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IPHMI Literature Review

Keeping You Up to Date with Current EMS Literature and Studies

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- 1. Completeness of Pediatric Versus Adult Patient Assessment Documentation in the National Emergency Medical Services Information System.** Cercone A, Ramgopal S, Martin-Gill C. *Prehosp Emerg Care*, 2024;28:243-252.

Pediatric prehospital encounters are relatively uncommon, making up only 5.7% to 7.4% of EMS responses. The American Academy of Pediatrics, the American College of Emergency Physicians, the Emergency Nurses Association, the National Association of EMS Physicians and the National Association of EMT's have emphasized preparing EMS responders to improve their pediatric competence. These initiatives call for comprehensive patient assessments that require complete and accurate vital signs for all patients evaluated in the out of hospital setting.

The authors conducted a retrospective review of the 2019 NEMSIS dataset involving over 10,000 EMS agencies in 47 states. They included all encounters, both BLS and ALS, which were transported to the hospital. Patients with no age listed, cardiac arrests, non-transport or cancellations, scene assists, interfacility transfers and specialty transports were excluded from their review.

They had identified 34,203,087 EMS activations and from these 18,918,914 were included in their study. Pediatric patients (age <18 years) accounted for 1,212,843 (6.4%) cases). Male patients made up 47.3% of the calls. The proportion of ALS vs BLS for the adult and pediatric populations were similar (adults 84.2% vs 83.6% pediatrics).

Documentation of vital signs increased as the patient population increased in age. Systolic blood pressures were documented in 32.2% of neonates and in 95.5% of the adults. The lowest incidence of complete vital signs was in children < 1 month old (30.8%). Documentation of complete vital signs increased to 89.2% for adolescents and to 91.8% for adults.

The authors also found regional differences with the highest proportion of complete vital signs occurring in the south and lower proportions of complete vital signs documented in the Midwest in the <12 years old population. In addition, higher proportions of complete vital signs were documented in children in all age groups by for profit and non-hospital based ambulance services. The lowest

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proportion of vital signs documented were in children <12 years old managed by tribal ambulance services.

Other findings included a slight increase in reporting of respiratory rates in all age categories when the patients had respiratory complaints. Pulse oximetry readings were less prevalent in pediatric patients versus adult patients with respiratory complaints. (73.9% vs 95.1%).

In patients with cardiac complaints, 80.9% of the adult patients were placed on cardiac monitors while only 24.4% of the children less than 1 year old had monitors.

Limitations of this study include the fact that the NEMSIS does not include all EMS encounters in the United States. It does, however, report on > 1 million pediatric encounters every year for over 10,000 EMS agencies so this likely provides a generalized view of the state of pediatric assessments. Some of the variables used for adjustment in the multivariable models were subject to higher rates of missing data. They did not review the narrative reports which could have included some of the missing data.

Documentation of complete vital signs in pediatric patients occurs less frequently than in adult patients in the prehospital setting. This finding persists across locations and response levels. This result is particularly concerning and indicates the need for increased education of prehospital providers regarding complete pediatric assessment.

2. National analysis of motorcycle associated injuries and fatalities: wearing helmets saves lives.

Rosander A, Breeding T, Ngatuvai M, et al. *Am J Emerg Med* 2023 ;69:108-113.

As the number of registered motorcycles has doubled over the last 20 years, the incidence of motorcycle fatalities has also increased. Unlike automobile occupants, motorcyclists often have very limited protection when involved in a collision. Despite data from the National Highway Traffic Safety Administration that shows that use of helmets is associated with an estimate 40% reduction in fatalities amongst riders, motorcyclists claim laws that mandate the use of helmets impinge on their personal freedom. As a result, some states have either repealed mandatory helmet laws or required helmet use by younger riders only. Some data indicated that almost one-third of motorcyclists infrequently or never use a helmet.

A team of researchers assembled by traumatologists at the Orlando Regional Medical Center sought to provide a “comprehensive analysis of current motorcycle injuries, injury types, and the impact of helmet use.” They devised a retrospective cohort study to query the American College of Surgeons Trauma Quality Improvement Program (TQIP)’s participant use file from 2017 – 2020 to abstract data on motorcycle associated injuries and fatalities in relation to helmet use. De-identified data for motorcyclists age 18 or older were included if they suffered blunt or penetrating injury or fatality and had an Injury Severity Score (ISS) of 15 or greater. Cases were excluded if the patient was dead on arrival, had an ISS of 14 or less or lacked key information (age, race, gender or helmet status). The primary outcome was the adjusted motorcycle related in-hospital mortality rate and the secondary outcome with the ICU-length of stay (LOS) in days. Standard statistical analysis was performed and a *p* value <0.05 was considered statistically significant.

