HHS Public Access

Author manuscript

J Pediatr. Author manuscript; available in PMC 2020 March 16.

Published in final edited form as:

J Pediatr. 2018 August ; 199: 200–205.e6. doi:10.1016/j.jpeds.2018.03.069.

Differences in prehospital patient assessments for pediatric versus adult patients

Sriram Ramgopal, MD[1], **Jonathan Elmer, MD MS**[2,3], **Jeremiah Escajeda, MD**[2], **Christian Martin-Gill, MD MPH**[2]

[1]Division of Pediatric Emergency Medicine, Department of Pediatrics, University of Pittsburgh School of Medicine; Children's Hospital of Pittsburgh, Pittsburgh, Pennsylvania, United States of America

[2]Department of Emergency Medicine, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania, United States of America

[3]Department of Critical Care Medicine, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania, United States of America

Abstract

Objective: To evaluate if completion of vital signs assessments in pediatric transports by emergency medical services (EMS) differs by age.

Methods: We reviewed records by 20 agencies in a regional EMS system in Southwestern Pennsylvania between April 1, 2013 and December 31, 2016. We abstracted demographics, vital signs (systolic blood pressure, heart rate, respiratory rate), clinical and transport characteristics. We categorized age as neonates (≤30 days), infants (1 month to <1 year), toddler (1 to <2 years), early childhood (2 to <6 years), middle childhood (6 to <12 years), adolescent (12 to <18 years), and adult (≥18 years). We used unadjusted and adjusted logistic regression to test if age group was associated with vital signs documentation, reporting of Glasgow Coma Scale and pain scale after trauma, and recording of oxygen saturation and breath sounds in respiratory complaints, using adults as the reference group.

Results: 371,746 cases (21,883 pediatric, 5.9%) were included. In adjusted analysis, most pediatric categories had reduced odds of complete vitals documentation (percent, OR, 95%CI): neonates (49.6%, 0.02, 0.02–0.03), infants (68.2%, 0.04, 0.03–0.04), toddlers (78.1%, 0.07, 0.06–0.07), early childhood (87.4%, 0.13, 0.12–0.15), and middle childhood (95.3%, 0.54, 0.46–0.63). Pain score documentation was lower in children after trauma (OR 0.80, 95%CI 0.76–0.85) and oxygen saturation documentation was lower in children with respiratory complaints (OR 0.20, 95%CI 0.18–0.25).

Correspondence: Sriram Ramgopal, MD, Division of Emergency Medicine, Children's Hospital of Pittsburgh, AOB 2400, 4401 Penn Avenue, Pittsburgh, PA 15224, Telephone: 412-692-7980, Fax: 412-692-7464, Sriram.ramgopal2@upmc.edu.

Conflicts of Interest: The authors have no conflicts of interest relevant to this article to disclose.

Conclusion: Pediatric patients were at increased risk of lacking vital signs documentation during prehospital care. This represents a critical area for education and quality improvement.

Introduction

Background.

Emergency Medical Services (EMS) systems are an integral component of medical care for acutely ill and injured patients. Children comprise up to 10% of all patients transported by EMS,[1, 2] representing a small but substantial proportion of patients cared for by EMS personnel compared to adults. Pediatric patients that reach the emergency department by EMS are an at-risk population who are more likely to have higher acuity illness than other pediatric patients.[3]

Importance.

Prehospital care of children requires specific knowledge, equipment and interpersonal skills that are distinct from those used to manage adults. Primary and continuing education related to children is commonly less than that required for adult patients, potentially leading to a lack of comfort in patient assessment and management of children. In a study by Fleischman et al., a majority of EMS personnel identified themselves as less than “comfortable” in providing pediatric care.[4] Brown et al. similarly identified suboptimal pediatric education and gaps in training of EMS personnel in pediatric care.[5] Without the right knowledge, EMS personnel may have difficulty in effectively triaging and treating children. In a sample of children with traumatic brain injury, Zebrack et al. identified 31% did not have blood pressure recorded in the prehospital or emergency department setting, while children with untreated hypotension had a three-fold increased incidence of disability compared to treated hypotensive children.[6]

The effectiveness of efforts in education, clinical patient care, and future research begins with a robust understanding of patient assessments currently being completed. Previous investigators have noted discrepancies in rates of vital sign assessments in children as compared to adults.[7, 8] Better identification of these assessments by age groups and after controlling for potential confounders can further inform aspects of education and practice guidelines that are needed for the management of pediatric patients.

Goals of this Investigation.

We aimed to evaluate the level of assessment currently being performed by EMS personnel for pediatric patients. We further aimed to compare patient assessments by age groups with those performed on adult patients in the out-of-hospital setting. We hypothesized that rates of prehospital vital signs and complaint-specific assessments differed in pediatric patients versus adults.

Methods

Study design and setting.

We performed a retrospective review of ground EMS transports from a scene to a hospital by 20 urban, suburban, and rural EMS agencies in Southwestern Pennsylvania between April 1, 2013 and December 31, 2016. These EMS agencies receive centralized medical oversight and have research data use agreements with the University of Pittsburgh Medical Center. This study was approved by the University of Pittsburgh Institutional Review Board with a waiver of informed consent.

Selection of participants.

Data were collected from a common electronic patient care record (emsCharts, Warrendale, PA), which has custom reporting software allowing the extraction of robust clinical patient data. We initially screened all patient reports from the participating EMS agencies over the study period. We excluded cases if there was documentation of cardiac arrest, no documentation of age, if the transport was between medical facilities, if the transport was a scene assist (an additional EMS crew called to the scene to provide additional assistance, but identified as not providing primary care of the patient), or if the patient was ultimately not transported. Cardiac arrest was defined as any of the following: 1) documented provider impression of cardiac arrest, death, traumatic arrest, or dead on arrival; 2) documented outcome listed as funeral home, pronounced, dead, or coroner transport; 3) documented rhythm of asystole, PEA, pulseless, agonal, or ventricular fibrillation; 4) documented procedure of defibrillation or CPR; or 5) documented use of epinephrine as dosed for cardiac arrest. Patients that were not transported from the scene were excluded, as patient assessments may differ substantially between patients that are or are not transported to the hospital, and patients or parents declining transport to the hospital after calling 911 may also decline complete assessments by EMS personnel.

Measurements.

From the study cohort, we abstracted patient demographics, transport characteristics, vital signs (systolic blood pressure, heart rate, and respiratory rate), Glasgow Coma Scale (GCS) score, pain scales, and lung sound assessment. Patient demographics included age, gender, race, ethnicity, weight, height, and medical complaint. Race was divided into categories of white, black, and other/unknown. Ethnicity was categorized as Hispanic, not Hispanic, or unknown. We considered patients to be pediatric if they were <18 years of age. Pediatric patients were further categorized as: neonates (≤30 days), infants (1 month to <1 year), toddlers (1 to <2 years), early childhood (2 to <6 years), middle childhood (6 to <12 years), and adolescent (12 to <18 years). Documented medical categories based on chief complaints were re-classified into 12 categories: general medical, trauma, respiratory, allergic, gastrointestinal, cardiovascular, neurologic, psychiatric, toxicological, dizziness/syncope, other, and unknown.

Transport characteristics included year and time of day of transport, response time (between dispatch and arrival to scene), time at scene (between arrival to scene and departure to

hospital), transport time (between departure from scene to arrival at hospital), provider certification (basic versus advanced life support), and use of cardiac monitor.

We defined complete vital signs assessment as documentation of patient heart rate, respiratory rate, and systolic blood pressure at least once. Because pulse oximetry and temperature are not routinely collected in prehospital patients for all medical categories, these were not included as components of complete vital signs. For secondary assessment of patients with medical category of respiratory and traumatic complaints, we collected data regarding pulse oximetry, assessment of lung sounds, pain scores and Glasgow coma scale.

Analysis.

