Trauma and Emergency Care

Research Article

The role of health insurance in pediatric ambulance use: are children just small adults?

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Abstract

Objective: Rapidly rising healthcare costs require a thorough analysis of all the components of care. Multiple studies of adult patients with public insurance or without private insurance have shown that they are more likely than those with private insurance to use the ambulance. Multiple studies of pediatric ambulance use have been limited in generalizability because they rely on individual hospital or single statewide databases and do not specifically look at insurance. The purpose of this study was to describe pediatric ambulance use and its association with specific health insurances using the National Hospital Ambulatory Medical Survey (NHAMCS) database.

Methods: NHAMCS data between 2008 to 2010 for all pediatric (age <19 years) visits were analyzed. Multivariate logistic regression was used to model ambulance utilization on insurance status while controlling for variability in demographics and severity levels.

Outcomes Measured: A total of 25,215 pediatric ED visits were included representing a national sample of approximately 97,341,191 million ED visits between 2008-2010. Non-insured (9.9%) compared to privately insured (6.6%) children had significantly higher rates of ambulance use. No significant difference in ambulance utilization was noted between those with Medicaid/State Children's Health Insurance Program (SCHIP) (5.8%) versus private (6.6%) insurance. Even after controlling for demographic and severity variables the adjusted odds ratio (1.66, 95% CI 1.30-2.13, p<0.0001) identified those visits without insurance as an independent predictor of ambulance utilization. In addition, older children (12-18 years), those of black race and residing in urban areas or the Northeast also had significantly higher odds of ambulance utilization. Visits by older children, specifically those without insurance, had increased odds of ratio of ambulance utilization (1.83, CI: 1.36-2.45, p<0.0001).

Conclusions: Similar to adult patients, non-uninsured versus insured visits by pediatric patients have increased ambulance utilization. Different from the adults, public the type of insurance public versus private did not affect pediatric ambulance use. Health policies that facilitate continuous insurance coverage for children may be one way to maximize resource utilization in regards to ambulance use.

Introduction

Growth of ambulance use is increasing in the United States (US) and other industrialized nations [1-6]. Adult patients with high rates of ambulance utilization, especially for low acuity complaints, are disproportionately uninsured or have public insurance [7-9]. This non-urgent ambulance and Emergency Department (ED) use is a contributor to ED overcrowding, leading to higher rates of ambulance diversions and delaying care for higher acuity emergencies [5,9,10].

Studies that focus on adults have found that ambulance use is associated with having public insurance or no insurance [11,12]. Most pediatric ambulance studies have utilized data from individual hospitals or statewide databases and very few have examined the effect of insurance on ambulance use [13-16]. Some studies that focus on adults have suggested that those patients without insurance or public insurance view the ambulance as a "taxi service" since they do not see a bill Other studies that focus on adults suggest that the utilization pattern is multifactorial [8,9,17-20].

Shah et al. identified several factors that are associated with higher rates of ambulance use but they did not specifically examine insurance status. They performed a secondary analysis of the National Hospital Ambulatory Medical Care Survey (NHAMCS) from 1997 to 2000 [20]. This comprehensive study concluded that those in the Northeast, older children and African American children younger than 19 years had increased odds of ambulance use [20].

Our study aims to assess the patterns of ambulance utilization in relation to insurance status and age for pediatric patients using a nationally representative dataset.

Patients and Methods

Data Source and Design

This is a retrospective secondary analysis of data collected in the National Hospital Ambulatory Medical Care Survey (NHAMCS). The NHAMCS is an annual sample consisting of ambulatory and ED visits made to non-federal, general, and short-stay hospitals in the U.S from the 1970s to the present. It is conducted by the Centers for Disease Control and Prevention, National Center for Health Statistics. Regarding the ED visit survey collection, it consists of a four-stage

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probability design with samples of multiple hospitals. Hospitals are chosen for inclusion in the NHAMCS by field representatives of the U.S. Census Bureau [21].

The survey design can be found in more detail within the Public-Use downloadable documentation files [21]. The NHAMCS from 2008-2010 was used in our study.

