A Comparison of Medications in 38 Pediatric EMS Protocols to Those Listed on the Broselow™ Length-Based Tape

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DISCLOSURE

Conflict of Interest / Disclosure Statement
Peter Antevy MD is the Founder & CMO of Pediatric Emergency Standards, Inc. and developer of a pediatric resuscitation system.

BACKGROUND

- Pediatric medication errors are common.[1]
- PALS 2015 recommends the use of a length based tape with precalculated doses.[2]
- This study seeks to compare pediatric drug dosages from large and small EMS agencies to those listed on the Broselow LBT and determine discordance rates.

METHODS

- Determine the percentage of medications on the Broselow LBT found at incongruent dosages compared to the EMS protocols.
- Determine the total number of medications from each EMS protocol that were not present on the Broselow LBT.
- For each EMS agency, the discordance rate was determined.
- Calculation of the frequency of each of the medications in each EMS protocol that were missing from the Broselow LBT, as well as those that were listed at incongruent doses.

RESULTS

38 EMS Agencies

Population 294 to 2.4 million
Urban – Suburban – Rural

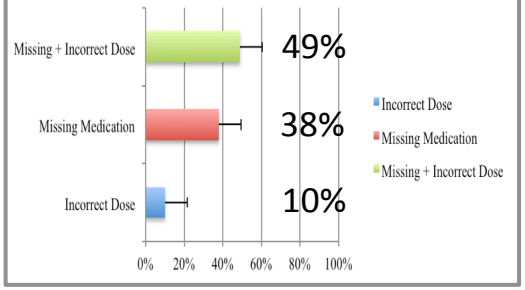
49% Discordance

Pediatric ALS Protocols Compared to Broselow LBT

Table 1. Missing and Incorrect Dosages

	M	SD	Min	Max
Incorrect Dose	10%	6%	0%	20%
Missing Medications	38%	7%	23%	50%
Missing Medication + Incorrect Dose	49%	8%	32%	63%

Average Discordance



Missing Medications*
Normal Saline
Ondansetron
Diphenhydramine
Morphine
Albuterol

*Represents 62% of all missing medications

Incorrect Dosing*
Epinephrine IM
Midazolam
Fentanyl
Diazepam

*Represents largest percentage of incorrectly dosed medications

CONCLUSION

A significant discrepancy exists between the pediatric drug dosages found in 38 EMS protocols and those listed on the Broselow LBT.

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been of recent interest to EMS educators. Many paramedic programs require varying levels of EMT experience for admission, because experience is believed to offer enhanced understanding. Although these predictive variables have been discussed, limited research on this subject has been completed. **Methods:** Scores on a validated summative EMS exam (PRE) were compared to sub-scores on a validated entrance exam (EE) and self-reported prior EMT experience. The EE consists of four content areas: Math, Reading, Anatomy/Physiology, and EMT Basics; and three non-cognitive sections: Agreeableness, Conscientiousness, and Neuroticism. Scores for the PRE and the EE were converted from total scores to logit scores, and the data was fit into a series of linear regression models. **Results:** The total number of students who completed both the EE and PRE was 291. The average PRE score was 74% (range 47–89%). The corresponding average logit score was 1.02 (range −0.10–2.09). The coefficients from the model suggest that four variables explain the differences in PRE logit scores with statistical significance. These factors were: 1) Experience of 2–5 years; 2) EE Anatomy/Physiology scores; 3) EE EMT Basic scores; and 4) EE Conscientiousness scores. Examinees with 2–5 years of experience score, on average, 0.13 logits higher on the PRE ($t = 0.03$). On average, students with higher scores on the EE Anatomy/Physiology and EMT Basics subsections obtained higher scores on the PRE. Every 10-scale point increase in Anatomy/Physiology raises the PRE by 0.17 logits ($t < 0.001$). Likewise, every 10-scale point increase in EE EMT Basics raises the PRE by score 0.11 logits ($t = 0.01$). Finally, every 10-scale point increase in Conscientiousness scale scores, decreases the PRE by 0.06 logits ($t = 0.03$). **Conclusion:** Although significant, the result is a statistical artifact due to multicollinearity, and this negative result should be ignored.