We used descriptive statistics to summarize data, and presented mean with standard deviation for continuous variables and raw number with corresponding percentages for categorical data. Percentages were also obtained for the rates of collection of individual and complete vital signs in each age group. We performed unadjusted analysis using univariate regression, followed by adjusted analysis using multivariate logistic regression to test associations of clinical predictors with outcomes, while adjusting for potential confounders. Our primary predictor of interest was age category. Our primary outcome of interest was documentation of complete vital signs. Secondary outcomes included documentation of pain scores and GCS in trauma patients and documentation of lung sounds and oxygen saturation in patients with a respiratory complaint. We included variables in adjusted models if they had an unadjusted association with outcome significant at a threshold of $P < 0.10$. In adjusted models, we excluded height and weight as they were collinear with age. Because patients may cluster within primary EMS provider or ambulance service, it was our *a priori* analysis plan to perform hierarchical models using random effects for provider and service. However, even 2-level intercept-only models failed to converge. Instead, we repeated all analyses *post hoc* using robust Huber/White/sandwich estimators adjusting for clustering within these groups and noted no change in the results.

Results

Characteristics of study subjects.

We identified 661,800 EMS cases during the study period, of which 371,746 met study criteria and comprised the final cohort (Figure 1). The study cohort included 349,863 (94.1%) adult and 21,883 (5.9%) pediatric patients (Table 1).

Main results.

Rates of vital signs documentation increased with age, with measurements of blood pressure constituting the primary driver of incomplete vital signs documentation. Blood pressure was measured in 50.4% of neonates versus 98.9% of adults. Documentation of complete vital signs (pulse, blood pressure, and respiratory rate) was lowest at 49.6% in neonates and increased in older age groups. Adolescents had similar rates of vital signs documentation compared to adults (98.0% versus 97.7%) (Table 1).

Odds of complete vital signs assessment were decreased in most pediatric age groups as compared to adults, a finding that was confirmed in the adjusted analysis. The adjusted odds ratio of complete vital signs assessment was 0.02 in neonates (95% CI 0.02 – 0.03), 0.04 in infants (95% CI 0.03 – 0.04), 0.07 in toddlers (95% CI 0.06 – 0.07), 0.13 in early childhood (95% CI 0.12 – 0.15), and 0.54 in middle childhood (95% CI 0.46 – 0.63). The only exception was in adolescents, who had slightly higher odds of vital signs assessment in the adjusted model (OR 1.40, 95% CI 1.18 – 1.66) (Tables 2, Figure 2).

In patients with a medical category of trauma, there were no significant age-related factors accounting for differences in GCS ascertainment after adjusted analysis (Tables 3–4; online). Pediatric pain scores were assessed less frequently in pediatric traumas compared to adult traumas in adjusted analysis (OR 0.80, 95% CI 0.76 – 0.85). This was noted specifically in neonates (OR 0.11, 95% CI 0.01 – 0.80), infants (OR 0.33, 95% CI 0.24 – 0.46), toddlers (OR 0.26, 95% CI 0.19 – 0.35), and in early childhood (OR 0.57, 95% CI 0.49 – 0.65) (Tables 5–6; online). In patients with a respiratory complaint, pulse oximetry was less frequently checked in pediatric patients following adjusted analysis (OR 0.20, 95% CI 0.18–0.25). This was noted in neonates (0.03, 95% CI 0.02 – 0.05), infants (OR 0.06, 95% CI 0.05 – 0.08), toddlers (OR 0.16, 95% CI 0.11 – 0.23), and in early childhood (OR 0.45, 95% CI 0.29 – 0.69) when compared to adults (Tables 7–8; online). No significant differences were noted in rates of lung sound assessments between pediatric and adult patients following adjusted analysis (Tables 9–10; online).

We performed a sensitivity analysis for our primary outcome (vital signs assessment) adjusting for standard errors for clustering within service or providers. Overall results were similar in respect to age to those presented in the primary analysis (Tables 11–14; online).

Discussion

The purpose of this study was to compare the quality of prehospital assessments in pediatric versus adult patients. Using multivariate logistic regression evaluating a regional EMS database, we found that rates of vital signs assessments in most pediatric age groups were significantly lower compared to adult patients. This study emphasizes the need to improve pediatric assessments in the prehospital setting and can inform future education and research efforts aimed to improve the assessment and management of pediatric patients in the out-of-hospital setting.

Our findings confirm and further characterize the results of other studies that have shown a comparatively low rate of pediatric prehospital vital signs acquisition. A lack of vital signs documentation has been reported in regional studies[7, 8] and in specific evaluations of trauma patients.[6, 9] A study evaluating records from the National EMS Information System (NEMSIS) found that though 61.5% of pediatric EMS transports had at least one abnormal vital sign, complete documentation of vitals was highly variable.[10] Our data add to prior literature by providing a level of granularity not available in similarly large administrative datasets. Additionally, this study was able to provide rates of assessments by age group and to control for potential confounders.

Subgroup analyses provided additional insight into prehospital pediatric assessments. We found lower rates of pain score assessments in pediatric patients with traumatic complaints. Pain is the most common complaint requiring pediatric EMS transport,[11] and guidelines have been established for prehospital analgesia in trauma requiring the use of age-appropriate pain scales.[12] Our finding of lower rates of pulse oximetry measurements in pediatric patients with respiratory complaints is consistent with findings from children included in the NEMSIS dataset[11] In the present study, we were able to segregate our analysis to only those patients with a respiratory complaint, where all should ideally have pulse oximetry documented.

Other study findings also correlate with findings from national datasets, further supporting their generalizability. Our finding that pediatric cases constituted 6% of EMS transports is generally consistent with the reported EMS literature,[2, 4, 7, 10, 13, 14] including an analysis from the 2013 NEMSIS Public Release Research Data Set.[11] The most common reasons for pediatric transports included traumatic and respiratory conditions, a finding that correlates well with other pediatric prehospital studies[1, 11, 13] and further emphasizes the importance of obtaining a thorough assessment for these common pediatric complaints.

A variety of factors may underlie the discrepancies in assessment of pediatric vital signs. Normal values for vital signs are age-dependent and more difficult to interpret for children. Though mandates require EMS providers to carry dedicated pediatric equipment, providers may be unfamiliar with their use. A large proportion of prehospital personnel see three or fewer pediatric patients in a given month.[15] A survey of EMS personnel noted that only 19% had conducted pediatric simulation training using a highly realistic simulator in the two years preceding the study.[4]

Educational initiatives are likely required to improve pediatric prehospital assessments as providers will be unable to obtain sufficient training by experience alone. Suggestions to improve pediatric prehospital care have included increasing the frequency of pediatric training, increasing hands-on and shadowing time with pediatric patients, adding mixed methods of instruction, and providing specific teaching on pediatric dosing and procedures.[5] A retrospective statewide study from Utah found that educational initiatives consisting of a short lecture series and a hands-on session targeted toward vital signs improved the rates of assessments by EMS providers over time.[8]

This was a retrospective study that relied on previously collected data. Additionally, data were collected in a single region from Western Pennsylvania. This study was unable to associate the vital signs assessments to outcomes of patients on arrival to the Emergency Department or to identify which system factors may have impacted pediatric vital signs assessments. Despite this, we suspect that age-related differences in assessments likely occur across urban, suburban, and rural regions nationally.

Conclusion

Care of pediatric patients relies on accurate and timely assessments in the prehospital setting. Rates of thorough vital signs assessment in many of these groups are significantly

less than those of adults, a finding which persists after controlling for a variety of other factors and within important subgroups. Educational initiatives, including increasing hands-on time with pediatric patients and simulation sessions, may serve a role in improving comfort and familiarity of pediatric assessments.

Funding Source:

Dr. Elmer's research time is supported by the NIH through grant 1K23NS097629.

