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THE EPIDEMIOLOGY OF EMERGENCY MEDICAL SERVICES USE BY CHILDREN:

AN ANALYSIS OF THE NATIONAL HOSPITAL AMBULATORY MEDICAL CARE SURVEY

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Abstract

Objective—There is an absence of nationally representative data describing pediatric patients who use emergency medical services (EMS) and the factors associated with EMS use by children. This study characterizes pediatric emergency department (ED) visits for which the patient arrived by EMS and identifies factors associated with those visits using a nationally representative database.

Methods—A secondary analysis of the ED component of the 1997–2000 National Hospital Ambulatory Medical Care Survey was performed. The dependent variable was the mode of arrival to the ED (EMS vs. not EMS), and independent variables were grouped into four domains: demographic, clinical, system, and service characteristics. Bivariate analyses and multivariate logistic regression analyses were conducted.

Results—There were 110.9 million ED visits by children aged <19 years between 1997 and 2000. Pediatric patients constituted 27.3% of all ED visits during this time, and 7.9 million (7.1%) of these patients arrived via EMS. Pediatric patients represented 13% of all EMS transports. The annual EMS utilization rate by children was 26 per 1,000, compared with 66 per 1,000 in the adult population ($p < 0.001$). Sixteen percent of children transported by EMS were admitted to the hospital. Sixty-two percent of pediatric patients arriving at the ED by EMS were transported as a result of injury or poisoning. Characteristics significantly associated with arrival by EMS in the final multivariate model included demographic (age, African American race, urban residence), clinical (need for greater immediacy of care, illnesses associated with certain diagnoses), and service (greater number of diagnostic services) variables.

Conclusions—Pediatric patients transported by EMS are more likely to have injuries and poisoning, and have higher-acuity illness than those arriving at the ED by other means. The epidemiology of pediatric EMS use may have important operational, training, and public health implications and requires further study.

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Keywords

emergency medical services; prehospital care; emergency medicine; pediatrics; epidemiology

Introduction

The emergency medical services (EMS) system in the United States was originally developed as a response to deficiencies in caring for patients with traumatic injuries and cardiac arrest.¹ Equipment and training were geared primarily toward adult patients, and little attention was paid to the needs of pediatric patients until the Emergency Medical Services for Children (EMSC) legislation in 1985.² Despite continued calls for additional research in the area of pediatric EMS,^{3,4} there remain significant limitations in the available literature describing the demographic characteristics, utilization rates, and outcomes of pediatric patients using the EMS system. This paucity of evidence was recently highlighted in the Institute of Medicine's report on pediatric emergency medicine.⁵

The available literature suggests that children account for approximately 4–10% of all EMS^{6–10} and use EMS as a mode of transport to the emergency department (ED) only 5–7% of the time.^{9,11,12} Despite this low utilization rate, children transported by EMS have more complaints related to injury and poisoning^{7,13} and have admission rates of up to 26%, approximately three times greater than that for children arriving to the ED by other means.¹¹ Although previous studies have examined various aspects of EMS use by children, their results have varied and none have simultaneously examined multiple demographic, clinical, and system characteristics within a heterogeneous population of pediatric EMS users.^{6–15} Further, previous work on the epidemiology of EMS use by children utilized information from individual hospitals,^{10,11} or statewide databases,^{8,12} and the results have limited nationwide generalizability. Despite previous studies indicating higher EMS use rates by African Americans under the age of 24 years¹⁶ and describing EMS usage patterns in the elderly,^{17–22} no similar studies have been performed for the pediatric population.

There remains a distinct absence of nationally representative data describing pediatric patients who use EMS and the factors associated with EMS use by children. The lack of such information inhibits the development of evidence-based improvements that specifically benefit children and hinders the ability of EMS and other health care leaders to make operational and policy decisions, train prehospital care providers, and optimize EMS for children. The aim of this study was to characterize, in a nationally representative sample, children cared for by EMS who were transported to EDs. Further, this study identified factors associated with EMS use by children.

