2016

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Original Publication Citation

Diggs, L. A., Sheth-Chandra, M., & De Leo, G. (2016). Epidemiology of pediatric prehospital basic life support care in the united states. *Prehospital Emergency Care, 20*(2), 230-238. doi:10.3109/10903127.2015.1076099

Prehospital Emergency Care

ISSN: 1090-3127 (Print) 1545-0066 (Online) Journal homepage: http://www.tandfonline.com/loi/ipec20

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To cite this article: Leigh Ann Diggs MPH, Manasi Sheth-Chandra PhD & Gianluca De Leo PhD, MBA (2016) Epidemiology of Pediatric Prehospital Basic Life Support Care in the United States, Prehospital Emergency Care, 20:2, 230-238, DOI: 10.3109/10903127.2015.1076099

To link to this article: http://dx.doi.org/10.3109/10903127.2015.1076099

Published online: 10 Nov 2015.

Focus on Pediatrics

Epidemiology of Pediatric Prehospital Basic Life Support Care in the United States

Leigh Ann Diggs, MPH, Manasi Sheth-Chandra, PhD, Gianluca De Leo, PhD, MBA

Abstract

Children have unique medical needs compared to adults. Emergency medical services personnel need proper equipment and training to care for children. The purpose of this study is to characterize emergency medical services pediatric basic life support to help better understand the needs of children transported by ambulance. Pediatric basic life support patients were identified in this retrospective descriptive study. Descriptive statistics were used to examine incident location, possible injury, cardiac arrest, resuscitation attempted, chief complaint, primary symptom, provider's primary impression, cause of injury, and procedures performed during pediatric basic life support calls using the largest aggregate of emergency medical services data available, the 2013 National Emergency Medical Services Information System (NEMSIS) Public Release Research Data Set. Pediatric calls represented 7.4% of emergency medical services activations. Most pediatric patients were male (49.8%), White (40.0%), and of non-Hispanic origin (56.5%). Most incidents occurred in the home. Injury, cardiac arrest, and resuscitation attempts were highest in the 15 to 19 year old age group. Global complaints (37.1%) predominated by anatomic location and musculoskeletal complaints (26.9%) by organ system. The most common primary symptom was pain (30.3%) followed by mental/psychiatric (13.4%). Provider's top primary impression was traumatic injury (35.7%). The most common cause of injury was motor vehicle accident (32.3%). The most common procedure performed was patient assessment (27.4%). Median EMS system response time was 7 minutes (IQR: 5–12). Median EMS scene time was 12 minutes (IQR: 8–19). Median transport time was 14 minutes (IQR: 8–24). Median EMS total call time was 51 minutes (IQR: 33–77). The epidemiology of pediatric basic life support can help to guide efforts in both emergency medical services operations and training. **Key words:** pediatric; prehospital; basic life support; emergency medical services

PREHOSPITAL EMERGENCY CARE 2016;20:230–238

Received April 22, 2015 from Old Dominion University, Community and Environmental Health, Norfolk, Virginia (LAD); Old Dominion University, Virginia Modeling Analysis and Simulation Center, Norfolk, Virginia (LAD); Old Dominion University, Center for Global Health, Norfolk, Virginia (MS-C); Georgia Regents University, Clinical and Environmental Health Sciences, Augusta, Georgia (GDL). Revision received June 25, 2015; accepted for publication June 25, 2015

The authors would like to acknowledge the generous support of the Modeling and Simulation Graduate Research Fellowship provided to both Ms. Leigh Diggs by Old Dominion University and VMASC during academic year 2013–4.