During the study period, more than 43,000 motorcyclists met inclusion criteria. Of this group, only 56.4% (24,389) were using helmets while 43.6% were not. Helmet users were predominantly male (90.4%), white (77.8%) and between the ages of 18 – 34 (37.9%), while non helmet users were similarly male (89.0%), white (80.9%) and between the ages of 18-34 (31.2%). Helmeted motorcyclists had a significantly lower rate of skull fractures compared to non-users (0.5% vs 2.1%, *p*<0.001), but suffered a greater number of bodily injuries including chest trauma, pelvic fractures and greater than two extremity fractures. Crushed extremities, extremity amputation and paralysis were also significantly higher in the helmeted group. Non-helmet users were significantly more likely (*p*<0.001) to present with Glasgow Coma Scale (GCS) score of 13 or less (14.9%) than helmeted riders (12.3%). Helmeted

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motorcyclists had a 35% reduction in the relative risk of dying in the hospital from motorcycle-related injuries compared to non-users (aOR 0.65, 95% CI [0.59-0.70]). Lastly, helmet use was associated with a decreased ICU-LOS compared to non-helmet users.

The authors note that their study showed that helmeted riders had significantly decreased odds of dying in the hospital from their injuries and a significantly decreased ICU-LOS compared to non-helmet motorcyclists. The investigators found that those wearing helmets had significantly higher incidence of bodily injury compared to helmet non-users, a finding that has been previously documented. Other researchers had proposed that, because the helmet protects the head, the body can withstand higher forces in collisions. That is, non-helmeted riders with more severe head trauma would succumb more quickly from their brain injury (at the scene or during transport) and not survive long enough for their bodily injury to be identified. Another rational explanation may be that those motorcyclists who wear helmets may feel overconfident in their protection and may therefore operate their motorcycle in a manner that puts them at greater risk for bodily injury (increased speed or recklessness).

One limitation of the study noted by the authors was that the database utilized lacked details regarding the type of motorcycle helmet used (half helmet/skull cap vs open face vs full face), so no comparative analysis could be performed. In addition, the exclusion of those motorcyclists that were declared dead at the scene may have underestimated the effect of wearing a helmet.

The authors fell short of their proposed goal of producing a comprehensive analysis of motorcycle injuries and injury types related to helmet use. While they briefly reported on the various injuries, there was little discussion. These investigators really didn't present any substantially new findings, however they did confirm previous studies which have documented that helmet use is associated with saving the lives of motorcyclists.

3. Accuracy of the American College of Surgeons Minimum Criteria for Full Trauma Team Activation for Children. Lerner EB, Drendel AL, Badawy M, et al. *Ped Emerg Care* 2024;40:187-190.

In many EMS systems, providers are required to notify receiving facilities, prior to arrival, of their patient status and chief complaint. Facilities use this information to plan Emergency Department bed assignments and if any specialty resources are required to optimally care for the patient. Those specialty resources include resuscitation teams, sepsis protocols and trauma teams to name a few.

The American College of Surgeons (ACS) recommends that Adult and Pediatric Trauma Centers have prearrival activation criteria for trauma patients arriving via EMS. Current ACS recommendations for prearrival notifications resulting in a trauma team response for pediatric trauma patients include age specific hypotension, gunshot wounds, a Glasgow Coma Scale (GCS) score less than 9, and or an emergent airway. The ACS further recommends that institutions expand prearrival trauma team activation criteria based on several anatomical indicators and local experience with patient populations.

The authors of this paper attempted to evaluate the efficacy of ACS pediatric trauma team activation criteria as well as the expanded local criteria of three Trauma Centers located within three separate cities in the United States. This was a three year, prospective, institution review board consent waived, observational study. The three institutions are located within EMS regions that have protocols in place that direct potentially seriously injured children to ACS credentialed, pediatric trauma centers with notification of their impending arrival. Following arrival and handoff of an injured pediatric patient, a trained interviewer asked the EMS provider responsible for the child's care if they would consent to take a brief survey on the child's condition on scene and injuries. Pediatrics were defined as patient's fifteen years of age or less. If the EMS provider consented to being interviewed, the child's care and disposition were followed from Emergency Department admission until discharge from the hospital. Interviewers were available between 8 and 16 hours a day.

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The investigators conducted 9,483 EMS interviews with providers from both ground and aeromedical EMS programs. All patients came directly from the scene and interfacility transfers were excluded from the study. The average age of patients enrolled into the study was 7.7 years of age. Two percent of the patients (202) required trauma team activations. This cohort of patients often required advanced airways with 2 hours of arrival or surgery within 4 hours. A total of 299 children met ACS minimal criteria for a prearrival trauma team activation. The authors found that this minimum criterion over-triaged 2% of the pediatric patients and under-triaged 44% that should have been met by a trauma team. GCS scores produced the least number of false positives and age specific hypotension produced the greatest number of false positives. Overall, the authors discovered a higher rate of under-triage versus over-triage regardless of the criterion used (ACS minimum criteria, expanded criteria or local criteria). The authors noted that there is no recommended rate of over-triage versus under-triage for pediatric trauma team activations. There have been suggested rates of 5% under-triage and 25% to 50% over-triage being acceptable.