Methods

Study Design

This study was a secondary analysis of the ED component of the National Hospital Ambulatory Medical Care Survey (NHAMCS), a cross-sectional probability sample survey

of visits to EDs of nonfederal and short-stay hospitals in the United States. The institution's research subjects review board determined that this study qualified as exempt from review.

Study Setting, Participants, and Protocol

The Centers for Disease Control and Prevention, National Center for Health Statistics (NCHS), uses a four-stage probability design for the NHAMCS and includes 112 primary sampling units. A sample of nonfederal hospitals with eligible EDs are selected from the sampling units, and staff at each of these EDs systematically collects data for a random sample of patient visits. Collected variables change based on public health needs. However, the sampling strategy was the same during each year of the study and is able to represent the characteristics of the population of ED visits.

Use of the NHAMCS database requires acknowledging several statistical issues.²³ First, any time there are fewer than 30 cases in the sample cell, or the relative standard error exceeds 30% of the estimate, population estimates may not be considered reliable. Second, although nonresponse rates are very low and represent less than 5% for most variables, the NCHS provides imputed results for selected ED variables. Third, national estimates are obtained by using sampling weights provided by the NCHS. The weighted sample of pediatric patients included in the NHAMCS data set can be used to represent the full population of pediatric patients who seek ED care in nonfederal, short-stay, and general hospitals in the United States. Lastly, given the multistage sample size design, appropriate statistical methods must be used to account for such a methodology.

The de-identified NHAMCS data files including all variables sampled and sampling weights as assigned by the NCHS were obtained.²⁴ Only ED visits by pediatric patients from birth until their 19th birthday were included in this study. Visits between 1997 and 2000 were combined to provide more reliable estimates because information regarding mode of arrival was collected during that period. To prevent the unnecessary loss of patients from missing fields within the data set, hot deck imputation was performed using Solas 3.0 (Statistical Solutions Corp., Saugus, MA). Six variables were imputed, replacing unknown values based on a set of auxiliary variables. The six imputed variables were immediacy of care provided (25.5% unknown), ethnicity (18.5% unknown), arrival mode (5.9% unknown), insurance (5.9% unknown), procedures performed (0.8% unknown), and diagnostic services provided (0.4% unknown).

Data Analysis

The dependent variable for the analysis was the mode of arrival to the ED, coded as arrival via EMS (both ground and air) or not. The independent variables were limited by their availability in the NHAMCS data set and were categorized into four domains. The first domain included demographic characteristics: age, gender, Hispanic ethnicity, race, region of residence, and residence in a nonmetropolitan (rural) area. The second domain included clinical characteristics: estimated immediacy of care required and primary diagnosis based on the International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9-CM), code.²⁵ The estimated immediacy of care required, as collected by the NCHS, was used as a proxy for patient acuity. Primary diagnoses were grouped by ICD-9-CM code to

allow sufficient sample size for comparison. For example, the “other” category included such codes as 140–239.9 (neoplasms), 280–289.9 (diseases of the blood and blood-forming organs), 630–679.9 (complications of pregnancy and childbirth), and 740–759.9 (congenital abnormalities), all of which had such small sample sizes individually that no meaningful comparisons could be made. The third domain included system characteristics: the presence of any health insurance, and the year, season, and time of service. The fourth domain included services provided to the patient in the ED: diagnostic services, procedures, and medications.

To represent statistical significance, the more conservative 99% confidence interval was calculated and a p-value of 0.01 was used. This was done to address the large number of observations present in the database and the large number of comparisons that can increase the risk of identification of an association between variables by chance alone. Because of the multistage sample design of the NHAMCS survey and the need to provide accurate point and variance estimates, primary statistical analyses were performed using SUDAAN (RTI International, Research Triangle Park, NC).²⁶

To characterize the pediatric population being transported to the ED via EMS, patients were categorized as to whether they arrived via EMS or via other means. These subsets were then compared. Bivariate analysis was performed to assess associations between the independent variables and the outcome variable (mode of arrival). For categorical variables, the chi-square test was used; for continuous variables, Student’s t-test was used. Weighted multivariate logistic regression analysis was used to identify characteristics associated with using EMS and subsequent transport to an ED versus not using EMS. Independent variables were included in the model based on previously identified associations or if bivariate analysis demonstrated they were associated with mode of arrival ($p < 0.20$). As the variance explained by the system factors was extremely small, they were not retained in the final multivariate model. Existing literature and deductive reasoning were used to determine that there was no clinical justification for testing interactions in the model.