104. Paramedic Attitudes toward Participation in Research: A Systematic Review of the Literature

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Background: Research is essential for the development of evidence-based paramedicine and is now recognized as an essential component of the discipline.As the profession grows and paramedicine based research is increasingly called upon to inform practice, meaningful paramedic participation supporting research becomes vital. However, increased system pressures and demands for service puts a considerable strain on paramedics raising concerns as to what extent research is a priority. Promoting research in paramedicine therefore may be contingent on paramedics' attitudes and experiences as participants in paramedicine research. **Objectives:** To identify paramedics' attitudes toward participation in prehospital research, we completed a systematic review of the literature. **Methods:** We searched MEDLINE, EMBASE, Evidence Based Medicine (EBM) Reviews, and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases for combinations of relevant terms composed by an expert information specialist familiar with prehospital research from inception (of each database) until March 2015. We excluded commentaries, opinions, letters, conference proceedings or abstracts and non-English publications. One investigator (JEB) screened all titles and two investigators (JEB & MJE) performed an independent hierarchical screening of abstracts and full-text articles (blinded to source) for inclusion.Differences were resolved by consensus. **Results:** We retrieved 2,801 titles from the search, of which 10 publications were retained for analysis.The kappa for abstracts, and full texts were 0.74 and 0.78, respectively.All articles were qualitative interviews or surveys. We discovered that paramedics are interested in research and believe it is important for advancing the profession and improving patient care.However, significant barriers exist (e.g., lack of funding, research training programs, dedicated time for research) that limit paramedics' involvement with research. **Conclusion:** Paramedics appear to support participation in research, believing it has both clinical and professional benefits; however, barriers to participation exist. Additional work is needed to determine ways to best engage non-participating paramedics and identify the strategies to mitigate potential barriers.

105. Differences in Prehospital Patient Assessment between Pediatric and Adult Patients

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Background: A distinct set of skills, familiarity, and knowledge is required to assess pediatric compared to adult patients, and Emergency Medical Services (EMS) providers may not perform the same level of assessment skills in pediatric patients. **Objectives:** We sought to identify differences between prehospital patient assessments performed for pediatric vs. adult patients. **Methods:** We performed a retrospective review of ground EMS transports from a scene by 20 EMS agencies in a regional EMS system between July 1, 2013 and December 30, 2014. We collected data on patient and transport characteristics, vital signs, Glasgow coma score (GCS), pain scores, and lung sounds assessment. Multivariable logistic regression controlling for EMS service, gender, medical category, and transport distance was performed to assess for differences between pediatric and adult patients in individual components of patient assessment. **Results:** Of 232,999 patients transported to a hospital, cases were excluded that were inter-facility transports (44,349, 19.0%), cardiac arrest (1,976, 0.8%), or missing demographic data (5,074, 2.2%).A total of 182,321 patients were included. There were 171,150 (93.9%) adult patients (≥18 years) and 11,171 (6.1%) pediatric patients, including neonates (<1 mon, $N = 187$), infants (1 mon–1 year, $N = 1,217$), toddlers (1–2 years, $N = 1,106$), early childhood (2–5 years, $N = 2,286$), middle childhood (6–11 years, $N = 2,357$), and adolescents (12–17 years, $N = 4,018$). Less pediatric patients had a full set of vital signs (HR, SBP, and RR) compared to adults (85.8% vs. 95.1%, OR 0.260, 95%CI 0.244–0.277), with the lowest proportions in the youngest age groups (51.3%, 64.5%, 73.9%, 83.6%, 91.7%, and 94.8%, respectively). Glasgow coma score was less frequent in pediatric patients vs. adults (77.8% vs. 78.9%, OR 0.907, 95%CI 0.864–0.951). In trauma patients ($N = 34,601$), pain score documentation was less frequent in pediatric patients (33.7% vs. 38.7%, OR 0.809, 95%CI 0.747–0.876). In respiratory patients ($N = 16,775$), pediatric patients had less frequent pulse oximetry (89.2% vs. 97.2%, OR 0.213, 95%CI 0.174–0.262) and similar assessment of lung sounds (94.3% vs. 95.7%, OR 0.819, 95%CI 0.639–1.050). **Conclusions:** There is a disparity between prehospital assessments of pediatric vs. adult patients, especially for patients in the youngest age categories. EMS providers would benefit from additional education regarding pediatric patient assessment.