The NHAMCS is approved annually by the Ethics Review Board of National Center for Health Statistics. Data processing, including medical coding of reason for visit, cause of injury, diagnosis, and medications are performed by SRA International, Inc., Durham, NC. Error rates typically range up to 0.9% for various survey items [21].

Data Collection

We included children age less than 19 years who visited an ED between January 1, 2008 to December 31, 2010. The source of payments for all pediatric patients who arrived via ambulance were collected. Insurance status was compared via: private vs. no insurance vs. Medicaid and State Children's Health Insurance Program (SCHIP) vs. Medicare vs. other. For each source of payment, urgency was established using Emergency Severity Index levels. Demographics for all patients included age, gender, ethnicity, race, region of residence, and MSA (which means Metropolitan area or urban area).

This study was approved and exempt by the Institutional Review Board at SUNY Downstate Medical Center.

Definitions

To define urgency, the Emergency Severity Index (ESI) level was used. Emergency Severity Index level is a validated tool that is used in EDs (Pediatric and Adults) in the United States as a way to establish immediacy of care required based on vital signs and the number of resources likely needed in the ED [22,23]. Emergency Severity Index levels 1 to 5 are used with the assignment of ESI 1 for patients requiring life saving intervention with multiple resources and ESI 5 for patients with non-urgent complaints and not requiring any resources [22-24]. In our study, ESI levels 1-3 were given a category of urgent and ESI 4-5 were given a category of non-urgent. ESI levels as an assessment of triage urgency has been also proposed in multiple studies [11,25].

To define insurance types, the NHAMCS has a list of expected payment sources. In our study we used the following categorizations from the NHAMCS: private insurance, Medicaid/SCHIP (which include worker's compensation), Medicare (typically those children 18 years or older whom are disabled) self-pay as those without insurance (listed as non-insured or without insurance in this article), and our category of "other" (patients with other sources of payment not covered by the other categories, such as TRICARE, private charitable organizations, liability insurance and those in which no fee is charged such as charity or research purposes).

Statistical Analysis

The primary outcome for the analysis was mode of arrival to the ED (ambulance vs. non-ambulance). Only children visits (age <19) were included in this study. The relationship between the source of payment and arrival by ambulance for children was investigated with multiple logistic regression using the 2008 to 2010 ED data from NHAMCS. The analysis was adjusted for race (White, Black, Asians, and other), urgency (urgent versus non-urgent), year, region (Northeast, South, West, Midwest) and gender. Statistical analysis of the data took into account the sampling design, using SAS version 9.4 (SAS Institute Inc., Cary, NC) procedures. $P<0.05$ were considered statistically significant.

Results

For the 3-year study period (2008-2010), the estimated total number of annual pediatric visits to hospitals in NHAMCS was 97,341,191. This was based on a total of 25,215 visits from the survey. Table 1 displays the ED visit characteristics during the study period and compares demographics of the ED visits. Ambulance as a mode of arrival was 6.6%. Patient visits with less urgent complaints (ESI 4-5) comprised more than half of the ED visits. Medicaid/SCHIP comprised of half of ED visits.

Table 2 displays the adjusted odds ratio of arriving by ambulance compared to non-ambulance visits. Those higher acuity visits were more likely to arrive to the ED by ambulance (adjusted odds ratio [aOR] =1.60, 95% CI= 2.2.-3.4). Children younger than 12 were less likely to use the ambulance with [aOR] ranging from 0.40-0.52. Visits of those patients in the Northeast and located in urban areas (MSA) had higher odds of ambulance use as well as blacks. In regards to insurance status, visits of patients without insurance and the "other" category (those defined in methods) were more likely to use the ambulance ([aOR] =1.66, 95% CI= 1.3-2.13 and [aOR] =1.54, 95% CI= 1.03-2.30, respectively).

No interactions were found to be significant, including those between expected payer and MSA, year, ESI and Race (p values for the interaction terms ranged from 0.4 to 0.8). However, we found a significant interaction between expected payer and age group

Table 1. Pediatric ED Visit Characteristics 2008-2010 of children <19 years old.