All variables were retained in the multivariate model unless significant multicollinearity was identified (correlation coefficient >0.9). The variance inflation factor for each variable was also calculated to assess for multicollinearity.²⁷ Multicollinearity was not believed to be problematic based on these analyses. The Hosmer-Lemeshow test and C-statistic (area under the receiveroperating characteristic [ROC] curve) were used to examine the goodness of fit of the logistic regression model.^{28,29} The correlation method was used to evaluate variance in the logistic regression model.³⁰ The R^2 for system characteristics was 0.003 and was thus excluded from the final model.

Results

Between 1997 and 2000, there were 110.9 million visits by children under the age of 19 years to US EDs, an annual average of 27.7 million visits. This represents 27.3% of all ED visits during this time, and 7.9 million (7.1%) of these children arrived via EMS. During the same time period, there were 295.1 million visits by adults, of whom 54.4 million (18.4%) arrived by EMS. The difference in proportions of visits between pediatric and adult patients

arriving by EMS is statistically significant ($p < 0.001$). Based on the US population in 2000, the average annual rate of ED visits by children less than 19 years of age transported by EMS was 26 per 1,000, compared with 66 per 1,000 in the adult population ($p < 0.001$). Pediatric patients thus represented about 13% of all EMS transports to EDs.

Unadjusted bivariate analysis compares the characteristics of pediatric ED patient visits by mode of arrival for the studied variables (Table 1). Pediatric patients arriving via EMS were more likely to be associated with nonwhite race, urban residence, visit due to injury or poisoning, and lack of insurance. They were more likely to undergo diagnostic tests and procedures, but they received fewer medications. Table 2 displays the results of unadjusted bivariate analysis comparing the dispositions of pediatric patient visits by mode of arrival. Pediatric patients arriving by EMS were more frequently admitted to intensive care unit (ICU) or to non-ICU settings or to die in the ED than those arriving by other means.

Many of the variables maintain their association with EMS use after controlling for the presence of other variables using weighted multivariate analysis (Table 3). Demographic characteristics associated with EMS use included African American race and urban residence. Clinical characteristics associated with EMS use included increased patient acuity, as demonstrated by the immediacy of care required, injuries related to injury or poisoning, or diseases of the circulatory system. Service characteristics included an increased number of diagnostic services provided to patients arriving by EMS, which can be considered to be another measure of increased patient acuity.

Several notable differences were identified when the bivariate and multivariate analyses were repeated without the use of imputed data. The use of imputed data resulted in a decrease in the odds ratio and a narrowing of the confidence interval for Hispanic ethnicity from 1.48 (1.09, 2.02) to 1.19 (0.93, 1.51). Further, ICD-9-CM codes indicating diseases of the circulatory system and other unspecified conditions resulted in similar odds ratios when using imputed data. However, their confidence intervals narrowed as well.

Additionally, the use of imputed data resulted in a decrease in the odds ratio (from 0.77 to 0.66) and a change in the confidence interval (from 0.48, 1.24 to 0.46, 0.96) for children aged 1–4 years. All other age groups demonstrated no significant change with the use of imputed data.

The correlation method was used to evaluate the variance explained by the logistic regression model using imputed data. The R^2 statistic for the overall regression model (excluding the system characteristics) was 0.046, while the R^2 for each individual domain was as follows: demographic characteristics 0.015, clinical characteristics 0.029, system characteristics 0.003, and service characteristics 0.013. The Hosmer-Lemeshow test and C-statistic indicated a good fit of the imputed model when excluding the system characteristics.