References:

[1]. Tsai A, Kallsen G. Epidemiology of pediatric prehospital care. Ann Emerg Med. 1987;16:284–92. [PubMed: 3813162]

[2]. Seidel JS, Hornbein M, Yoshiyama K, Kuznets D, Finklestein JZ, St Geme JW Jr.. Emergency medical services and the pediatric patient: are the needs being met? Pediatrics. 1984;73:769–72. [PubMed: 6728578]

[3]. Shah MN, Cushman JT, Davis CO, Bazarian JJ, Auinger P, Friedman B. The epidemiology of emergency medical services use by children: an analysis of the National Hospital Ambulatory Medical Care Survey. Prehosp Emerg Care. 2008;12:269–76. [PubMed: 18584491]

[4]. Fleischman RJ, Yarris LM, Curry MT, Yuen SC, Breon AR, Meckler GD. Pediatric educational needs assessment for urban and rural emergency medical technicians. Pediatr Emerg Care. 2011;27:1130–5. [PubMed: 22134229]

[5]. Brown SA, Hayden TC, Randell KA, Rappaport L, Stevenson MD, Kim IK. Improving Pediatric Education for Emergency Medical Services Providers: A Qualitative Study. Prehosp Disaster Med. 2017;32:20–6. [PubMed: 28003036]

[6]. Zebrack M, Dandoy C, Hansen K, Scaife E, Mann NC, Bratton SL. Early resuscitation of children with moderate-to-severe traumatic brain injury. Pediatrics. 2009;124:56–64. [PubMed: 19564283]

[7]. Joyce SM, Brown DE, Nelson EA. Epidemiology of pediatric EMS practice: a multistate analysis. Prehosp Disaster Med. 1996;11:180–7. [PubMed: 10163380]

[8]. Hewes H, Hunsaker S, Christensen M, Whitney J, Dalrymple T, Taillac P. Documentation of pediatric vital signs by EMS providers over time. J Pediatr Surg. 2016;51:329–32. [PubMed: 26563528]

[9]. Lerner EB, Drendel AL, Cushman JT, Badawy M, Shah MN, Guse CE, et al. Ability of the Physiologic Criteria of the Field Triage Guidelines to Identify Children Who Need the Resources of a Trauma Center. Prehosp Emerg Care. 2017;21:180–4. [PubMed: 27710155]

[10]. Drayna PC, Browne LR, Guse CE, Brousseau DC, Lerner EB. Prehospital Pediatric Care: 2015;19:441–7.

[11]. Diggs LA, Sheth-Chandra M, De Leo G. Epidemiology of Pediatric Prehospital Basic Life Support Care in the United States. Prehosp Emerg Care. 2016;20:230–8. [PubMed: 26555372]

[12]. Gausche-Hill M, Brown KM, Oliver ZJ, Sasson C, Dayan PS, Eschmann NM, et al. An Evidencebased Guideline for prehospital analgesia in trauma. Prehosp Emerg Care. 2014;18 Suppl 1:25–34. [PubMed: 24279813]

[13]. Murdock TC, Knapp JF, Dowd MD, Campbell JP. Bridging the emergency medical services for children information gap. Arch Pediatr Adolesc Med. 1999;153:281–5. [PubMed: 10086406]

[14]. Foltin GL, Pon S, Tunik M, Fierman A, Dreyer B, Cooper A, et al. Pediatric ambulance utilization in a large American city: a systems analysis approach. Pediatr Emerg Care. 1998;14:254–8. [PubMed: 9733245]

[15]. Glaeser PW, Linzer J, Tunik MG, Henderson DP, Ball J. Survey of nationally registered emergency medical services providers: pediatric education. Ann Emerg Med. 2000;36:33–8. [PubMed: 10874233]

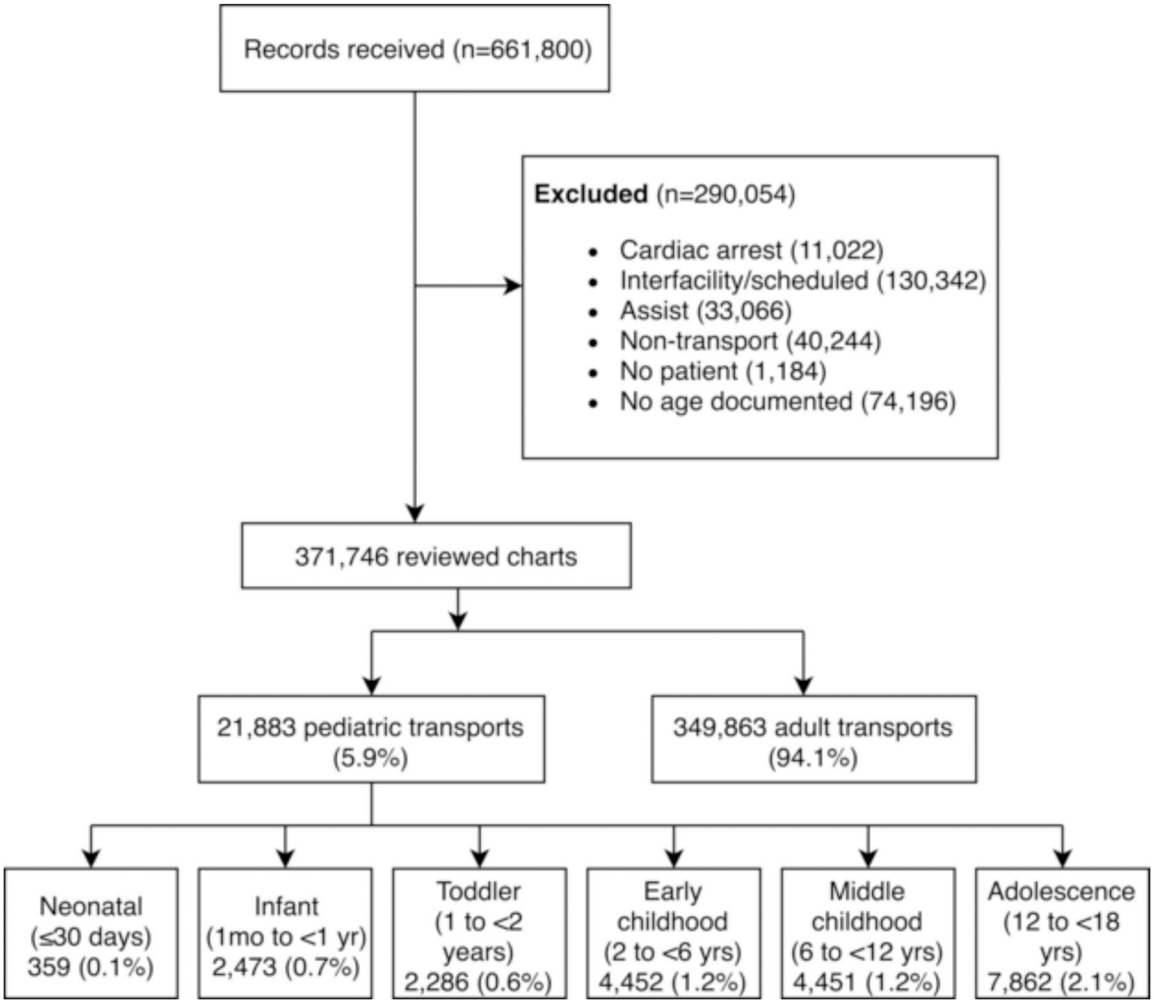

Figure 1.
STROBE diagram illustrating patient inclusion.