106. Prehospital Providers' Perceptions on Providing Patient and Family Centered Care

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Background: A gap exists in understanding a provider's approach to delivering care that is mutually beneficial to patients, families, and other providers in the prehospital setting. **Objectives:** The purpose of this study was to identify attitudes, beliefs, and perceived barriers to providing patient and family centered care (PFCC) in the prehospital setting and to describe potential solutions for improving PFCC during critical pediatric events. **Methods:** We conducted a qualitative, cross-sectional study of a purposive sample of Emergency Medical Technicians (EMT) and paramedics from an urban, municipal, fire-based EMS system, who participated in the Pediatric Simulation Training for Emergency Prehospital Providers (PediSTEPPS) course. Two coders reviewed transcriptions of audio recordings from participants' first simulation scenario debriefings and underwent constant comparison analysis to identify unifying themes.Themes were verified through member checking with two focus groups of prehospital providers. **Results:** A total of 102 EMTs and paramedics participated in 16 audiotaped debriefing sessions. Four overarching themes, each with subthemes, emerged regarding the experience of PFCC by prehospital providers: (1) Perceived barriers included the prehospital environment, limited manpower, multitasking medical care, and concern for interference with patient care; (2) Providing emotional support comprised of empathetically comforting caregivers, maintaining a calm demeanor, and empowering families to feel involved; (3) Effective communication strategies consisted of narrating actions, designating someone to communicate with the family, speaking in lay terms, using the patient's name, summarizing during downtime, and conveying a positive first impression; and (4) Tactics to overcome parental barriers were maintaining a line of sight, preempting the next actions, removal, and return of a parent to the scene if necessary, and providing situational awareness. **Conclusion:** Based on debriefings from simulated scenarios, some prehospital providers identify the provision of emotional support and effective communication as important components to the delivery of PFCC.Other providers revealed several perceived barriers to providing PFCC, although potential solutions to overcome many of these barriers were also identified.These findings can be utilized to integrate effective communication and emotional support techniques into EMS protocols and provider training to overcome perceived barriers to PFCC in the prehospital setting.

107. A Comparison of Medications in 38 Pediatric EMS Protocols to Those Listed on the Broselow-Length Based Tape

Peter M. Antevy, Caroline Epstein, Patrick Hardigan, *Joe DiMaggio Children's Hospital*

Background: Pediatric Advanced Life Support guidelines set forth by the American Heart Association recommends use of a length-based resuscitation tape(LBT) by healthcare providers. Pediatric medication errors in the prehospital setting have been studied by numerous investigators, occur frequently and are potentially fatal.This study seeks to compare pediatric drug

dosages from large and small EMS agencies to those listed on the Broselow LBT and determine discordance rates. **Methods:** We first sought to determine the percentage of medications on the Broselow LBT found at incongruent dosages compared to the EMS protocols. We then determined the total number of medications from each EMS protocol that were not present on the Broselow LBT. For each EMS agency, the sum of incongruent medications and missing medications was divided by the total number of medications to determine the overall discordance rate for each EMS agency. Finally, we calculated the frequency of each of the medications in each EMS protocol, which were missing from the Broselow LBT, as well as those that were listed at incongruent doses. **Results:** Thirty-eight EMS protocols were reviewed. Populations served by these agencies ranged from 291 to 2.49 million. Of medications listed in both the Broselow LBT and EMS protocol, 10% were listed at a dose at least 30% greater than that recommended by the EMS protocol. On average, 38% of EMS protocol medications were not listed on the Broselow LBT. This calculated to a total average medication discordance rate of 49% (Range 32–63%, SD 8%). We compared the average discordance of 49% (95% CI: 32%, 63%) against a hypothetical measure of 10% using a test for a difference in proportions.The calculated discordance was statistically greater than a standard of 10% ($p < 0.001$).Further analysis revealed that five medications represented 62% of the missing medications: Epinephrine 1:1000 IM, Ondansetron, Diphenhydramine, Morphine, and Albuterol.Three medications accounted for 84% of the incongruent dosages: Midazolam, Fentanyl, and Diazepam. **Conclusion:** A significant discrepancy exists between the pediatric drug dosages found in 38 EMS protocols and those listed on the Broselow Length-Based Tape.