Discussion

To our knowledge, this is the first study to use a nationally representative sample to describe the demographic, clinical, system, and service characteristics of pediatric patients utilizing EMS to access the ED. Representing 13% of EMS transports, pediatric patients annually

utilize EMS at a rate of 26 per 1,000, less than half the rate of adult patients. Our data compare favorably with those of previous single hospital studies, which indicated that 5% to 7% of ED pediatric patients arrive by EMS.^{9,11,12} Previous studies have also indicated a wide variety of annual pediatric EMS utilization rates ranging from 21 to 75 transports per 1,000.^{8,31}

A number of demographic and system characteristics were associated with increased use of EMS and may help explain the wide variation in annual pediatric EMS utilization rates observed in other studies. Urban residence and living in the northeast United States was associated with EMS use, although it is unclear if this relationship is due to an increased use rate among pediatric patients in the urban northeast or decreased use in other parts of the country or rural areas. Varying rates of pediatric EMS use have been reported in previous studies,^{8,31} and the present analysis suggests that some of these differences may be due to regional variation.

African American race was associated with increased EMS use; however, the available data preclude an analysis of the factors suggesting reasons why this was the case. Earlier research identified substantially higher age- and gender-standardized EMS utilization rates for African Americans in a large single urban city.¹⁶ The lack of primary care and increased incidence of illness and intentional injury observed in minority populations may account for this reliance on EMS transport.¹⁶ Future study is required to adequately examine the multiple demographic, socioeconomic, and health care factors that play a role in the observed increased EMS utilization rate among the African American pediatric population.

It is striking that the rate of uninsurance is 43% higher among pediatric patients arriving by EMS (20%) as compared with those arriving by other means (14%). This is consistent with a large urban center's report of 16% of pediatric patients arriving by EMS uninsured compared with 10% arriving by other means.¹⁰ However, while a significant bivariate relationship was found between insurance status and EMS use, this association was not significant in the multivariate model. It is likely that other factors correlated with insurance status may be responsible for the difference in rates. The data analyzed herein can speak only to the relationship of EMS use with insurance status; thus, we cannot posit specific reasons for EMS use or the appropriateness of EMS transport for the patients included in this study.

Children arriving by EMS more frequently required care within 15 minutes after arrival, suggesting a higher acuity than for patients arriving at the ED by other means. Further, EMS patients had an elevated acute illness level as demonstrated by a greater admission rate to non-ICU (14% vs. 3.9%) and ICU (1.8% vs. 0.12%) settings than patients arriving by other means. The combined 16% admission rate is lower than that observed in other studies and may be more reflective of national trends rather than smaller studies suggesting the higher rates of 22–26%.^{11,12}

Service characteristics identified that a higher number of diagnostic services were performed on patients arriving via EMS, again suggesting a more acutely ill patient population with presentations requiring additional data to secure the child's diagnosis. This is likely due to

the high frequency of injury and poisoning in the pediatric EMS population and the propensity of these patients to receive imaging studies because of the mechanism of injury. These results suggest that despite pediatric patients' comprising a relatively small portion of the EMS transport volume, the patients who are transported have a high level of acuity and need significant care. This has important implications for EMS training because retention of a low-volume but highly technical skill such as endotracheal intubation is difficult unless frequent dedicated pediatric training is incorporated into EMS continuing education.

Consistent with the EMS system's original design, a large proportion (62%) of pediatric patients cared for by the EMS system suffered from injury or poisoning, a rate comparable to those found in previous studies (53–76%).^{8,10}

Originally, the majority of EMS equipment was designed and manufactured for adults and subsequently used for pediatric patients. In recent years, pediatric specialty equipment such as immobilization and airway devices has been developed and made available to EMS, and such innovation is vital to ensure the highest quality of care to children. Further, given the large number of pediatric patients transported by EMS who require care because of injury or poisoning, EMS has a unique position in which it can monitor, track, and intervene on the public health and safety of the pediatric population. In this respect, EMS is an important and vital partner with the public health community to reach the common goals of decreased morbidity and mortality due to accidental and intentional injury in this age group.