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doi: 10.3109/10903127.2015.1076099

Introduction

Approximately 30 million children visit emergency departments each year in the United States.[1] An estimated 1.5 to 3 million (5%–10%) children arrive to the emergency department by ambulance.[2] Previous literature reports that 10% of emergency medical services (EMS) transports are children.[3,4] Children have unique medical needs in comparison to adults and represent a special challenge for emergency medical services providers.[5,6] Prehospital providers must stock ambulances with appropriately sized pediatric equipment to best serve the needs of children. EMS providers need specialized training, such as Pediatric Advanced Life Support (PALS) or Pediatric Training for Prehospital Providers (PEPP), and safe and effective pediatric protocols to treat children.[1]

The EMS system in the United States was created due to deficiencies in care for trauma and cardiac arrest patients.[6,7] Prior to the Emergency Medical Services for Children legislation in 1984, equipment and train-

ing were geared toward the adult population and the needs of pediatric patients were often overlooked.[6,8] Many studies have called for more pediatric EMS research[1,3–6,9–17] The framework for this study originated from the limitations of a 2008 study[7] that analyzed data from the emergency department component of the 1997–2000 National Hospital Ambulatory Medical Care Survey. The 2008 study[7] did not analyze specific prehospital care data, but made inferences regarding the care provided by EMS, due to the lack of nationally representative, high-quality, prehospital epidemiologic data. The National EMS Information System (NEMSIS) project made the current data analysis possible. The purpose of this article is to characterize pediatric basic life support (BLS) using the largest aggregate of EMS data currently available, NEMSIS.

Methods

NEMSIS Database

The Institutional Review Board at Old Dominion University deemed this study to be exempt. This retrospective descriptive study of pediatric BLS utilized the 2013 Public-Release Research Data Set available through request from the NEMSIS project. For this study, we used the 2013 NEMSIS Public-Release Research Data Set version 2.2.1. This paper describes pediatric BLS EMS episodes by providing information regarding pediatric patients' age, gender, race, ethnicity, chief complaint, providers' primary impression, where the EMS event occurred, type of response to and from the EMS scene, if an injury occurred, or if resuscitation was attempted.

NEMSIS is a standardized system of collecting, storing, and sharing EMS data at the local, state, and national level. Data includes agency, provider, and patient information. Approximately 90% of state agencies have NEMSIS compliant systems in place to transmit EMS data. Agency's NEMSIS compliant systems have varying levels of sophistication. The data set is maintained by the NEMSIS Technical Assistance Center (University of Utah School of Medicine, Salt Lake City, UT).

Pediatric BLS

In this study, BLS care was defined based on the National Highway Traffic Safety Administration's definition.[18] The data set was split into advanced life support (ALS) and BLS events using Center for Medicare and Medicaid Services (CMS) level (#E07_14) keeping only field values representing BLS calls in the data set (#990, basic life support; #995, basic life support emergency). The completeness of data elements for pediatric BLS can be found in Table 1. Primary type of payment or type of insurance associated with this EMS encounter (#E07_01) was examined.

Patient Variables

As defined by the Pediatric Emergency Care Applied Research Network (PECARN),[19] a pediatric patient was defined as a person ≤19 years of age. Age categories analyzed were 0–1 year (infants), 2–3 years (toddlers), 4–5 years (preschoolers), 6–8 years (middle childhood), 9–11 years (pre-teens), 12–14 years (young teens), and 15–19 years (teenagers). Age group (#E06_14 recoded into categories), gender (#E06_11), race (#E06_12), and ethnicity (#E06_13) were all analyzed.

Scene Variables

Scene variables describe the location where the EMS event occurred. The only scene variable examined was incident location type (#E08_07). Incident location type includes home, health care facility, street/highway, public building, trade/service, recreational sport, residential institution, industrial place, farm, lake/river/ocean, mine/quarry, and other.

Unit and Agency Variables

Type of service requested (#E02_04), primary role of the unit (#E02_05), and response mode to scene (#E02_20) were examined.

Situation Variables

Possible injury (#E09_04) and cardiac arrest (#E11_01) were tabulated by age group. Chief complaint anatomic location (#E09_11), chief complaint organ system (#E09_12), primary symptom (#E09_13), provider's primary impression (#E09_15), and cause of injury (#E10_01) were examined.

Intervention Variables

Procedures performed (#E19_03) was the only intervention variable calculated.