Visit Characteristics:	Percent(%)	95% CI	
Urgency			
ESI: 1-3	47.7	44.8	50.5
ESI: 4-5	52.3	49.5	55.2
Age			
<1 yo	12.0	11.3	12.8
1-4 yo	30.0	28.9	31.0
5-11 yo	26.2	25.4	26.9
12-18	31.8	30.5	33.2
Race			
Black	25.0	21.8	28.3
White	69.8	66.4	73.2
Other	5.2	4.1	6.2
Sex			
Male	52.8	51.8	53.8
Female	47.2	46.2	48.2
Region			
Northeast	17.7	14.9	20.6
Midwest	21.7	16.5	26.8
South	42.6	37.1	48.2
West	18.0	14.0	22.0
MSA			
MSA	83.8	75.4	92.1
Non-MSA	16.2	7.9	24.6
Type of Insurance			
Medicaid/SCHIP	50.1	47.5	52.6
Private	37.7	35.3	40.1
Medicare	0.8	0.6	1.0
Self-Pay	8.9	7.9	9.9
Other	2.5	1.8	3.1
Mode of Arrival			
Ambulance	6.6	5.9	7.3
Non-Ambulance	93.4	92.7	94.1

(p<0.0001). The adjusted associations with between ambulance arrivals and insurance types based on age are listed in Table 3. Significance was found in those visits with expected source of payment for "other" in ages 5-11 ([aOR] =2.31, 95% CI= 1.03-5.16) and children between ages 12-18 without insurance ([aOR] =1.83, 95% CI= 1.36-2.45).

Discussion

We found that, similar to adults, pediatric patients without insurance were more likely to use the ambulance compared to those with private insurance. Unlike adults, pediatric patients with public insurance did not have an increased odds of ambulance use. We also found that when the expected source of payment was listed as "other" there was also an increased odds of ambulance use. This category included those with an expected source of payment from military funds or charity. These findings are important because it may imply that by having more children insured, the rate of ambulance utilization will decrease. Reasons to use an ambulance as means of transportation to a hospital is complex and our study demonstrates that many factors can increase the odds of ambulance usage.

After adjusting for confounders, our study found that there is a lower rate of ambulance use by younger children (<12 years old), but that by the teenage years, the rate of use approximates that of adults. To look closer at the effect of age, we adjusted for specific insurance types and found that older children without insurance have increased odds of ambulance use, similar to adult studies. One possible explanation for the difference in use by age is the higher incidence of injuries, poisoning and mental health problems in the older age group; all of which are associated with higher rates of ambulance use [15,20,25].

Table 2. Adjusted Odds of Arriving by Ambulance Compared to Non-Ambulance Transportation 2008-2010

Visit Characteristics:	Percent Ambulance (%)	aOR	95% CI	P-value
Urgency				
ESI: 4-5	3.8	Reference		
ESI: 1-3	9.9	2.82**	2.2-3.4	<0.0001
Age				
12-18	10.2	Reference		
5-11 yo	5.5	0.52**	0.42-0.64	<0.0001
1-4 yo	4.5	0.42**	0.35-0.50	<0.0001
<1 yo	4.5	0.40**	0.30-0.52	<0.0001
Race				
White	6.0	Reference		
Black	8.1	1.32*	1.10-1.58	0.003
Other	7.4	1.33	0.95-1.86	0.10
Sex				
Female	6.5	Reference		
Male	6.6	0.91	0.79-1.05	0.21
Region				
Northeast	9.6	Reference		
Midwest	6.0	0.71*	0.55-0.93	0.01
South	6.2	0.67*	0.50-0.89	0.01
West	5.1	0.48**	0.32-0.71	0.0002
MSA				
Non-MSA	7.0	Reference		
MSA	4.3	1.71**	1.30-2.23	0.0001
Type of Insurance				
Private	6.6	Reference		
Medicaid/SCHIP	5.8	1.03	0.84-1.26	0.81
Medicare	8.6	1.38	0.67-2.83	0.38
Self-Pay	9.6	1.66**	1.30-2.13	<0.0001
Other	9.9	1.54**	1.03-2.30	<0.0001
Year				
2008		Reference		
2009		1.17	0.91-1.51	0.22
2010		1.26	0.99-1.61	0.06

* =p<0.05 and **=p<0.01.