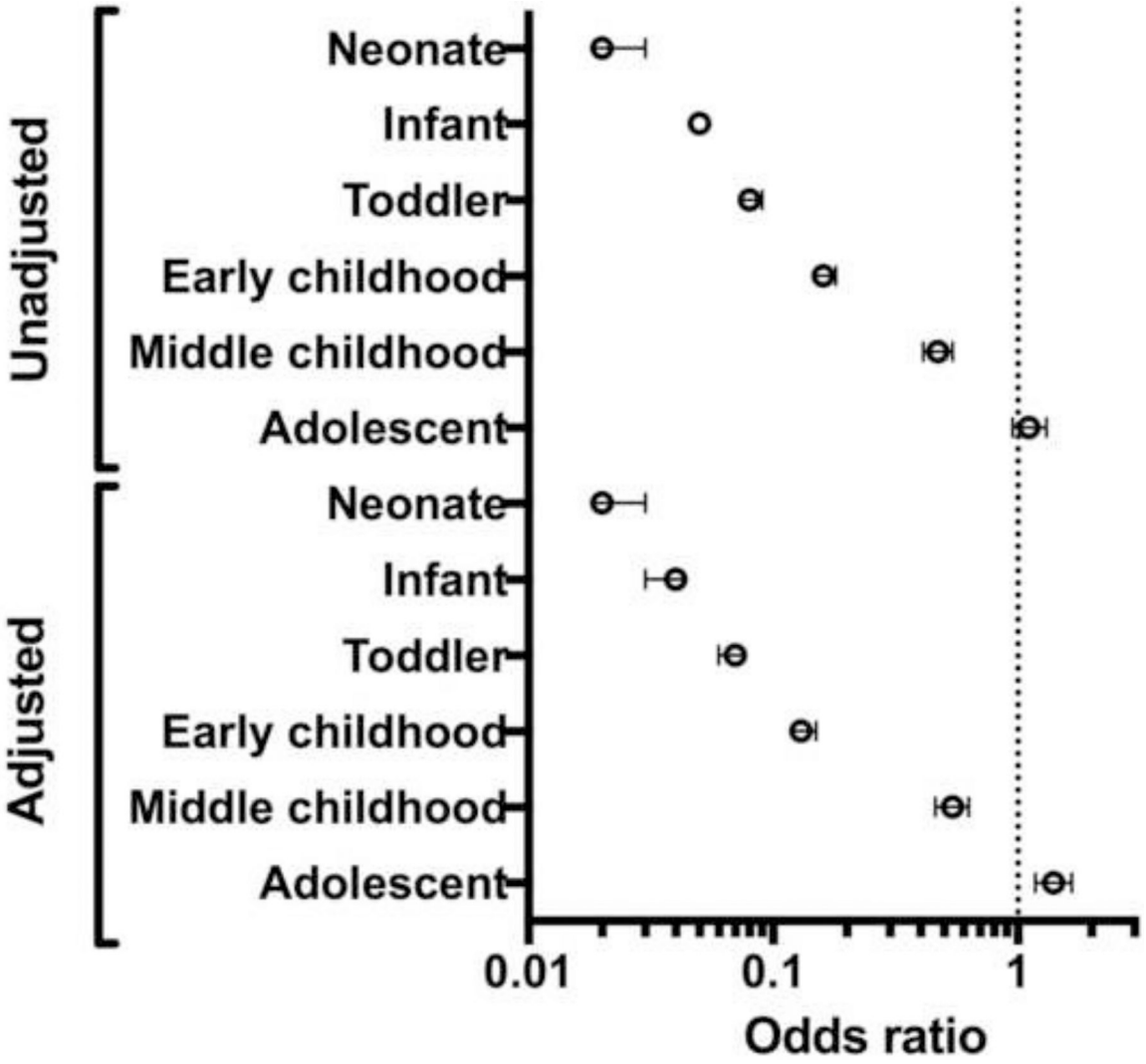

Figure 2.
Odds ratios with 95% confidence intervals of complete vital signs assessments by age group in unadjusted and adjusted models.

J Pediatr. Author manuscript; available in PMC 2020 March 16.

Table 1.

Case characteristics, rates of vital signs and subgroup assessments by age group.

	Pediatric						Adult
	Neonate	**Infant**	**Toddler**	**Early childhood**	**Middle childhood**	**Adolescent**	
Demographics							
Number	359 (0.1%)	2,473 (0.7%)	2,286 (0.6%)	4,452 (1.2%)	4,451 (1.2%)	7,862 (2.1%)	349,863 (94.1%)
No. male/total (%)	167/338 (49.4%)	1,386/2,457 (56.4%)	1,332/2,272 (58.6%)	2,529/4,435 (57.0%)	2,494/4,430 (56.3%)	3,631/7,814 (46.5%)	152,375/348,417 (43.7%)
EMS characteristics							
Mean response time (min) [mean (SD)]	8.8 (6.0)	9.2 (5.1)	9.2 (5.0)	9.2 (5.3)	9.0 (5.3)	8.8 (5.3)	9.2 (5.8)
Time at scene (min) [mean (SD)]	13.5 (10.1)	11.3 (7.0)	10.9 (6.5)	10.9 (6.8)	12.4 (7.9)	12.8 (8.1)	15.5 (9.0)
Transport time (min) [mean (SD)]	17.6 (10.3)	18.6 (11.3)	18.5 (11.2)	18.0 (11.2)	18.4 (12.1)	16.6 (11.0)	13.9 (9.1)
Lights and siren use [number/total (%)]	117/358 (32.7%)	547/2,468 (22.2%)	529/2,282 (23.2%)	1,033/4,446 (23.2%)	902/4,437 (20.3%)	1,537/7,846 (19.6%)	69,578/349,077 (19.9%)
ALS Transport [number/total (%)]	354/358 (98.9%)	2,438/2,471 (98.7%)	2,242/2,284 (98.2%)	4,349/4,446 (98.3%)	4,344/4,447 (97.4%)	337,469/349,122 (96.7%)	358,860/370,973 (96.7%)
Medical category							
General medical	123 (34.4%)	1,279 (51.7%)	884 (38.7%)	1,524 (34.3%)	1,034 (23.3%)	1,542 (19.6%)	108,796 (31.3%)
Trauma	23 (6.2%)	282 (11.4%)	373 (16.3%)	1,143 (25.7%)	1,499 (33.8%)	2,390 (30.4%)	58,759 (16.9%)
Respiratory/airway	104 (29.1%)	524 (21.2%)	354 (15.5%)	655 (14.7%)	492 (11.1%)	530 (6.8%)	34,472 (9.9%)
Allergic	0 (0.0%)	42 (1.7%)	56 (2.5%)	108 (2.4%)	111 (2.5%)	142 (1.8%)	1,855 (0.5%)
Gastrointestinal	13 (3.6%)	63 (2.6%)	50 (2.2%)	193 (4.3%)	232 (5.2%)	515 (6.6%)	29,599 (8.5%)
Cardiovascular	1 (0.3%)	5 (0.2%)	5 (0.2%)	12 (0.3%)	60 (1.4%)	164 (2.1%)	24,387 (7.0%)
Neurological	7 (2.0%)	106 (4.3%)	343 (15.0%)	461 (10.4%)	492 (11.1%)	595 (7.6%)	26,587 (7.6%)
Psychiatric/behavioral	0 (0.0%)	0 (0.0%)	1 (0.0%)	5 (0.1%)	240 (5.4%)	717 (9.1%)	9,465 (2.7%)
Toxicological	1 (0.3%)	15 (0.6%)	58 (2.6%)	86 (1.9%)	28 (0.6%)	406 (5.2%)	15,564 (4.5%)
Dizziness/syncope	3 (0.8%)	26 (1.1%)	30 (1.3%)	44 (1.0%)	112 (2.5%)	427 (5.4%)	17,537 (5.0%)
Other	78 (21.8%)	115 (4.7%)	121 (5.3%)	188 (4.2%)	122 (2.8%)	397 (5.1%)	18,403 (5.3%)
Unknown	5 (1.4%)	15 (0.6%)	11 (0.5%)	31 (0.7%)	19 (0.4%)	26 (0.3%)	2,347 (0.7%)
Vital sign assessments							

	Pediatric						Adult
	Neonate	Infant	Toddler	Early childhood	Middle childhood	Adolescent	
Heart rate	310 (86.4%)	2,368 (95.8%)	2,198 (96.2%)	4,331 (97.3%)	4,364 (98.1%)	7,802 (99.2%)	347,042 (99.1%)
Systolic blood pressure	181 (50.4%)	1,705 (68.9%)	1,805 (79.0%)	3,949 (88.7%)	4,299 (96.6%)	7,782 (99.0%)	345,996 (98.9%)
Respiratory rate	302 (84.1%)	2,324 (94.0%)	2,167 (94.8%)	4,269 (95.9%)	4,313 (96.9%)	7,734 (98.4%)	343,485 (98.2%)
All three vital signs	178 (49.6%)	1,687 (68.2%)	1,786 (78.1%)	3,892 (87.4%)	4,241 (95.3%)	7,701 (98.0%)	341,893 (97.7%)
Respiratory patients							
Pulse oximetry	65 (62.5%)	413 (78.8%)	321 (90.7%)	631 (96.3%)	489 (99.4%)	525 (99.1%)	33,833 (98.2%)
Lung sound assessment	95 (91.4%)	494 (94.3%)	326 (92.1%)	620 (94.7%)	471 (95.7%)	504 (95.1%)	33,176 (96.2%)
Trauma patients							
Pain score	1 (4.4%)	44 (15.6%)	48 (12.9%)	281 (24.6%)	555 (37.0%)	1,070 (44.8%)	23,628 (40.2%)
GCS assessment	20 (87.0%)	281 (99.7%)	368 (98.7%)	1,131 (99.0%)	1,487 (99.2%)	2,378 (99.5%)	58,293 (99.2%)
Cardiac							
Monitor placement	0 (0.0%)	5 (100.0%)	4 (80.0%)	10 (83.3%)	36 (60.0%)	139 (84.8%)	23,002 (94.3%)

SD, standard deviation; ALS, Advanced life support; min, minutes; GCS, Glasgow coma scale

J Pediatr. Author manuscript; available in PMC 2020 March 16.