Disposition Variables

Incident/patient disposition (#E20_10), transport mode from scene (#E20_14), and type of destination (#E20_17) were examined.

EMS Call Times

EMS call times were analyzed. EMS system response time is the time difference in minutes between unit notified by dispatch and unit arrival on scene. EMS scene time is the time difference in minutes between the unit

TABLE 1. Completeness of data elements for pediatric basic life support calls

Identifier	Data Element	Missing	Available (n/350,414)
#E10_01	Cause of Injury	294,631 (84.1%)	55,783
#E09_11	Chief Complaint Anatomic Location	192,781 (55.0%)	157,633
#E09_15	Primary Impression	183,904 (52.5%)	166,510
#E09_12	Chief Complaint Organ System	173,635 (49.6%)	176,779
#E06_13	Ethnicity	119,785 (34.2%)	230,629
#E09_13	Primary Symptom	118,721 (33.9%)	231,693
#E06_12	Race	91,590 (26.1%)	258,824
#E11_01	Cardiac Arrest	58,515 (16.7%)	291,899
#E09_04	Possible Injury	38,582 (11.0%)	311,832
#E08_07	Incident Location Type	26,802 (7.6%)	323,612
#E06_11	Gender	2,830 (0.8%)	347,584
#E02_04	Type of Service Requested	0 (0%)	350,414
#E02_05	Primary Role of Unit	0 (0%)	350,414
#E02_20	Response Mode to Scene	0 (0%)	350,414
#E20_10	Incident Patient Disposition	0 (0%)	350,414
#E20_14	Transport Mode from Scene	0 (0%)	350,414
URBAN	Urbanicity	0 (0%)	350,414
CR	Census Region	0 (0%)	350,414
#E06_14	Age	0 (0%)	350,414

arrival on scene and the unit left scene. Transport time is the difference in minutes between the unit left the scene and patient arrival at destination. EMS total call time is the time difference in minutes between the unit back in service and unit notified by dispatch.

Geocode Variables

Population setting (urbanicity) was examined. Population setting was classified by the NEMSIS project using the United States Department of Agriculture (USDA) and Office of Management and Budget (OMB) definitions. Urban included counties with large (1+ million residents) and small (less than 1 million residents) metropolitan areas. Suburban consisted of micropolitan (with an urban core of at least 10,000 residents) counties adjacent to a large or small metropolitan area. Rural areas were non-urban core counties adjacent to a large metropolitan area or a small metropolitan area with or without a town. Wilderness areas were made of non-core counties that are adjacent to micropolitan counties with or without a town. We also evaluated where pediatric BLS calls were located according to United States Census Region (Northeast, South, Midwest, and West).

Data Analysis

We used descriptive statistics to analyze the data. The number of pediatric BLS episodes was portrayed. Demographics of the population including age, race, and ethnicity were characterized. Possible injury and cardiac arrest were categorized by age group. Incident location type, chief complaint by anatomic location and organ system, patient's primary symptom, provider's primary impression, cause of injury, and procedures performed during pediatric BLS calls were all tabulated and calculated as occurrence per 1,000 pediatric basic life support events. STATA Version 13 was used to analyze the data.

RESULTS

Pediatric BLS

This data set contained 23,897,211 EMS activations from 41 states and two United States territories for the one year period January 1, 2013 to December 31, 2013. Of the total EMS activations, 7.4% (n = 1,761,950) EMS activations were pediatric. Pediatric EMS activations could be divided by CMS service level which included

TABLE 2. Demographic characteristics of patients during pediatric basic life support calls

Demographic Characteristics	Frequency	%
Gender		
Male	174,382	49.8
Female	173,202	49.4
Not Known	2,830	0.8
Race		
White	140,264	40.0
African American	85,950	24.5
Asian	3,419	1.0
American Indian/Alaskan Native	2,327	0.6
Hawaiian/Pacific Islander	511	0.2
Other	26,353	7.5
Not Known	91,590	26.1
Ethnicity		
Not Hispanic	197,993	56.5
Hispanic	32,636	9.3
Not Known	119,785	34.2

ALS, BLS, and unknown type. There were 350,414 known pediatric BLS events remaining for analysis (see Figure 1). Primary types of payment included the following: private insurance 15.1% (n = 52,879), Medicaid 15.1% (n = 52,750), self-pay 5.5% (n = 19,400), not billed 0.7% (n = 2,451), Medicare 0.6% (n = 2,064), other government 0.5% (n = 1,679), Worker's Compensation 0.06% (n = 197), and not known 62.4% (n = 218,994).