108. 5-YEAR EXPERIENCE WITH PREHOSPITAL ANTIARRHYTHMIC MEDICATION IN PEDIATRICS IN A STATEWIDE EMS SYSTEM

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Background: Antiarrhythmic medications are frequently included in EMS pediatric protocols despite little evidence supporting their safety/efficacy in this setting. **Objectives:** The purpose of this study is to analyze the 5-year statewide experience with antiarrhythmic medications in pediatrics. **Methods:** This was a retrospective analysis of a statewide EMS information system (EMSIS) conducted from 1/1/2010 to 12/31/2014.The study population was children <13 years old who received prehospital adenosine, amiodarone, or lidocaine, the three antiarrhythmic medications permitted in state EMS protocols, for presumed tachycardic arrhythmia. Cases were excluded for interfacility transfer, cardiac arrest upon EMS arrival, use of medication for other than arrhythmia, or age/medication documentation errors. Records were obtained from the EMSIS using filters for patient age <13 years old and administration of the three medications.Standard statistical analysis was performed. **Results:** During the study period there were 6,683,098 records within the EMSIS, 221,894 (3.3%) were <13 years old. Medications were administered to 13,434 patients within this age group (6.1%).The three study medications were administered to 78 patients.However, 71 of these cases were excluded leaving only 7 cases for analysis. Reasons for exclusion included interfacility air transport (43), interfacility ground transport (7), presentation in cardiac arrest (5), lidocaine for intraosseous anesthesia (7), age documentation error (4), medication documentation error (3), duplicate patient from a second ALS agency (1), and no narrative for review (1). Among the 7 remaining cases for analysis, a single dose of lidocaine was used unsuccessfully for a 10-year-old with reported stable ventricular tachycardia (vs. LBB). Adenosine was administered to 6 patients for reported stable paroxysmal supraventricular tachycardia, with 3 patients converting to sinus rhythm after receiving a single dose.The 3 patients who did not convert received 3 escalating doses of adenosine consistent with weight-based protocols.Amiodarone was not administered. The median age (range) of patients receiving antiarrhythmic medications was 9 years (26 days–12 years). There were no apparent adverse effects reported from the medications. **Conclusion:** Antiarrhythmic medications are very rarely given in the prehospital setting to children under 13 years of age. In this statewide EMS system we identified only 7 patients to receive these medications over 5 years.

109. IMPROVING PREHOSPITAL PEDIATRIC MEDICATION VOLUMETRIC ADMINISTRATION WITH A PROTOCOL SPECIFIC WEIGHT-BASED REFERENCE TOOL