Table 2.

Unadjusted and adjusted logistic regression of complete vital signs assessments.

	Univariate analysis		*Multivariate analysis*	
	OR (95% CI)	***P***	**OR (95% CI)**	***P***
Age Group				
Adult	Ref	--	Ref	--
Neonate	0.02 (0.02 – 0.03)	<0.001	0.02 (0.02 – 0.03)	<0.001
Infant	0.05 (0.05 – 0.05)	<0.001	0.04 (0.03 – 0.04)	<0.001
Toddler	0.08 (0.08 – 0.09)	<0.001	0.07 (0.06 – 0.07)	<0.001
Early childhood	0.16 (0.15 – 0.18)	<0.001	0.13 (0.12 – 0.15)	<0.001
Middle childhood	0.47 (0.41 – 0.54)	<0.001	0.54 (0.46 – 0.63)	<0.001
Adolescent	1.11 (0.95 – 1.31)	<0.176	1.40 (1.18 – 1.66)	<0.001
Demographics				
Male sex	0.87 (0.84 – 0.91)	<0.001	0.93 (0.89 – 0.97)	0.001
Height (inches)	1.08 (1.07 – 1.08)	<0.001		
Weight (kg)	1.01 (1.01 – 1.01)	<0.001		
Race/ethnicity				
White/Non-Hispanic	Ref	--	Ref	--
White/Hispanic	1.00 (0.76 – 1.33)	0.984	1.12 (0.81 – 1.54)	0.488
Black/Non-Hispanic	1.16 (1.10 – 1.23)	<0.001	1.45 (1.37 – 1.55)	<0.001
Black/Hispanic	1.16 (0.73 – 1.86)	0.526	1.46 (0.86 – 2.46)	0.160
Other/Unknown	1.45 (1.39 – 1.52)	<0.001	1.71 (1.61 – 1.80)	<0.001
Medical category				
Medical	Ref	--	Ref	--
Trauma	0.79 (0.75 – 0.84)	<0.001	0.75 (0.70 – 0.80)	<0.001
Respiratory	1.04 (0.96 – 1.13)	0.301	0.78 (0.71 – 0.85)	<0.001
Allergy	1.13 (0.85 – 1.51)	0.409	1.26 (0.92 – 1.73)	0.156
GI/Abdominal	1.27 (1.16 – 1.39)	<0.001	0.88 (0.80 – 0.97)	0.010
Cardiac	2.45 (2.15 – 2.80)	<0.001	0.72 (0.62 – 0.83)	<0.001
Neurology	1.23 (1.12 – 1.35)	<0.001	0.86 (0.78 – 0.96)	0.004
Psychiatry	0.19 (0.18 – 0.20)	<0.001	0.18 (0.17 – 0.20)	<0.001
Toxicology	2.97 (2.49 – 3.55)	<0.001	2.14 (1.77 – 2.59)	<0.001
Dizziness/Syncope	1.98 (1.72 – 2.28)	<0.001	0.87 (0.75 – 1.01)	0.071
Other	0.23 (0.21 – 0.24)	<0.001	0.31 (0.29 – 0.33)	<0.001
Unknown	0.26 (0.22 – 0.30)	<0.001	0.43 (0.34 – 0.53)	<0.001
Day period				
00:00–05:59	Ref	--	Ref	--
06:00–11:59	1.03 (0.97 – 1.10)	0.323	1.07 (1.00 – 1.16)	0.057
12:00–17:59	0.93 (0.88 – 1.00)	0.035	1.01 (0.94 – 1.08)	0.789
18:00–23:59	0.99 (0.92 – 1.06)	0.713	1.08 (1.00 – 1.16)	0.037

	Univariate analysis		*Multivariate analysis*	
	OR (95% CI)	***P***	**OR (95% CI)**	***P***
Year				
2013	Ref	--	Ref	--
2014	0.84 (0.79 – 0.90)	<0.001	0.77 (0.72 – 0.83)	<0.001
2015	0.78 (0.73 – 0.84)	<0.001	0.70 (0.65 – 0.75)	<0.001
2016	0.81 (0.76 – 0.87)	<0.001	0.71 (0.66 – 0.76)	<0.001
Response characteristics				
Advanced Life Support	5.74 (5.42 – 6.08)	<0.001	3.12 (2.91 – 3.35)	<0.001
Lights and siren use	1.59 (1.50 – 1.68)	<0.001	1.19 (1.11 – 1.27)	<0.001
Mileage	1.00 (1.00 – 1.00)	0.910		
Response time	0.98 (0.98 – 0.98)	<0.001	1.00 (0.99 – 1.00)	0.034
Scene time	1.01 (1.01 – 1.01)	<0.001	0.99 (0.99 – 0.99)	<0.001
Transport time	0.99 (0.99–0.99)	<0.001	1.00 (1.00 – 1.01)	<0.001
Intravenous access	6.02 (5.65 – 6.42)	<0.001	2.83 (2.60 – 3.08)	<0.001
Monitor used	4.04 (3.83 – 4.26)	<0.001	1.82 (1.69 – 1.95)	<0.001
Glasgow Coma Score obtained	1.08 (1.07 – 1.09)	<0.001	1.14 (1.12 – 1.15)	<0.001

OR, odds ratio; CI, confidence interval

Table 3.

Trauma patients: assessment of GCS, unadjusted (univariate) analysis.

Variable	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.05 (0.02 – 0.18)	<0.001
Infant	2.25 (0.31 – 16.04)	0.420
Toddler	0.59 (0.24 – 1.43)	0.241
Early childhood	0.75 (0.42 – 1.34)	0.335
Middle childhood	0.99 (0.56 – 1.76)	0.974
Adolescent	1.58 (0.89 – 2.81)	0.117
Demographics		
Male sex	0.98 (0.82 – 1.17)	0.856
Height (inches)	1.02 (0.96 – 1.09)	0.547
Weight (kg)	1.00 (1.00 – 1.01)	0.208
Race/Ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	0.43 (0.18 – 1.06)	0.066
Black/Non-Hispanic	1.19 (0.88 – 1.60)	0.261
Black/Hispanic	1*	--
Other/Unknown	0.76 (0.63 – 0.92)	<0.001
Day period		
00:00–05:59	Ref	
00:00–05:59	0.62 (0.45 – 0.87)	<0.01
06:00–11:59	0.63 (0.46 – 0.86)	<0.01
12:00–17:59	0.76 (0.55 – 1.06)	0.10
Year		
2013	Ref	
2014	1.03 (0.78 – 1.36)	0.834
2015	0.99 (0.75 – 1.31)	0.954
2016	1.10 (0.83 – 1.46)	0.489
Response Characteristics		
Advanced Life support	2.82 (2.07 – 3.84)	<0.001
Lights and siren use	1.24 (0.97 – 1.58)	0.088
Mileage	1.00 (0.99 – 1.01)	0.624
Response time	0.99 (0.97 – 1.00)	0.058
Scene time	1.02 (1.00 – 1.03)	0.005
Transport time	1.00 (0.99 – 1.01)	0.762
Intravenous Access	3.16 (2.41 – 4.13)	<0.001

Variable	OR (95% CI)	*p*
Monitor placed	4.19 (3.05 – 5.75)	<0.001

OR, odds ratio; CI, confidence interval.

*Outcome in Black/Hispanic patients was collinear with outcome in this subanalysis.

Table 4.