Patient Variables

Age groups can be found in Figure 1. Demographic characteristics can be found in Table 2. No difference was found in patient gender. Most patients were White (40.0%) and of non-Hispanic origin (56.5%).

Scene Variables

The incident location type can be found in Table 3. Most incidents occurred at the home (37.2%) followed by health care facilities (27.3%) and on the street or highway (16.9%).

Unit and Agency Variables

Of type of services requested, 73.6% (n = 257,847) were 911 response; 15.4% (n = 53,815) medical transport; 10.4% (n = 36,580) interfacility transfer; 0.4% (n = 1,280) mutual aid; 0.2% (n = 620) standby; and 0.08% (n = 272) intercept. Data suggests the primary role of the unit was 96.2% (n = 337,079) transport, 2.9% (n = 9,996) non-transport, 0.9% (n = 3,138) rescue, and 0.06% (n = 201) supervisor. Response mode to the scene included 56.2% (n = 196,804) lights and siren, 41.6% (n = 145,663) no lights and sirens, 1.4% (n = 5,023) initial no lights and sirens upgraded to lights and sirens, and 0.8% (n = 2,924) initial lights and siren downgraded to no lights and sirens.

TABLE 3. Incident location type

Incident Location Type	Frequency (n of 323,612)	Rate n Per 1000 Pediatric BLS Care Events
Home	120,400	372.1
Health Care Facility	88,598	273.8
Street/Highway	54,696	169.0
Public Building	26,317	81.3
Trade/Service	10,616	32.8
Recreational Sport	7,728	23.9
Residential Institution	3,507	10.8
Industrial Place	1,097	3.4
Farm	204	0.6
Lake/River/Ocean	172	0.5
Mine/Quarry	19	0.1
Other	10,259	31.7

Situation Variables

Possible injury and cardiac arrest occurring in pediatric BLS patients were tabulated by age group and can be found in Table 4 with the greatest number of injuries and cardiac arrests occurring in the 15–19 year old age group. Chief complaint by anatomic location and organ system of pediatric BLS patients can be found in Table 5. By anatomic location, most chief complaints were global (37.1%) followed by the head (20.1%) and abdomen (9.8%). By organ system, chief complaints were most frequently musculoskeletal (26.9%) followed by global complaints (25.1%) and psychiatric complaints (12.8%).

Table 6 summarizes the primary symptom of patients during pediatric BLS calls. The most frequently occurring primary symptom being pain (30.3%) followed mental/psychiatric (13.4%). Provider's primary impression can be found in Table 7. The most frequent provider's primary impression was traumatic injury (35.7%) followed by behavioral/psychiatric (22.0%) and abdominal pain or problems (10.1%). Table 8 examines the cause of injury for pediatric BLS calls with motor vehicle accidents (32.3%), falls (30.1%), and being struck with a blunt object (15.6%) accounting for more than 75% of calls.

Intervention Variables

Procedures performed during pediatric BLS calls can be found in Table 9. The most common procedure performed was patient assessment (27.4%) followed by pulse oximetry (17.8%) and spinal immobilization (14.5%).