Limitations and Future Studies

This study does not analyze specific out-of-hospital care data. Rather, it makes inferences regarding the care provided by EMS. Given the lack of nationally representative, high-quality, out-of-hospital epidemiologic data, it is acknowledged that this analysis is less than ideal. Until nationwide collection of out-of-hospital care data is feasible through such projects as the National EMS Information System (NEMSIS),³² these data are the best possible surrogate.

As this is an analysis of an existing data set, we are limited by the quality of the data and variables collected by the NCHS. We acknowledge that others have previously identified problems with the NHAMCS data set such as the quality of the included variables.^{33,34} Because the data were collected by self-report from ED staff at participating hospitals, they could be susceptible to misclassification bias. However, these errors should be minimal given the rigorous methods used by the NCHS in collecting these data. Further, we were unable to evaluate variables not included in the NHAMCS data set or variables included but with such a small frequency that meaningful analysis could not be performed. Examples of such variables include availability of primary care, patient opinions, mode of EMS transport (air vs. ground), and prehospital treatment. Additionally, future studies may consider further subdividing the ICD-9-CM categories when sufficient sample size exists to identify specific diagnosis patterns, such as the relationship of psychiatric versus neurologic emergencies in this population. Although the absence of such variables limits the depth of the analysis and the conclusions that can be drawn, these data provide direction for future studies examining pediatric use of EMS at the national level.

It is impossible to determine whether the associations with EMS use were due to overuse by one group or underuse by another. Particularly with reference to insurance status, race, and urban location, further study will be required to clarify these relationships. Lastly, this study does not address those patients who request EMS but are not transported to an ED. As a result, this study likely underestimates the total number of pediatric EMS requests by approximately 10–13% based on previously described transport refusal rates among children.³⁵

Conclusions

Pediatric patients represent 13% of all EMS transports to USEDs. Pediatric patients transported by EMS are more likely to have injuries or poisoning, and have higher acuity illness than those arriving to the ED by other means. The epidemiology of pediatric EMS use may have important operational, training, and public health implications and requires further study.

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TABLE 1
Bivariate Comparison of Pediatric Emergency Department Patient Visits by Their Arrival Mode

Characteristic	Arrive without EMS			Arrive via EMS			p-value
	Number of Visits (in millions)*	Percentage of Visits	99% CI	Number of Visits (in millions)*	Percentage of Visits	99% CI	
Demographic characteristics							
Age							<0.001
<1 year	13.9	14%	12–15	0.8	10%	8–13	
1–4 years	30.9	30%	29–31	1.3	16%	14–19	
5–11 years	31.1	30%	29–31	2.2	28%	24–31	
12–18 years	27.2	26%	25–28	3.6	46%	42–50	
Age in years, mean (standard error)	103.1	7.3 (0.1)	7–8	7.9	10 (0.2)	10–11	<0.001
Gender—female	54.8	53%	52–54	4.0	52%	48–55	0.307
Ethnicity							0.730
Hispanic	17.2	17%	13–21	1.3	16%	13–21	
Not Hispanic	85.9	83%	79–87	6.6	84%	79–87	
Race							0.008
White	76.2	74%	69–78	5.4	69%	64–73	
African American	24.1	23%	19–28	2.2	28%	23–33	
Other	2.9	3%	2–4	0.3	3%	2–6	
Urban residence	79.4	77%	64–86	6.5	83%	71–91	0.002
Region of country							0.020
Northeast	17.1	17%	14–19	1.7	22%	17–28	
Midwest	27.8	27%	23–32	2.1	27%	21–34	
South	41.2	40%	35–45	2.7	35%	28–42	
West	17.0	16%	12–22	1.3	16%	11–23	
Clinical characteristics							
Immediacy of care required							<0.001
<15 min	17.7	17%	15–20	3.1	40%	35–45	
15–59 min	43.1	42%	39–45	3.0	38%	34–42	
1–2 hours	25.9	25%	22–28	1.1	15%	12–18	

