3 payer source definitions (Table 1). Statistical significance was defined as $P < .05$. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) are reported. Statistical analyses were performed by using SPSS for Windows, Version 20.0 (IBM SPSS Statistics, IBM Corporation).

RESULTS

Of the 2650 pediatric patients in the final sample, 63.2% ($n = 1675$) were commercially insured, 30.8% ($n = 815$) were insured by Medicaid, and 6.0% ($n = 160$) were uninsured (Table 2). Most, 61.3% ($n = 1625$) were boys and 88.4% ($n = 2342$) were white. The mean age was 8.67 years (SD 6.03). The mean ISS was 9.06 (SD 8.83). Falls were the most common MOI (33.1%) followed by motor vehicle crash (26.3%), other (26.3%; eg, gunshot wound, drowning), and recreational (13.7%; eg, sports injury, off-road vehicle). Most (97.1%) survived.

TABLE 1 Literature-Derived Payer Source Definitions and Analysis

	Definition 1[5,6,8,9,12,15,16]	Definition 2[10]	Definition 3[2,13]
Definitions	Commercially insured (Auto, commercial, military, workers' compensation) Medicaid Uninsured (Self-pay)	Insured (Commercially insured, Medicaid) Uninsured (Self-pay)	Commercially insured (Auto, commercial, military, workers' compensation) Underinsured (Medicaid, self-pay)
Control variables	Age, sex, MOI, ISS, GCS, race, physiologic complications		
Outcome variables	ICU LOS, hospital LOS, medical consults, hospital disposition, mortality		

TABLE 2 Demographics and Outcomes Based on Definition 1

	Total	Commercially Insured[a]	Medicaid	Uninsured[a]	*P*
	2650	1675 (63.2)	815 (30.8)	160 (6.0)	
Age, y, mean (SD)	8.67 (6.03)	9.76 (5.77)	6.34 (5.82)	9.11 (6.32)	<.001
ISS, mean (SD)	9.06 (8.83)	9.05 (8.55)	9.00 (9.31)	9.52 (9.29)	.504
GCS, mean (SD)	13.77 (3.34)	13.95 (3.09)	13.57 (3.56)	12.88 (4.34)	.001
ICU LOS, exclude deceased, mean (SD)	1.13 (2.98)	1.01 (2.81)	1.26 (2.73)	1.75 (5.21)	<.001
Hospital LOS, exclude deceased, mean (SD)	1.83 (2.83)	1.78 (2.11)	1.93 (3.88)	1.80 (3.25)	.068
Physiologic complications, mean (SD)	0.40 (0.78)	0.39 (0.77)	0.40 (0.77)	0.51 (0.92)	.827
Medical consults, mean (SD)	1.09 (1.06)	1.02 (0.99)	1.24 (1.17)	1.13 (1.20)	.001
Procedures, mean (SD)	3.13 (3.36)	3.17 (3.38)	3.00 (3.24)	3.38 (3.69)	.416
Sex					.914
Boys	1625 (61.3)	1022 (61.0)	504 (61.8)	99 (61.9)	
Girls	1025 (38.7)	653 (39.0)	311 (38.2)	61 (38.1)	
Race					<.001
White	2342 (88.4)	1537 (92.0)	673 (82.9)	132 (83.0)	
Nonwhite	299 (11.3)	133 (8.0)	139 (17.1)	27 (17.0)	
Trauma type					.327
Blunt	2428 (91.6)	1547 (92.4)	740 (90.9)	141 (88.1)	
Penetrating	158 (6.0)	92 (5.5)	52 (6.4)	14 (8.8)	
Drowning	62 (2.3)	35 (2.1)	22 (2.7)	5 (3.1)	
MOI					<.001
Fall	876 (33.1)	491 (29.4)	345 (42.9)	40 (25.3)	
Motor vehicle crash	696 (26.3)	551 (33.0)	96 (11.9)	49 (31.0)	
Other	696 (26.3)	356 (21.3)	282 (35.0)	58 (36.7)	
Recreational	363 (13.7)	270 (16.2)	82 (10.2)	11 (7.0)	
Hospital disposition, nondeceased					<.001
Home	2403 (93.4)	1541 (94.1)	717 (91.6)	145 (96.0)	
Continued care	112 (4.4)	83 (5.1)	26 (3.3)	3 (2.0)	
Nonhome	57 (2.2)	14 (0.9)	40 (5.1)	3 (2.0)	
Mortality					.007
Survived	2572 (97.1)	1638 (97.8)	783 (96.1)	151 (94.4)	
Deceased	78 (2.9)	37 (2.2)	32 (3.9)	9 (5.6)	

Percentages may not add to 100 due to missing data; data presented as frequency (%) unless otherwise specified. Kruskal-Wallis and Mann-Whitney *U* completed for means testing. χ^2 test completed for frequency analysis.

[a] Commercially insured: auto, commercial, military, workers' compensation; Uninsured: self-pay.