Disposition Variables

Incident or patient disposition included most pediatric patients being treated and transported by EMS 92.3% (n = 323,612), followed by being treated and released 4.3% (n = 15,183), being treated and having care transferred 2.8% (n = 9,760), being treated and transported by private vehicle 0.4% (n = 1,243), and being treated and transported by law enforcement 0.2% (n = 616). Transport mode from the scene of the incident included 71.6% (n = 251,044) no lights and sirens, 18.9% (n = 66,335) lights and siren, 1.6% (n = 5,717) primary lights and sirens decreased to no lights and siren, 0.6% (n = 2,093) primary no lights and siren increased to lights and siren with 22,225 (7.2%) not being recorded. Most patients were transported to the hospital representing 83.8% (n = 292,702) during pediatric BLS calls. Other places pediatric patients were transported included medical office or clinic 1.9% (n = 6,564), other facility 1.5% (n = 5,220), home 1.3% (n = 4,528), nursing home 0.9% (n = 3,144), air transport 0.2% (n = 515), jail 0.02% (n = 63), and morgue 0.01% (n = 20) while 10% (n = 34,951) were not recorded.

TABLE 4. Possible injury and cardiac arrest during pediatric basic life support calls

	Age in Years						
	0 to 1	2 to 3	4 to 5	6 to 8	9 to 11	12 to 14	15 to 19
Possible Injury (n of 311,832)							
No	13,852	24,051	16,219	21,367	22,091	31,709	96,880
Yes	2,330	6,963	6,114	8,802	9,730	12,839	38,885
Cardiac Arrest (n of 291,899)							
No	14,741	29,381	21,117	28,284	29,786	41,221	127,114
Yes, Prior to EMS Arrival	18	39	28	24	15	23	54
Yes, After EMS Arrival	5	8	5	7	5	13	11

TABLE 5. Chief complaint anatomic location and chief complaint organ system of pediatric basic life support patients

Chief Complaint Anatomic Location	Frequency(n of 157,633)	Rate n Per 1000 Pediatric BLS Care Events
General/Global	58,481	371.0
Head	31,674	200.9
Abdomen	15,438	97.9
Lower Extremity	13,817	87.7
Upper Extremity	13,166	83.5
Chest	10,951	69.5
Back	6,124	38.8
Neck	5,772	36.6
Genitalia	2,210	14.0
Chief Complaint Organ System	**Frequency (n of 176,779)**	**Rate n Per 1000 Pediatric BLS Care Events**
Musculoskeletal	47,512	268.8
Global	44,392	251.1
Psychiatric	22,648	128.1
CNS/Neurological	13,423	75.9
Pulmonary	12,619	71.4
Gastrointestinal	12,327	69.7
Skin	12,507	70.7
OBGyn	4,456	25.2
Endocrine/Metabolic	3,375	19.1
Cardiovascular	2,593	14.7
Pulmonary	927	5.2

TABLE 6. Primary symptom of patients during pediatric basic life support calls

Primary Symptom	Frequency (n of 231,693)	Rate n per 1000 Pediatric BLS Care Events
Pain	70,300	303.4
Mental/Psychiatric	31,076	134.1
Transport Only	15,486	66.8
Breathing Problem	15,469	66.8
Bleeding	13,365	57.7
Change in responsiveness	12,558	54.2
Fever	12,292	53.1
Nausea/Vomiting	9,510	41.0
Wound	7,851	33.9
Weakness	7,720	33.3
Swelling	4,135	17.8
Malaise	3,470	15.0
Rash/Itching	2,173	9.4
Choking	1,317	5.7
Diarrhea	823	3.6
Drainage/Discharge	578	2.5
Mass/Lesion	343	1.5
Palpitations	286	1.2
Device/Equipment Problem	191	0.8
Death	128	0.6
None	22,622	97.6