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Background: Prehospital pediatric emergencies are far less frequent than adult emergencies, accounting for 10% or less of total calls.In addition, the utilization of prehospital medications for pediatric patients is even less common, accounting for as few as 1.4% of all procedures.Because providers uncommonly encounter these types of situations, the literature indicates that there are significant error rates in medication dosages administered to pediatric patients.There have been studies analyzing the use of weight-based dosing and volume of administration utilizing pediatric reference tools, but none to our knowledge that have also scrutinized these tools by employing hands on volume extraction into the correct size syringe. **Methods:** Prehospital advance life support (ALS) providers were randomized into control and test groups. The control group was given access to any references of their choice whereas the test group was given only the pediatric medication reference tool. Both groups were given a 1, 3, 6, and 12 milliliter syringe.Subjects were instructed to calculate the appropriate weight-based dose of epinephrine and midazolam by drawing up the appropriate volume in one of the syringes provided. **Results:** Of the 272 ALS prehospital care providers participating, 139 answered utilizing the pediatric medication reference tool, and 133 answered without the tool. The group receiving the reference card was significantly more likely to provide the correct dose for midazolam (Versed) (87.0% vs. 53.4%; $p < 0.001$) and epinephrine (74.1% vs. 55.3%; $p = 0.001$). After adjusting for other factors, the use of the reference card was significantly associated with an increased likelihood of correct dosing for midazolam (Versed) (OR = 6.80, $p < 0.001$) and epinephrine (OR = 2.54, $p = 0.001$). **Conclusion:** The pediatric protocol specific weight-based reference tool enabled prehospital care providers to establish weight-based medication doses and volumes of medication administration more accurately than providers without access to this tool.Further education on syringe usage, Broselow tape limitations, and enhanced electronic patient care reporting (ePCR) medication documentation capturing could be of benefit and assist in decreasing pediatric prehospital medication administration errors.

110. TRENDS IN NALOXONE USE IN PEDIATRIC PATIENTS IN A LARGE URBAN EMS SYSTEM

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Background: Death from opiate overdose poses a large societal burden. Naloxone is a safe opiate reversal agent.The CDC reported significant increased heroin overdose deaths across 28 states between 2010 and 2012. Similar opiate abuse trends have been seen the pediatric population. It is unclear if the described increase in opiate use among pediatrics has led to an increase in the use of naloxone among prehospital providers for pediatric patients. **Objectives:** We describe prehospital naloxone utilization among pediatric patients in a large urban EMS system. **Methods:** This is a retrospective case review study. We collected data from a prehospital database from an urban EMS system.Children less than 18 years old receiving naloxone in the prehospital setting between 2010 and 2014 were included.A chart review of the individuals included in the study was performed.Basic demographic data was collected including age, race, indication, route of delivery, and medication effect.We describe the number of cases per year as well as the median age of the patients. **Results:** Thirty-six children out of 36,346 pediatric encounters received naloxone. By comparison, total annual naloxone use from 2012 to 2014 nearly doubled, with 1,063 doses administered in 2014.The median age of all pediatric patients receiving naloxone is 16 (IQR 11–17).Twenty-five (69.4%) of the patients were between the ages of 14 and 17 with 15 (44.4%) of those being 17-years-olds.The number of naloxone use ranged from 5–9 patients annually over the 5 years of the study.Indication, route, and outcome was missing in 12 records.Of the remaining 24 patients, the two most common indications were pinpoint pupils (54%) and depressed respirations (33%).Intravenous Naloxone was given in all but one patient.Most patients (71%) had clinical improvement after delivery of Naloxone. **Conclusion:** Prehospital use of naloxone in the pediatric population remains uncommon.There is not increased naloxone use among pediatric patients as has been described in the adult literature. Most naloxone use in the study population occurred in those individuals between 14 and 17 years old.

111. HIDE OR GO SEEK: DO MORE PEDIATRIC ENCOUNTERS MAKE BETTER PARAMEDICS?

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Background: The primary goal of paramedic education is to produce competent entry-level paramedics with demonstrated critical thinking ability. Although revised educational standards exist, EMS educators do not have a reliable method for assessing student competency. **Objectives:** This study sought to better understand the association between the quantity and role of pediatric encounters compared to cognitive testing outcomes after completion of clinical and field experiences. **Methods:** A retrospective review and descriptive study of data abstracted from the web-based Fisdap® system, a student clinical experience tracking system, for the years 2008–12. Only clinical data from shifts occurring before the first Fisdap® Paramedic BLUE exam attempt was used. Scaled scores of the pediatric questions using the Rasch model to create a continuous "logit" variable and obtain latent scores on the pediatric scale. After obtaining the scale scores, a linear model was fit to predict scale score using