Trauma patients: assessment of GCS, adjusted (multivariate) analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.21 (0.03 – 1.64)	0.137
Infant	2.77 (0.39 – 19.80)	0.311
Toddler	0.75 (0.31 – 1.84)	0.528
Early childhood	1.02 (0.56 – 1.88)	0.938
Middle childhood	1.16 (0.65 – 2.07)	0.622
Adolescent	1.72 (0.95 – 3.16)	0.075
Demographics		
Male sex	0.90 (0.75 – 1.08)	0.245
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	0.39 (0.16 – 0.95)	0.038
Black/Non-Hispanic	1.17 (0.86 – 1.60)	0.313
Black/Hispanic	1 *	--
Other/Unknown	0.78 (0.64 – 0.95)	0.012
Day period		
00:00–05:59	Ref	
00:00–05:59	0.62 (0.45 – 0.87)	0.006
06:00–11:59	0.62 (0.45 – 0.86)	0.004
12:00–17:59	0.74 (0.53 – 1.04)	0.079
Year		
2013	Ref	
2014	1.016 (0.767 – 1.346)	0.911
2015	1.065 (0.804 – 1.411)	0.659
2016	1.215 (0.915 – 1.615)	0.178
Response Characteristics		
Advanced Life Support	2.30 (1.67 – 3.17)	<0.001
Lights and siren use	0.98 (0.76 – 1.26)	0.879
Response time	0.99 (0.98 – 1.00)	0.277
Scene time	1.00 (0.99 – 1.01)	0.211
Transport time	0.99 (0.98 – 1.00)	<0.001
Intravenous Access	1.76 (1.27 – 2.45)	0.001
Monitor placed	2.83 (1.95 – 4.11)	<0.001

OR, odds ratio; CI, confidence interval.

* Outcome in Black/Hispanic patients was collinear with outcome in this subanalysis.

Table 5.

Trauma patients: assessment of pain scores; unadjusted (univariate) analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.07 (0.01 – 0.50)	0.008
Infant	0.25 (0.20 – 0.38)	<0.001
Toddler	0.22 (0.16 – 0.30)	<0.001
Early childhood	0.49 (0.42 – 0.56)	<0.001
Middle childhood	0.87 (0.79 – 0.97)	0.013
Adolescent	1.21 (1.11 – 1.31)	<0.001
Demographics		
Male sex	0.99 (0.96 – 1.03)	0.738
Height (inches)	1.01 (1.00 – 1.03)	0.023
Weight (kg)	1.00 (1.00 – 1.00)	<0.001
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	1.11 (0.88 – 1.38)	0.388
Black/Non-Hispanic	0.83 (0.79 – 0.87)	<0.001
Black/Hispanic	0.97 (0.66 – 1.44)	0.896
Other/Unknown	0.60 (0.58 – 0.62)	<0.001
Day Period		
00:00–05:59	Ref	
06:00–11:59	1.20 (1.14 – 1.26)	<0.001
12:00–17:59	1.19 (1.13 – 1.26)	<0.001
18:00–23:59	1.10 (1.05 – 1.16)	<0.001
Year		
2013	Ref	
2014	1.03 (0.98 – 1.09)	0.193
2015	0.97 (0.92 – 1.02)	0.237
2016	0.93 (0.88 – 0.99)	0.005
Response Characteristics		
Advanced Life Support	1.42 (1.30 – 1.56)	<0.001
Lights and sirens	0.96 (0.92 – 1.00)	0.060
Mileage	1.00 (1.00 – 1.000)	0.444
Response time	1.01 (1.01 – 1.01)	<0.001
Scene time	1.02 (1.01 – 1.02)	<0.001
Transport time	1.01 (1.01 – 1.01)	<0.001
Intravenous Access	1.63 (1.57 – 1.69)	<0.001
Monitor placed	1.74 (1.68 – 1.80)	<0.001

Glasgow Coma Score assessment	1.23 (1.20 – 1.26)	<0.001

OR, odds ratio; CI, confidence interval

Table 6.

Trauma patients: assessment of pain scores; adjusted (multivariate) analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.11 (0.01 – 0.80)	0.030
Infant	0.33 (0.24 – 0.46)	<0.001
Toddler	0.26 (0.19 – 0.35)	<0.001
Early childhood	0.57 (0.49 – 0.65)	<0.001
Middle childhood	0.99 (0.88 – 1.10)	0.823
Adolescent	1.23 (1.17 – 1.39)	<0.001
Demographics		
Male sex	1.01 (0.98 – 1.05)	0.485
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	1.09 (0.86 – 1.38)	0.465
Black/Non-Hispanic	0.89 (0.84 – 0.93)	<0.001
Black/Hispanic	1.10 (0.74 – 1.64)	0.639
Other/Unknown	0.64 (0.61 – 0.66)	<0.001
Day Period		
00:00–05:59	Ref	
06:00–11:59	1.15 (1.09 – 1.22)	<0.001
12:00–17:59	1.16 (1.10 – 1.22)	<0.001
18:00–23:59	1.09 (1.03 – 1.15)	0.002
Year		
2013	Ref	
2014	1.01 (0.96 – 1.07)	0.707
2015	0.97 (0.92 – 1.02)	0.203
2016	0.95 (0.90 – 1.00)	0.050
Response Characteristics		
Advanced Life Support	1.33 (1.21 – 1.47)	<0.001
Lights and sirens	1.01 (0.97 – 1.06)	0.653
Response time	1.01 (1.01 – 1.01)	<0.001
Scene time	1.01 (1.01 – 1.01)	<0.001
Transport time	1.00 (1.00 – 1.01)	0.001
Intravenous Access	1.27 (1.21 – 1.33)	<0.001
Monitor placed	1.39 (1.33 – 1.46)	<0.001
Glasgow Coma Score assessment	1.30 (1.27 – 1.33)	<0.001

OR, odds ratio; CI, confidence interval

Table 7.

Respiratory patients: assessment of pulse oximetry; unadjusted (univariate) analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.03 (0.21 – 0.05)	<0.001
Infant	0.07 (0.06 – 0.09)	<0.001
Toddler	0.18 (0.13 – 0.27)	<0.001
Early childhood	0.50 (0.33 – 0.75)	0.001
Middle childhood	3.08 (0.99 – 9.60)	0.053
Adolescent	1.98 (0.82 – 4.80)	0.129
Demographics		
Male sex	0.96 (0.83 – 1.10)	0.529
Height (inches)	1.06 (1.04 – 1.08)	<0.001
Weight (kg)	1.00 (1.00 – 1.01)	<0.001
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	0.71 (0.29 – 1.73)	0.453
Black/Non-Hispanic	1.54 (1.26 – 1.88)	<0.001
Black/Hispanic	0.79 (0.19 – 3.23)	0.741
Other/Unknown	1.17 (1.00 – 1.37)	0.055
Day Period		
00:00–05:59	Ref	
06:00–11:59	1.03 (0.83 – 1.23)	0.795
12:00–17:59	0.84 (0.68 – 1.04)	0.109
18:00–23:59	0.92 (0.74 – 1.15)	0.467
Year		
2013	Ref	
2014	1.10 (0.90 – 1.35)	0.361
2015	1.39 (1.13 – 1.72)	0.002
2016	1.53 (1.23 – 1.89)	<0.001
Response Characteristics		
Advanced Life Support	6.80 (5.04 – 9.18)	<0.001
Lights and sirens use	1.16 (1.00 – 1.35)	0.057
Mileage	1.00 (1.00 – 1.00)	0.403
Response time	1.01 (1.01 – 1.01)	<0.001
Scene time	1.02 (1.01 – 1.02)	<0.001
Transport time	1.02 (1.00 – 1.03)	0.048
Intravenous Access	1.02 (1.01 – 1.03)	<0.001
Monitor placed	1.00 (1.00 – 1.01)	0.290

	OR (95% CI)	*p*
Glasgow Coma Score assessment	1.08 (1.04 – 1.11)	<0.001

OR, odds ratio; CI, confidence interval

Table 8.

Respiratory patients: assessment of pulse oximetry; adjusted (multivariate) analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.03 (0.02 – 0.05)	<0.001
Infant	0.06 (0.05 – 0.08)	<0.001
Toddler	0.16 (0.11 – 0.23)	<0.001
Early childhood	0.45 (0.29 – 0.69)	<0.001
Middle childhood	2.56 (0.81 – 8.04)	0.108
Adolescent	1.78 (0.73 – 4.32)	0.207
Demographics		
Male sex	1.08 (0.93 – 1.25)	0.291
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	0.88 (0.34 – 2.27)	0.799
Black/Non-Hispanic	2.25 (1.80 – 2.81)	<0.001
Black/Hispanic	2.39 (0.31 – 18.56)	0.404
Other/Unknown	1.71 (1.42 – 2.07)	<0.001
Day Period		
00:00–05:59	Ref	
06:00–11:59	0.94 (0.74 – 1.18)	0.569
12:00–17:59	0.81 (0.65 – 1.01)	0.066
18:00–23:59	0.97 (0.77 – 1.22)	0.810
Year		
2013	Ref	
2014	1.038 (0.84 – 1.29)	0.737
2015	1.379 (1.11 – 1.73)	0.004
2016	1.430 (1.14 – 1.80)	0.002
Response Characteristics		
Advanced Life Support	5.22 (3.74 – 7.27)	<0.001
Lights and sirens use	1.18 (1.00 – 1.40)	0.048
Response time	1.01 (0.99 – 1.02)	0.420
Scene time	1.00 (0.99 – 1.01)	0.901
Transport time	1.02 (1.01 – 1.03)	<0.001
Intravenous Access	1.20 (0.99 – 1.45)	0.066
Monitor placed	1.84 (1.53 – 2.20)	<0.001
Glasgow Coma Score assessment	1.09 (1.05 – 1.13)	<0.001

OR, odds ratio; CI, confidence interval

Table 9.