TABLE 7. Provider's primary impression during pediatric basic life support calls

Primary Impression	Frequency (n of 166,510)	Rate n per 1000 Pediatric BLS Care Events
Traumatic Injury	59,473	357.2
Behavioral/Psychiatric	36,673	220.2
Abdominal Pain/Problem	16,941	101.7
Respiratory Distress	12,202	73.3
Seizure	9,554	57.4
Poisoning/Drug Ingestion	5,656	34.0
Altered Level of Consciousness	4,238	25.5
Syncope	3,963	23.8
Allergic Reaction	3,549	21.3
Pregnancy/OBGyn Delivery	3,066	18.4
Hyperthermia	2,935	17.6
Chest Pain	2,646	15.9
Airway Obstruction	1,325	8.0
Hypoglycemia	715	4.3
Vaginal Hemorrhage	472	2.8
Sting/Venomous Bite	455	2.7
Sexual Assault/Rape	429	2.6
Hypovolemia/Shock	377	2.3
Cardiac Rhythm Disturbance	370	2.2
Smoke Inhalation	356	2.1
Stroke/CVA	272	1.6
Cardiac Arrest	231	1.4
Inhalation Injury	178	1.1
Hypothermia	164	1.0
Respiratory Arrest	145	0.9
Obvious Death	86	0.5
Electrocution	39	0.2

TABLE 8. Cause of injury for pediatric basic life support calls

Injury Cause	Frequency (n of 55,783)	Raten per 1000 Pediatric Injury Events
Motor Vehicle Accident	18,027	323.2
Falls	16,788	301.0
Struck by Blunt Object	8,698	155.9
Motor Vehicle Non-traffic Accident	2,593	46.5
Pedestrian Traffic Accident	1,352	24.2
Accidental Stabbing/Cutting	1,190	21.3
Bicycle Accident	1,119	20.1
Motorcycle Accident	1,057	18.9
Drug Poisoning	948	17.0
Stabbing/Cutting Assault	853	15.3
Bites	719	12.9
Excessive Heat	364	6.5
Machinery Accident	280	5.0
Rape	248	4.4
Fire/Flames	221	4.0
Firearm Assault	208	3.7
Excessive Cold	164	2.9
Child Battery	157	2.8
Non Motor Vehicle Accident	156	2.8
Chemical Poisoning	134	2.4
Water Transport Accident	115	2.1
Accidental Firearm Injury	85	1.5
Venomous Sting	69	1.2
Drowning	60	1.1
Mechanical Suffocation	46	0.8
Electrocution/Non-lightning	39	0.7
Smoke Inhalation	34	0.6
Firearm Self Inflicted	33	0.6
Aircraft Related Accident	17	0.3
Radiation Exposure	6	0.1
Lightning	3	0.1