Table 3. Relative Adjusted Odds Ratio of Arriving by Ambulance to Non- Ambulance, by Age

Expected Source of Payment	Percent Ambulance Use	OddsRatio	95% CI	P- value
Age <1				
Private	5.0	Reference		
Medicare	2.0	0.40	0.049-3.217	0.39
Public	4.4	0.88	0.454-1.7	0.70
Other	1.3	----		
Self pay	3.9	0.66	0.203- 2.13	0.48
Age 1-4				
Private	4.6	Reference		
Medicare	2.5	0.56	0.13-2.38	0.43
Public	4.1	0.94	0.64-1.38	0.75
Other	8.0	1.92	0.89-4.21	0.10
Self pay	5.0	1.29	0.60-2.78	0.52
Age 5-11				
Private	5.8	Reference		
Medicare	11.3	3.45	0.98-12.19	0.05
Public	4.1	0.87	0.57-1.34	0.52
Other	10.5	2.31*	1.03-5.16	0.04
Self pay	9.7	2.05	1.00-4.21	0.05
Age 12-18				
Private	9.0	Reference		
Medicare	17.0	1.53	0.62-3.76	0.36
Public	10.4	1.17	0.91-1.52	0.23
Other	13.7	1.40	0.85-2.33	0.19
Self pay	13.7	1.83*	1.36-2.45	<.0001

In many studies, patients in the Northeast and urban areas have been shown to be frequent users of ambulances, regardless of insurance status [11,20,25]. A likely contributor to the high rate of use in urban areas is that the response time is fairly rapid [25]. Another often cited reason for frequent ambulance use in urban areas is the concept of the "medical taxi service". To explore this idea, Camasso-Richardson et al9 performed a survey in an urban pediatric emergency department and found that Emergency physicians deemed 61% of arrivals via ambulance as medically unnecessary. Of these patients, 40% of the caregivers stated they had no other means of transportation.

Our study found results consistent to adult and other pediatric pre-hospital data that blacks are more likely to use the ambulance in comparison to other races [11,20,25]. This may be related to lack of primary care or the higher incidence of trauma or injuries in minority populations [20,26]. Similar to many pediatric and adult studies, our results show that patients with higher urgency (ESI 1-3) are more likely to use the ambulance- regardless of insurance type [11,20,25].

In 2015 *Rominger et al.* published a similar study to ours, utilizing the NHMACS database to examine ambulance utilization in the years 2000-2009 [25]. Rominger's multivariate analysis differed from our results in that they found that children with public insurance were more likely to use the ambulance ([aOR]=1.81, 95% CI 1.57-2.09). In their study, the expected source of payment "other" did not have any increased odds of ambulance use. This difference might be explained due to the fact that we used NHAMCS data from the years 2008 to

2010 as opposed to 2000 to 2009. In 2010, the Patient Protection and Affordability Care Act expanded the Children's Health Insurance Program. This program started in March of 2010 allowing more parents/guardians access to health insurance for their children with lower requirements of family income [27]. This resulted in a decrease in uninsured children from 12% in 1997 to about 8% in 2010, which may have caused the difference in findings [25,28].

Limitations

Our study has multiple limitations. The NHAMCS is a survey dataset. It is designed to represent a snapshot of the utilization and provision of ambulatory care services in hospital emergency and outpatient departments; this representation is limited by the sampling design and variables collected. Furthermore, incorrect data collection and missing data are always possible, although in our review of the data, the amount that was missing was not great enough to have an impact on our final results. The only variable that had a significant amount of missing data was race, however imputed variables were used.

Conclusion

Many different factors affect pediatric ambulance transport, including expected source of payment and patient age. Our study suggests that increasing the number of pediatric patients that are covered by insurance and focusing educational efforts in regards to appropriate ambulance use on the adolescent population will likely reduce ambulance over utilization by the pediatric population. Further research is needed to evaluate the impact of these potential interventions.

Declarations

There are no financial disclosures

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