Respiratory patients: assessment of lung sounds; unadjusted (univariate) analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.41 (0.21 – 0.82)	0.011
Infant	0.64 (0.44 – 0.93)	0.020
Toddler	0.45 (0.31 – 0.67)	<0.001
Early childhood	0.69 (0.49 – 0.98)	0.036
Middle childhood	0.88 (0.56 – 1.36)	0.556
Adolescent	0.76 (0.50 – 1.13)	0.171
Demographics		
Male sex	0.96 (0.83 – 1.10)	0.529
Height (inches)	1.06 (1.04 – 1.08)	<0.001
Weight (kg)	1.00 (1.00 – 1.01)	<0.001
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	0.71 (0.29 – 1.73)	0.453
Black/Non-Hispanic	1.54 (1.26 – 1.88)	<0.001
Black/Hispanic	0.79 (0.19 – 3.23)	0.741
Other/Unknown	1.17 (1.00 – 1.37)	0.055
Day Period		
00:00–05:59	Ref	
06:00–11:59	1.07 (0.91 – 1.25)	0.414
12:00–17:59	1.24 (1.06 – 1.45)	0.008
18:00–23:59	1.10 (0.94 – 1.30)	0.249
Year		
2013	Ref	
2014	1.24 (1.06 – 1.46)	0.008
2015	1.45 (1.23 – 1.71)	<0.001
2016	1.25 (1.06 – 1.47)	0.007
Response Characteristics		
Advanced Life Support	1.39 (0.89 – 2.17)	0.142
Lights and sirens use	0.44 (0.39 – 0.48)	<0.001
Mileage	1.08 (1.06 – 1.09)	<0.001
Response time	0.98 (0.97 – 0.99)	<0.001
Scene time	1.02 (1.01 – 1.02)	<0.001
Transport time	1.00 (0.99 – 1.00)	0.161
Intravenous Access	2.53 (2.27 – 2.82)	<0.001
Monitor placed	3.82 (3.43 – 4.25)	<0.001

	OR (95% CI)	*p*
Glasgow Coma Score assessment	1.04 (1.01 – 1.07)	0.005

OR, odds ratio; CI, confidence interval

Table 10.

Respiratory patients: assessment of lung sounds; adjusted (multivariate) analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	1.09 (0.47 – 2.53)	0.837
Infant	1.31 (0.86 – 1.99)	0.203
Toddler	0.85 (0.56 – 1.29)	0.434
Early childhood	1.37 (0.95 – 1.99)	0.096
Middle childhood	1.43 (0.90 – 2.28)	0.126
Adolescent	1.15 (0.76 – 1.76)	0.508
Demographics		
Male sex	0.87 (0.78 – 0.98)	0.017
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	0.60 (0.24 – 1.48)	0.265
Black/Non-Hispanic	0.67 (0.38 – 0.50)	<0.001
Black/Hispanic	0.80 (0.19 – 3.31)	0.754
Other/Unknown	0.43 (0.38 – 0.50)	<0.001
Day Period		
00:00–05:59	Ref	
06:00–11:59	0.93 (0.79 – 1.10)	0.424
12:00–17:59	1.11 (0.94 – 1.32)	0.220
18:00–23:59	1.08 (0.90 – 1.29)	0.395
Year		
2013	Ref	
2014	1.27 (1.07 – 1.51)	0.007
2015	1.54 (1.29 – 1.84)	<0.001
2016	1.29 (1.09 – 1.53)	0.004
Response Characteristics		
Advanced Life Support	0.88 (0.54 – 1.44)	0.610
Lights and sirens use	0.57 (0.51 – 0.64)	<0.001
Response time	0.98 (0.97 – 1.00)	0.005
Scene time	0.99 (0.98 – 1.00)	0.005
Transport time	0.99 (0.99 – 1.00)	0.048
Intravenous Access	1.40 (1.22 – 1.61)	<0.001
Monitor placed	2.86 (2.49 – 3.28)	<0.001
Glasgow Coma Score assessment	1.05 (1.02 – 1.09)	0.002

OR, odds ratio; CI, confidence interval

Table 11.

Odds ratios of complete vital sign assessment following adjustment of standard error for clusters in primary caregiver (n=1,444); unadjusted (univariate) analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.02 (0.02 – 0.32)	<0.001
Infant	0.05 (0.04 – 0.06)	<0.001
Toddler	0.08 (0.06 – 0.11)	<0.001
Early childhood	0.16 (0.13 – 0.20)	<0.001
Middle childhood	0.47 (0.38 – 0.57)	<0.001
Adolescent	1.13 (0.94 – 1.37)	0.185
Demographics		
Male sex	0.87 (0.82 – 0.93)	<0.001
Height (inches)	1.08 (1.06 – 1.10)	<0.001
Weight (kg)	1.01 (1.01 – 1.02)	<0.001
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	0.99 (0.72 – 1.36)	0.937
Black/Non-Hispanic	1.16 (0.97 – 1.38)	0.094
Black/Hispanic	1.15 (0.62 – 2.11)	0.660
Other/Unknown	1.46 (1.12 – 1.90)	0.005
Medical category		
Medical	Ref	
Trauma	0.80 (0.69 – 0.92)	0.002
Respiratory	1.06 (0.84 – 1.33)	0.641
Allergy	1.14 (0.81 – 1.62)	0.458
GI/Abdominal	1.27 (1.07 – 1.50)	0.005
Cardiac	2.50 (1.68 – 3.72)	<0.001
Neurology	1.23 (1.01 – 1.51)	0.041
Psychiatry	0.19 (0.16 – 0.23)	<0.001
Toxicology	3.04 (2.26 – 4.07)	<0.001
Dizziness/Syncope	2.05 (1.49 – 2.82)	<0.001
Other	0.23 (0.17 – 0.31)	<0.001
Unknown	0.26 (0.20 – 0.36)	<0.001
Day Period		
00:00–05:59	Ref	
06:00–11:59	1.03 (0.89 – 1.19)	0.706
12:00–17:59	0.94 (0.81 – 1.09)	0.420
18:00–23:59	0.99 (0.89 – 1.10)	0.842

	OR (95% CI)	***p***
Year		
2013	Ref	
2014	0.84 (0.70 – 1.00)	0.056
2015	0.78 (0.61 – 1.00)	0.048
2016	0.83 (0.64 – 1.08)	0.173
Response Characteristics		
Advanced Life Support	5.71 (4.02 – 8.12)	<0.001
Lights and sirens use	1.60 (1.26 – 2.03)	<0.001
Mileage	1.00 (1.00 – 1.00)	0.506
Response time	0.98 (0.96 – 1.00)	0.038
Scene time	1.01 (1.00 – 1.03)	0.040
Transport time	0.99 (0.98 – 1.00)	0.009
Intravenous Access	5.95 (3.98 – 9.10)	<0.001
Monitor placed	3.99 (2.79 – 5.70)	<0.001
Glasgow Coma Score assessment	1.08 (1.05 – 1.10)	<0.001

OR, odds ratio; CI, confidence interval

Table 12:

Odds ratios of complete vital sign assessment following adjustment of standard error for clusters in primary caregiver (n=1,444); adjusted analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.02 (0.01 – 0.03)	<0.001
Infant	0.04 (0.03 – 0.05)	<0.001
Toddler	0.07 (0.05 – 0.09)	<0.001
Early childhood	0.13 (0.09 – 0.19)	<0.001
Middle childhood	0.54 (0.42 – 0.68)	<0.001
Adolescent	1.42 (1.15 – 1.75)	0.001
Demographics		
Male sex	0.93 (0.89 – 0.98)	0.006
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	1.11 (0.78 – 1.57)	0.578
Black/Non-Hispanic	1.45 (1.24 – 1.70)	<0.001
Black/Hispanic	1.44 (0.71 – 2.92)	0.315
Other/Unknown	1.72 (1.31 – 2.26)	<0.001
Medical category		
Medical	Ref	
Trauma	0.75 (0.65 – 0.87)	<0.001
Respiratory	0.79 (0.66 – 0.95)	0.013
Allergy	1.25 (0.88 – 1.78)	0.204
GI/Abdominal	0.88 (0.74 – 1.04)	0.128
Cardiac	0.74 (0.57 – 0.96)	0.023
Neurology	0.87 (0.73 – 1.03)	0.099
Psychiatry	0.18 (0.14 – 0.23)	<0.001
Toxicology	2.17 (1.54 – 3.05)	<0.001
Dizziness/Syncope	0.90 (0.72 – 1.13)	0.363
Other	0.31 (0.22 – 0.42)	<0.001
Unknown	0.42 (0.29 – 0.63)	<0.001
Day Period		
00:00–05:59	Ref	
06:00–11:59	1.06 (0.94 – 1.21)	0.308
12:00–17:59	1.01 (0.89 – 1.16)	0.795
18:00–23:59	1.09 (0.98 – 1.21)	0.132
Year		
2013	Ref	

	OR (95% CI)	***p***
2014	0.77 (0.64 – 0.94)	0.009
2015	0.70 (0.53 – 0.92)	0.009
2016	0.72 (0.54 – 0.96)	0.027
Response Characteristics		
Advanced Life Support	3.09 (2.23 – 4.28)	<0.001
Lights and sirens use	1.20 (0.95 – 1.52)	0.129
Response time	1.00 (0.98 – 1.01)	0.652
Scene time	0.99 (0.99 – 1.00)	0.034
Transport time	1.00 (0.99 – 1.01)	0.408
Intravenous Access	2.80 (1.95 – 4.03)	<0.001
Monitor placed	1.79 (1.31 – 2.44)	<0.001
Glasgow Coma Score assessment	1.13 (1.11 – 1.16)	<0.001

OR, odds ratio; CI, confidence interval

Table 13:

Odds ratios of complete vital sign assessment following adjustment of standard error for clusters in 20 EMS agencies evaluated in this study; unadjusted (univariate) analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.02 (0.01 – 0.06)	<0.001
Infant	0.05 (0.02 – 0.11)	<0.001
Toddler	0.08 (0.04 – 0.16)	<0.001
Early childhood	0.16 (0.09 – 0.28)	<0.001
Middle childhood	0.47 (0.34 – 0.64)	<0.001
Adolescent	1.11 (0.92 – 1.36)	0.276
Demographics		
Male sex	0.87 (0.80 – 0.95)	0.002
Height (inches)	1.08 (1.05 – 1.11)	<0.001
Weight (kg)	1.01 (1.00 – 1.02)	0.032
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	1.00 (0.66 – 1.52)	0.989
Black/Non-Hispanic	1.16 (0.57 – 2.38)	0.680
Black/Hispanic	1.16 (0.44 – 3.09)	0.760
Other/Unknown	1.45 (0.50 – 4.26)	0.497
Medical category		
Medical	Ref	
Trauma	0.79 (0.48 – 1.31)	0.368
Respiratory	1.04 (0.61 – 1.78)	0.880
Allergy	1.13 (0.76 – 1.68)	0.547
GI/Abdominal	1.27 (0.79 – 2.06)	0.325
Cardiac	2.45 (1.27 – 4.75)	0.008
Neurology	1.23 (0.64 – 2.34)	0.532
Psychiatry	0.19 (0.09 – 0.40)	<0.001
Toxicology	2.97 (1.58 – 5.61)	0.001
Dizziness/Syncope	1.98 (0.98 – 3.96)	0.054
Other	0.23 (0.09 – 0.58)	0.002
Unknown	0.26 (0.09 – 0.77)	0.015
Day Period		
00:00–05:59	Ref	
06:00–11:59	1.03 (0.76 – 1.41)	0.832
12:00–17:59	0.93 (0.70 – 1.251	0.650
18:00–23:59	0.99 (0.87 – 1.12)	0.852

	OR (95% CI)	***p***
Year		
2013	Ref	
2014	0.84 (0.71 – 1.00)	0.048
2015	0.78 (0.54 – 1.12)	0.184
2016	0.81 (0.57 – 1.16)	0.257
Response Characteristics		
Advanced Life Support	5.74 (2.02 – 16.3)	0.001
Lights and sirens use	1.60 (0.83 – 3.07)	0.166
Mileage	1.00 (1.00 – 1.00)	0.234
Response time	0.98 (0.94 – 1.02)	0.346
Scene time	1.01 (0.99 – 1.04)	0.358
Transport time	0.99 (0.97 – 1.01)	0.273
Intravenous Access	6.02 (3.87 – 9.38)	<0.001
Monitor placed	3.99 (2.79 – 5.70)	<0.001
Glasgow Coma Score assessment	4.04 (2.00 – 8.14)	<0.001

OR, odds ratio; CI, confidence interval

Table 14:

Odds ratios of complete vital sign assessment following adjustment of standard error for clusters in 20 EMS agencies evaluated in this study; adjusted (multivariate) analysis.

	OR (95% CI)	*p*
Age Group		
Adult	Ref	
Neonate	0.02 (0.01 – 0.06)	<0.001
Infant	0.04 (0.02 – 0.08)	<0.001
Toddler	0.07 (0.03 – 0.13)	<0.001
Early childhood	0.13 (0.08 – 0.23)	<0.001
Middle childhood	0.54 (0.40 – 0.73)	<0.001
Adolescent	1.40 (1.12 – 1.74)	0.003
Demographics		
Male sex	0.93 (0.88 – 0.98)	0.010
Race/ethnicity		
White/Non-Hispanic	Ref	
White/Hispanic	1.12 (0.70 – 1.78)	0.636
Black/Non-Hispanic	1.45 (0.88 – 2.41)	0.147
Black/Hispanic	1.46 (0.49 – 4.34)	0.500
Other/Unknown	1.71 (0.71 – 4.09)	0.230
Medical category		
Medical	Ref	
Trauma	0.75 (0.51 – 1.11)	0.150
Respiratory	0.78 (0.56 – 1.07)	0.123
Allergy	1.26 (0.89 – 1.78)	0.197
GI/Abdominal	0.88 (0.60 – 1.30)	0.518
Cardiac	0.72 (0.53 – 0.97)	0.031
Neurology	0.86 (0.60 – 1.25)	0.434
Psychiatry	0.18 (0.10 – 0.34)	<0.001
Toxicology	2.14 (1.07 – 4.28)	0.031
Dizziness/Syncope	0.87 (0.60 – 1.25)	0.449
Other	0.31 (0.16 – 0.60)	0.001
Unknown	0.43 (0.24 – 0.77)	0.004
Day Period		
00:00–05:59	Ref	
06:00–11:59	1.07 (0.94 – 1.225)	0.290
12:00–17:59	1.01 (0.86 – 1.188)	0.909
18:00–23:59	1.08 (0.98 – 1.197)	0.135
Year		
2013	Ref	

	OR (95% CI)	***p***
2014	0.77 (0.65 – 0.93)	0.005
2015	0.70 (0.46 – 1.06)	0.089
2016	0.70 (0.47 – 1.07)	0.100
Response Characteristics		
Advanced Life Support	3.12 (1.54 – 6.31)	0.002
Lights and sirens use	1.19 (0.66 – 2.15)	0.566
Response time	1.00 (0.97 – 1.02)	0.808
Scene time	0.99 (0.99 – 1.00)	0.081
Transport time	1.00 (0.99 – 1.02)	0.628
Intravenous Access	2.83 (2.18 – 3.67)	<0.001
Monitor placed	1.82 (1.00 – 3.29)	0.048
Glasgow Coma Score assessment	1.14 (1.10 – 1.17)	<0.001

OR, odds ratio; CI, confidence interval