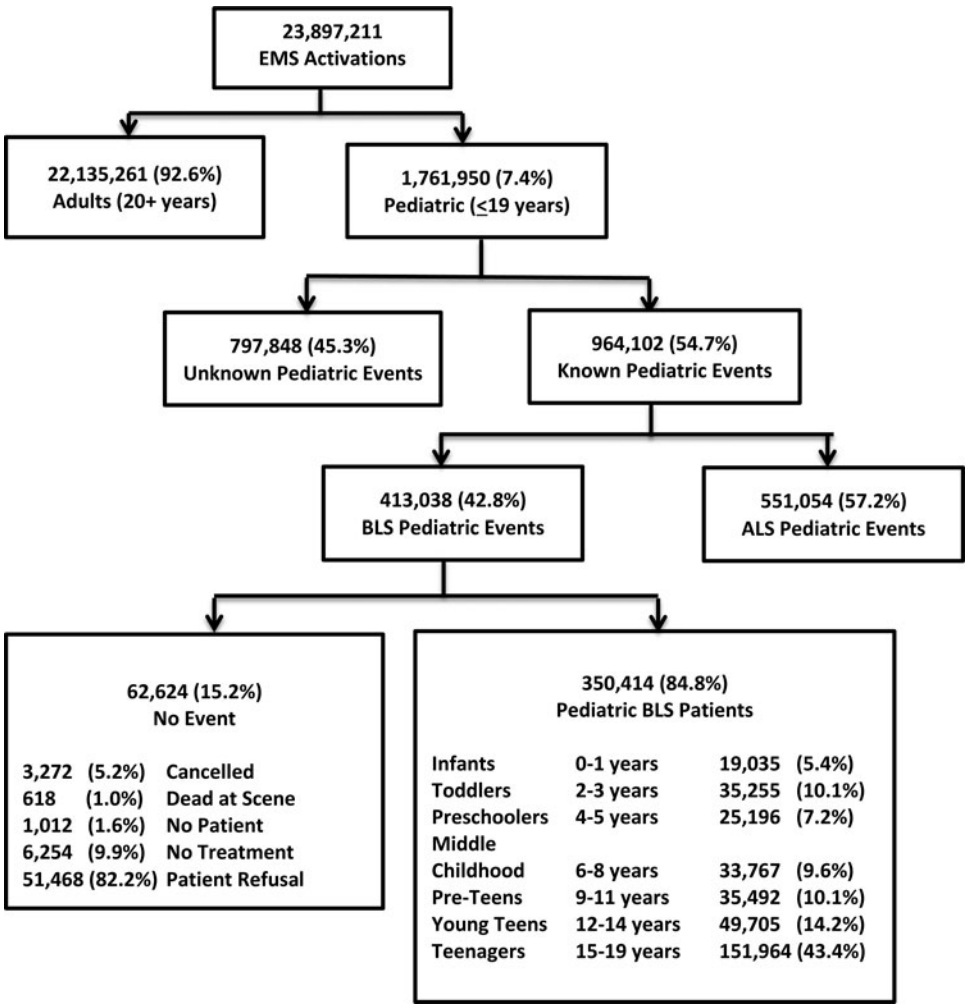

FIGURE 1. NEMSIS EMS activations and pediatric age groups.

EMS Call Times

Based on the available data, median EMS system response time was 7 minutes (IQR: 5–12). Median EMS scene time was 12 minutes (IQR: 8–19). Median transport time was 14 minutes (IQR: 8–24). Median EMS total call time was 51 minutes (IQR: 33–77).

Geocode Variables

Urbanicity included most pediatric BLS patients residing in urban areas 86.3% (n = 297,106) followed by suburban areas 6.8% (n = 23,343), rural areas 5.4% (n = 18,686), and wilderness areas 1.5% (n = 5,196). Most patients were located in the Northeast 40.8% (n = 142,802), followed by the South 39.7% (n = 139,131), Midwest 11.8% (n = 41,190), West 7.8% (n = 27,223), and Island areas 0.02% (n = 68).

DISCUSSION

This study analyzes the largest prehospital emergency medical services sample to date in a given year. Our data suggests 7.4% of transports are pediatric. This data is comparable to data from previous single hospital studies that reported 5% to 7% of emergency department pediatric patients arrive by EMS.[2,4,17] Two recent studies, one using NEMSIS and one using Virginia state data, characterizing endotracheal intubation found that pediatric patients, age 0–19 years, represented approximately 7% of total intubations.[20,21] This study demonstrates that electronic data capturing systems have been improving. The NEMSIS goal, to create a national EMS database from local and state EMS agencies from across the nation, has slowly been implemented. Ninety-five percent of states have some form of data collection system in place. Data sharing has improved due to standard data definitions that NEMSIS created.

The epidemiology of pediatric prehospital care is important to understand for research planning, system training, and resource allocation needs. The most common providers' primary impression was traumatic injury. Traumatic injury has been shown to be the most common chief complaint in previous research

TABLE 9. Procedures performed during pediatric basic life support calls

Procedure	Frequency (n of 182,264)	Rate n per 1000 Pediatric BLS Care Procedures
Patient Assessment	49,985	274.2
Pulse Oximetry	32,417	177.9
Spinal Immobilization	26,401	144.9
Venous Access	11,883	65.2
Pain Measurement	11,511	63.2
Patient Loaded/Off Loaded	9,112	50.0
Blood Glucose Analysis	6,590	36.2
Wound Care	6,348	34.8
Contact Medical Control	4,519	24.8
Cardiac Monitor	4,217	23.1
Nasal Airway	3,755	20.6
Splinting-Basic	3,742	20.5
Patient Monitoring	1,909	10.5
Temperature Measurement	1,891	10.4
Physical Restraints	1,071	5.9
Other	970	5.3
Orthostatic Blood Pressure	925	5.1
Patient Cooling	748	4.1
Airway-Nebulizer treatment	619	3.4
Airway -Suctioning	586	3.2
Capnography	573	3.1
Airway -Bagged via mask/tube	500	2.7
MAST	411	2.3
12 Lead EKG	356	2.0
Ventilator Operation	351	1.9
CPR	212	1.2
Airway- Cleared, Opened, or Heimlich	187	1.0
Airway-PEEP	173	0.9
Extrication	112	0.6
Oral Airway	106	0.6
Childbirth	84	0.5