The study group identified many limitations. The interviews with EMS providers post arrival at the hospital were voluntary. Not all providers consented to the interviews and potentially sicker or less sick patients were lost for participation in the study. Interviewers were not available 24/7 resulting in a loss of some study subjects. The authors did not account for levels of trauma team activations at facilities or modification of responses once the patient arrived at the Emergency Department.

The authors concluded that there is a high rate of under-triaged pediatric patients arriving at trauma centers. Local criteria for trauma team activations may decrease the rate of under-triage but will potentially increase the rate of false positives based on unique criteria within the trauma activation protocol.

Appropriate patients benefit from trauma teams awaiting their arrival at the Emergency Department. Overuse of trauma team activations may decrease the team's response abilities and accessibility to patients within the hospital that would benefit from their expertise. EMS providers must be familiar with their state and local Trauma Point of Entry Protocols and receiving trauma centers' trauma team activation criteria. The goal should be to activate trauma teams accurately and responsibly.

4. Video Laryngoscopy versus Direct Laryngoscopy for Orotracheal Intubation in the Out-of-Hospital Environment: A Systematic Review and MetaAnalysis. Kent ME, Sciavolino BM, Blickley ZJ, Pasichow SH. *Prehosp Emerg Care*, 2024;28:221-230.

Effective airway management is a crucial intervention across all healthcare settings, but the out-of-hospital environment, in particular, presents unique challenges. First-pass success, indicating successful intubation on the initial attempt, is a key indicator of effective airway management due to its association with reduced complications such as hypoxia and cardiac arrest. However, success rates vary among providers and settings. Video laryngoscopy (VL) has emerged as a method that may improve first-pass success, particularly in critical scenarios.

The authors performed a systematic review and metaanalysis of the literature. They included studies published in English that were conducted in the out-of-hospital setting and involved live human subjects aged 16 or older. These studies had direct laryngoscopy (DL) as the primary device for the control group, video laryngoscopy (VL) as the primary device for the experimental group, and reported either first-pass success or overall intubation success. The authors' primary outcome was determining the odds of achieving first-pass success using video laryngoscopy (VL) versus direct laryngoscopy (DL). The authors conducted subgroup analyses to assess how clinician type and the type of VL blade impacted the differences in first-pass success between VL and DL. A total of twenty-five (25) studies

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were included, yielding 35,489 intubations across all subgroups involving critical care paramedics (CCP) and nurses (CCRN), paramedics, and physicians.

They found that overall success rate for CCPs and CCRNs was the same for VL and DL. In the physician subgroup, VL was favored in 2/6 studies. In the paramedic subgroup, 9/10 studies favored VL. Intubation times were generally shorter with DL compared to VL.

The study has several limitations as noted by the authors. Substantial heterogeneity in the studies was observed across all outcomes and subgroups, potentially influenced by inconsistencies in defining overall intubation success among studies. While first-pass success is a common metric, its significance may vary depending on patient outcomes beyond mere intubation success. Sensitivity analyses excluding observational studies had minimal impact on results, suggesting consistency across methodologies. The performance of video laryngoscopy (VL) and direct laryngoscopy (DL) might differ in various clinical scenarios, such as trauma or airway obstruction, but data were insufficient to detail results by scenario. Moreover, variations in clinician training and experience, especially among critical care paramedics/nurses, may have affected outcomes. Inadequate reporting of bougie usage and differences in VL device design further complicate interpretation. Clarification of clinician training, standardization of terminology, and more detailed reporting in future studies are crucial for addressing these limitations and improving the reliability of meta-analytical findings in airway management research.

Given that airway management significantly impacts outcome for critically ill and injured patients, it is imperative to explore all avenues for enhancing first-pass intubation success rates. While the optimal approach to prehospital airway management remains uncertain, the introduction of video laryngoscopy (VL) offers an additional option. It is worth noting that a study highlighted previously in our literature reviews found that 76% of surveyed paramedics had not performed an intubation in the past year. Furthermore, research suggests that mastering DL and intubation requires a substantial number of procedures, ranging from 36 to over 200, which have become increasingly difficult for paramedic students to obtain. There are no data indicating the number of VL procedures needed to become proficient. Additionally, there is a need for further investigation into the efficacy of using VL as the primary method of visualization versus its role as a backup device.