Characteristic	Arrive without EMS			Arrive via EMS			p-value
	Number of Visits (in millions)*	Percentage of Visits	99% CI	Number of Visits (in millions)*	Percentage of Visits	99% CI	
>2 hours	16.4	16%	14–18	0.6	8%	5–10	
Care related to injury or poisoning	40.3	39%	37–41	4.9	62%	58–66	<0.001
Clinical diagnosis (ICD-9-CM code)							
Psychiatric and nervous system (290–389.9)	12.2	12%	11–13	0.5	6%	4–9	<0.001
Circulatory system (390–459.9)	0.2	0.2%	0.1–0.3	0.1	1% [†]	0.6–2.4	
Respiratory system (460–519.9)	19.3	19%	17–20	0.6	8%	6–10	
Gastrointestinal and genitourinary systems (520–629.9)	7.4	7%	7–8	0.3	4%	3–5	
Musculoskeletal, trauma, and poisonings (710–739.9, 800–999.9)	36.3	35%	33–37	4.2	54%	50–57	
Other	26.3	26%	24–27	2.1	26%	23–30	
Missing	1.4	1%	1–2	0.1	2% [†]	1–3	
System characteristics							
Year of visit							0.827
1997	24.1	23%	21–26	1.8	23%	19–27	
1998	26.1	25%	23–28	2.1	26%	22–31	
1999	25.5	25%	22–28	1.8	23%	19–28	
2000	27.4	27%	24–30	2.1	27%	23–32	
Season of visit							<0.001
Winter	25.9	25%	22–28	1.5	20%	16–24	
Spring	26.9	26%	23–29	1.9	25%	21–30	
Summer	24.7	24%	21–27	2.4	31%	26–36	
Fall	25.6	25%	22–28	1.9	25%	20–30	
Time of arrival in ED							0.044
Midnight–0759	13.4	13%	12–14	1.1	15%	12–18	
0800–1559	37.7	37%	35–38	3.0	39%	35–42	
1600–2359	52.0	50%	49–52	3.7	47%	43–50	
Insured							<0.001
Yes	88.3	86%	84–87	6.3	80%	76–83	

Characteristic	Arrive without EMS			Arrive via EMS			p-value
	Number of Visits (in millions)*	Percentage of Visits	99% CI	Number of Visits (in millions)*	Percentage of Visits	99% CI	
No	14.8	14%	13–16	1.6	20%	17–24	
Service characteristics							
Diagnostic services provided							<0.001
Yes	78.3	76%	73–78	7.0	90%	86–92	
No	24.8	24%	22–27	0.8	10%	8–14	
Number of diagnostic tests, mean (standard error)	103.1	1.5 (0.03)	1–1.6	7.9	2.8 (0.08)	2–3	<0.001
Specific diagnostic testing							
Mental status examination	10.3	10%	8.2–12	1.4	18%	15–23	<0.001
Complete blood count	12.3	12%	11–13	1.8	23%	19–26	<0.001
Electrocardiogram	1.5	2%	1.2–1.8	0.6	8%	6.0–11	<0.001
CT scan	1.9	2%	1.5–2.2	0.8	10%	8–13	<0.001
Procedures performed							<0.001
Yes	35.9	35%	33–37	3.9	49%	45–54	
No	67.2	65%	63–67	4.0	51%	46–55	
Number of procedures done, mean (standard error)	103.1	0.4 (0.01)	0.3–0.4	7.9	0.7	0.6–0.7	<0.001
Specific procedures performed							
Endotracheal intubation	0.1	0.1% [†]	0.1–0.2	0.1	1% [†]	0.7–2.6	<0.001
Cardiopulmonary resuscitation	0.1	0.1% [†]	0–0.1	0.1	1% [†]	0.5–2.1	0.001
Intravenous fluids	6.2	6.0%	5–7	1.8	23%	19–27	<0.001
Any medications given	70.4	68%	66–70	4.8	61%	58–65	<0.001
Number of medications							<0.001
0	32.7	32%	30–34	3.0	39%	35–42	
1–2	56.4	55%	53–57	3.8	48%	45–51	
>2	14.0	14%	12–15	1.0	13%	11–16	

Number of visits (in millions) is a weighted estimate.