studies.[14,17,22] The most recent pediatric study,[22] conducted in 2014, described pediatric patients, less than or equal to 19 years of age, treated between 2004 and 2006 by the Pediatric Emergency Care Research Network's (PECARN) affiliated agencies. Although 48% of pediatric patients in this study were treated by ALS providers, few patients received ALS interventions. Intravenous and intraosseous access was obtained in 13.8% of ALS patients, and an advanced airway was placed in 0.1% of ALS patients. Pediatric patients present far less than adult patients leading to deterioration of pediatric skills. This highlights the need for continuous education and training for pediatric-specific interventions.

This study highlights the need for better data collection by paramedics at the local and agency level. Over 45% of pediatric calls were of unknown type. Secondary data analysis has numerous pitfalls, and the lack of a simple checkmark in a box by a prehospital provider can lead to unknowns and poor data quality. To conduct clinical research, there needs to be strong partnerships between NEMSIS and local agencies that include patient care data. The NEMSIS Public Release Research Data Set currently lacks patient vitals and other elements that are collected at the local level. Poor recording of vitals and other patient care data also lead to poor data quality. Missing data can make it hard for researchers to analyze data and create models that could improve pediatric prehospital care. Imputation of missing data has not been perfected, and actual patient data is needed for research at the local, state, and national levels.

LIMITATIONS AND FUTURE STUDIES

As with any retrospective medical record review, this study was limited by the substantial amount of missing data. NEMSIS is a convenience sample. This study is subject to the limitations of any convenience sample and is therefore subject to various forms of bias. NEMSIS data are submitted voluntarily from EMS agencies and states that are committed to monitoring and improving the care of patients transported by EMS. The data is not representative and thus do not allow inferences about national incidence or prevalence. States also have different criteria for including patients in statewide EMS databases. Some states may include all 911 calls, while others may limit case additions to patient contacts or transports. The most obvious problems are selection bias (apparent differences between two groups caused by different inclusion criteria), information bias (apparent differences between two groups caused by differences in the data to com-

pare them), inconsistency how clinical values can be measured, and differences in interagency treatment and transport.[23] We did not use any regression techniques and wanted true totals from the data, so we did not use multiple imputation to handle missing data. These data also do not represent all BLS procedures performed during EMS calls, just those reported during known BLS events. ALS providers also perform BLS procedures during ALS calls. One study found that ALS procedures were only performed in 20% of runs where ALS was available.[13] Data in NEMSIS are also event-based and not patient-based meaning there is a possibility a single patient may be represented in more than one record for a variety of reasons. A patient could request EMS frequently and be recorded in the data set more than once. Several agencies could also report the same event. Future studies should link EMS data to emergency room and hospital data, so outcomes can be examined. The data in this study are not a random or a complete sample of the total population in the United States. While this limits establishing true population-based statistics on the use of basic life support services by children in the United States, it provides relative frequencies of use of basic life support by children.

CONCLUSIONS

Pediatric patients represented 7.4% of EMS activations and BLS activations represented 42.8% of all pediatric EMS calls. Pediatric patients transported by EMS are more likely to be suffering from traumatic injury followed by psychiatric and behavioral complaints. Most medical complaints involve abdominal pain or problems, respiratory distress, seizure, and poisoning or drug ingestion. The epidemiology of pediatric EMS use may have important public health implications and can help to guide efforts in both EMS operations and training.

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