Multivariate Analysis

To determine if payer source was associated with trauma outcomes, logistic regression analyses were completed for outcome variables while adjusting for age, sex, MOI, ISS, GCS, race, and physiologic complications (Table 3 as well as Supplemental Tables 4–6).

ICU LOS

Payer source was not significant in definition 1 between the commercially insured and Medicaid (aOR 1.238; CI 0.808–1.898) or commercially insured and uninsured (aOR 0.944; CI 0.426–2.089). In definition 2, there were no significant differences between insured and uninsured (aOR 0.891; CI 0.405–1.960). No differences between the commercially insured and underinsured (aOR 1.177; CI 0.792–1.748) were observed in definition 3.

Hospital LOS

Concerning hospital LOS, payer source was not significant in definition 1 (no significant differences between commercially insured and Medicaid [aOR 0.898; CI 0.592–1.362] or commercially insured and uninsured [aOR 0.901; CI 0.455–1.785]). There were no significant differences between the insured and uninsured (aOR 0.936; CI 0.480–1.826) in definition 2 or in definition 3 between the commercially insured and underinsured (aOR 0.898; CI 0.610–1.323).

Medical Consults

Payer source was not significant in definition 1 between the commercially insured and Medicaid (aOR 1.018; CI 0.680–1.525) or commercially insured and uninsured (aOR 0.781; CI 0.376–1.621). No significant differences were observed

TABLE 3 Trauma Outcomes Logistic Regression Analysis ($n = 2650$)

	Definition 1[a]	Definition 2[a]	Definition 3[a]
ICU LOS			
Medicaid	1.289 (0.832–1.998)	X	X
Uninsured	0.910 (0.410–2.024)	0.850 (0.385–1.877)	X
Underinsured	X	X	1.187 (0.803–1.754)
Hospital LOS			
Medicaid	0.922 (0.611–1.393)	X	X
Uninsured	0.843 (0.423–1.645)	0.867 (0.451–1.667)	X
Underinsured	X	X	0.904 (0.618–1.324)
Medical consults			
Medicaid	1.100 (0.732–1.651)	X	X
Uninsured	0.730 (0.350–1.522)	0.709 (0.344–1.463)	X
Underinsured	X	X	0.974 (0.671–1.415)
Hospital disposition[b]			
Medicaid	0.697 (0.318–1.527)	X	X
Uninsured	0.086 (0.016–0.458)*	0.096 (0.018–0.502)*	X
Underinsured	X	X	0.463 (0.227–0.946)*
Mortality			
Medicaid	1.716 (0.784–3.756)	X	X
Uninsured	1.496 (0.499–4.479)	1.199 (0.420–3.424)	X
Underinsured	X	X	1.652 (0.806–3.388)

Data presented as aOR (95% CI). X, Not included in literature-derived definition and not grouping included in analysis.
[a] Definition 1: commercially insured, Medicaid, uninsured; definition 2: insured, uninsured; definition 3: commercially insured, underinsured (Medicaid and uninsured).
[b] Home: home and home with health care; continued care: acute care hospital (same or lower level), rehabilitation center, skilled nursing. Does not include nonhome due to sample size.
*$P \leq .05$.

in definition 2 between insured and uninsured (aOR 0.776; CI 0.378–1.594) or in definition 3 between commercially insured and underinsured (aOR 0.968; CI 0.664–1.410).

Hospital Disposition

For hospital disposition (discharged from the hospital or continued care; nonhome eliminated due to sample size), payer source was significant in definition 1 (significant differences between commercially insured and uninsured [aOR 0.105; CI 0.020–0.546] only). Significant differences were also observed in definition 2 between the insured and uninsured (aOR 0.122; CI 0.024–0.619) and in definition 3 between the commercially insured and underinsured (aOR 0.426; CI 0.206–0.881).

Mortality

Payer source was not significant in definition 1 between the commercially insured and Medicaid (aOR 1.716; CI 0.784–3.756) or commercially insured and uninsured (aOR 1.496; CI 0.499–4.479). No significant differences were observed in definition 2 between insured and uninsured (aOR 1.199; CI 0.420–3.424) or in definition 3 between commercially insured and underinsured (aOR 1.652; CI 0.806–3.388).

DISCUSSION

The purpose of this study was to determine if differences in conclusions drawn regarding disparities existed in pediatric trauma outcomes based on payer source definitions observed in the literature. The results did not differ based on the literature-derived definition used and, therefore, neither did the conclusions drawn regarding outcome disparities in this pediatric population. Regardless of the definition used, payer source was not associated with ICU LOS, hospital LOS, medical consults, or mortality. Payer source was associated only with posthospital transfer (discharge disposition), regardless of the literature-derived definition used.