[†]Estimates are based on sample size <30 or relative standard error >30% and may be unreliable.

CI = confidence interval; ED = emergency department; CT = computed tomography; EMS = emergency medical services; ICD-9-CM = International Classification of Diseases, Ninth Edition, Clinical Modification.

TABLE 2

Bivariate Comparison of Pediatric Emergency Department Disposition by Mode of Arrival

Characteristic	Arrive without EMS			Arrive via EMS			p-value
	Number of Visits (in millions) *	Percentage of Visits	99% CI	Number of Visits (in millions) *	Percentage of Visits	99% CI	
Disposition							<0.001
Discharged from ED	97.6	95%	94–95	6.5	83%	80–86	
Admitted, non-ICU	4.0	4%	3–5	1.1	14%	11–17	
Admitted, ICU	0.1	0.1% [†]	0.1–0.2	0.1	2%	1–3	
Left before care complete	1.4	1%	1–2	0.1	1% [†]	0–2	
Referred to social worker on discharge	0.3	0.3%	0.2–0.4	0.1	1% [†]	0–2	0.044
Died in ED	0.1	0.1% [†]	0–0.1	0.1	1% [†]	0–2	0.002

* Number of visits (in millions) is a weighted estimate.

[†] Estimates are based on sample size <30 or relative standard error >30% and may be unreliable.

CI = confidence interval; ED = emergency department; EMS = emergency medical services; ICU = intensive care unit.

TABLE 3

Weighted Multivariate Analysis: Factors Associated with Emergency Medical Services Use by Pediatric Emergency Department Patients

Characteristic	Odds Ratio	99% CI	p-value
Demographic characteristics			
Age [*]			<0.001
<1 year	Reference		
1–4 years	0.66	0.46, 0.95	0.003
5–11 years	0.91	0.65, 1.28	0.49
12–18 years	1.51	1.11, 2.06	<0.001
Gender—female	1.12	0.95, 1.33	0.07
Ethnicity—Hispanic	1.15	0.91, 1.46	0.12
Race [*]			<0.001
White	Reference		
African American	1.42	1.15, 1.77	<0.001
Other	1.38	0.82, 2.32	0.11
Urban residence	1.53	1.10, 2.11	<0.001
Region of country [*]			0.01
Northeast [†]	1.27	0.95, 1.68	0.03
Midwest	Reference		
South	0.90	0.67, 1.22	0.38
West	0.92	0.65, 1.30	0.54
Clinical characteristics			
Immediacy of care required [*]			<0.001
<15 min	Reference		
15–59 min	0.39	0.31, 0.49	<0.001
1–2 hours	0.25	0.18, 0.34	<0.001
>2 hours	0.21	0.15, 0.32	<0.001
Clinical diagnosis (ICD-9-CM code) [†]			<0.001
Psychiatric and nervous system (290–389.9)	0.48	0.32, 0.74	<0.001
Circulatory system (390–459.9) [†]	3.55	1.39, 9.05	<0.001
Respiratory system (460–519.9)	0.34	0.24, 0.48	<0.001
Gastrointestinal and genitourinary systems (520–629.9)	0.34	0.22, 0.51	<0.001
Musculoskeletal, trauma, and poisonings (710–739.9, 800–999.9)	Reference		
Other	0.75	0.60, 0.92	<0.001
Missing	1.23	0.64, 2.40	0.41
Service characteristics			
Diagnostic services provided	2.11	1.56, 2.86	<0.001
Procedures performed	1.17	0.95, 1.44	0.05
Medications given	0.81	0.69, 0.95	0.001

* Wald test of significance for groups of variables.

[†] Estimates are based on sample size <30 or relative standard error >30% and may be unreliable.

CI = confidence interval; ICD-9-CM = International Classification of Diseases, Ninth Edition, Clinical Modification.

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