Methodologically, these findings are inconsistent with the adult population. Berg et al[14] found payer source varied as a significant predictor depending on the literature-derived definition used. However, the findings in the current study demonstrated consistency in payer source as a significant or nonsignificant predictor as related to pediatric trauma outcome variables. One potential explanation for these findings is that mortality was the only outcome variable assessed in the adult population.[14] Mortality is less likely in the pediatric population[21–25] and may not be optimal for discriminating outcomes for pediatrics. In addition, when shifting pediatric patients into different payer source definitions, differences are not apparent because of the similarities in health status. For example, the Medicaid population is heterogeneous, in that there are pediatric patients who maintain long-term coverage and others who gain coverage retroactively.[26] Therefore, when shifting a Medicaid case to insured (definition 2) or underinsured (definition 3), significance does not change because the Medicaid case could be reflective of both payer sources.

Another potential explanation is that an American College of Surgeons–verified level II pediatric trauma system is well equipped to mitigate adverse outcomes and offset the preexisting health conditions associated with payer status. According to the American College of Surgeons Committee on Trauma, pediatric trauma facilities pursing verification must meet the same requirements as adult trauma centers.[27] A level I facility provides total care for patients from preventive efforts through rehabilitative care and admits ≥200 injured children younger than 15 years annually. Level II centers are able to provide initial care for all injured patients, and annually admit ≥100 injured children younger than 15 years.[27] In the case of this trauma center, the level I adult center works collaboratively with the level II pediatric center to optimize resources to care for all injured patients in the area. Children with traumatic injuries treated at trauma centers typically have

lower rates of mortality and improved outcomes.[28] Outcome differences may be apparent in nontrauma centers that are not adequately prepared to care for such patients.

Posthospital transfer was associated with payer source within all 3 definitions; in definition 1, the uninsured were 90% less likely than commercially insured to be discharged to continued care; in definition 2, the uninsured were 88% less likely than insured to be discharged to continued care; and in definition 3, the underinsured were 57% less likely than commercially insured to be discharged to continued care. It has been suggested that significant disparities exist in the continued care of injured children, and the source of these disparities are multifactorial in nature and include insurance status, which may inhibit or delay subsequent treatments and rehabilitation dispositions.[28,29] Brown[28] advised that to provide equitable care to all children, further research concerning continuity of care is needed to reduce disparities. The findings of this study provide an initial gap at which to target interruptions in care; however, to determine the true nature of disparities, researchers should focus on the continuum of care (traumatic event through posthospital care), specifically examining long-term health outcomes.

Strengths and Limitations

Strengths of this study included adjustment of patient-level characteristics (age, sex, MOI, ISS, GCS, race, and physiologic complications) to minimize the influence of potential confounders on utilization patterns. Additionally, administrative datasets, such as hospital registries, offer total patient information and have been used in previous studies assessing health outcomes.[17] However, trauma registries typically are not designed for research purposes and incomplete or missing data may lead to a potential bias. The state this study was conducted in is a part of a regionalized trauma system in which transfers are based on catchment areas; therefore, results are reflective of this system. Although all patients are seen at the hospital regardless of trauma activation level, patients whose injuries warranted an initial trauma activation of III or IV may not be seen at a level II facility and could limit the generalizability to other facilities.

In addition, insurance status is not exact and may not accurately reflect insurance status of individuals (eg, children are uninsured on arrival and retroactively obtain Medicaid). Pediatric patients may be kept in the hospital until they qualify for Medicaid or in cases of suspected abuse for security purposes, potentially skewing LOS. Additionally, patients presenting with a traumatic brain injury who lack commercial insurance can be difficult to admit to a rehabilitation facility. The definitions used in our analysis may be variations of the definitions seen in the literature (including Medicare with Medicaid or state-based insurance). Although some definitions included Medicaid with the uninsured population, those with long-term Medicaid coverage are very different in terms of life experiences compared with those who truly do not have insurance. Also, concerning mortality, payer may be incorrectly recorded as self-insured at a higher rate in patients who die in the hospital, which could lead to potential bias in these findings.

Future Research

Future research should further explore the impact of disposition on outcomes after pediatric trauma. A similar study design with a larger population sample could give more insight into the effects of hospital disposition on health outcomes and identify disparities between payer source definitions. Barriers to continued care, specifically in the uninsured population, should be identified and analyzed to improve outcomes. Future research also should assess additional associations between payer source and other factors affecting trauma outcomes, such as MOI, injury type, and injury severity.

CONCLUSIONS

This study sought to determine if there were differences in conclusions drawn regarding disparities in trauma outcomes based on literature-derived definitions of payer source. Unlike in the adult population, differences were not observed based on the literature-derived definition used. This investigation demonstrated that although payer source was not associated with in-hospital outcomes (ICU and hospital LOS, medical consults, and mortality) regardless of the definition, it was associated with transfer to posthospital care in all 3 definitions. Therefore, the conclusions drawn did not vary based on the literature-derived definitions. Disparities in trauma outcomes are influenced by population definitions and without a universal definition of payer source, inconsistency across studies may occur. Therefore, additional research regarding the categorization of payer source in pediatric patients is imperative. These findings warrant future examinations on hospital disposition to gain a greater understanding of the barriers to posthospital care in the uninsured and Medicaid population. This study provides additional information concerning the course of care in the pediatric trauma population and potential care interruptions for pediatric patients.

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