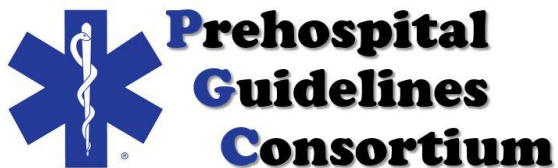


2026 EMS RESEARCH READING LIST

Literature Summaries



EXECUTIVE SUMMARY

The [National EMS Research Agenda](#), [EMS Education Agenda for the Future](#), and the Institute of Medicine's "[Emergency Medical Services: At the Crossroads](#)," have highlighted a decades-long effort to incorporate more scientific evidence into EMS education and clinical protocols. Similarly, the [EMS Agenda 2050](#) has emphasized the importance of making research-related publications accessible to EMS clinicians, educators, administrators, and physicians. Yet substantial barriers remain for local EMS systems to incorporate timely high-impact scientific evidence into practice. These include challenges in dissemination of important scientific publications to EMS personnel.

Evidence-based guidelines (EBGs) synthesize available evidence to produce recommendations that can inform EMS protocols, but their development often lags the publication of emerging science and does not address all aspects of EMS medicine. Identifying high impact primary scientific literature has the potential to inform EMS educators and other leaders of high-impact research and related publications that can inform initial and continuing education of EMS clinicians, aligning with a vision for a data-driven and evidence-based EMS practice.

As part of fulfilling the [National Prehospital Evidence-Based Guidelines Strategy](#), the Prehospital Guidelines Consortium (PGC) and the National Registry of Emergency Medical Technicians (National Registry) established a collaborative agreement to complete biennial [Systematic Reviews of Evidence-Based Guidelines for Prehospital Care](#) to identify the highest quality EBGs available to EMS clinicians and medical directors. These reviews, first published in 2020, aim to identify all guidelines providing recommendations for prehospital clinical care or operations and evaluate the quality of individual guidelines using standardized criteria.

Additionally, since 2022 on a biennial basis the PGC has identified a list of key, recently published scientific peer-reviewed articles that could be incorporated into certification and continued competency activities for EMS clinicians, which comprise an [EMS Research Reading List](#). The [Development of the EMS Research Reading List](#) has been published separately and involves an open call for candidate publications disseminated through representatives of over 35 EMS stakeholder organizations comprising the PGC. Submitted publications are reviewed and scored using a 1-5 Likert scale. Submissions were also categorized using the [Consensus Standard for Evidence Integration into EMS Education and High-Stakes Testing](#).

Submissions have included published original research, systematic reviews, position statements, and non-peer reviewed sources. The members of the PGC who review the submitted publications comprise a technical expert panel including EMS physicians, non-EMS physicians, paramedics, EMTs, and other healthcare personnel. A final list of articles is identified based on independent ratings and considering a mix of publications including high-impact evidence-based guidelines, position statements, and primary scientific literature.

Table. Recommended Reading List of Peer-Reviewed EMS Publication, 2026 (organized by author).

Publication	Category *	Page
2025 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care	Guideline	3
National Association of EMS Physicians Trauma Compendium	Position Statement	5
Couper et al. A Randomized Trial of Drug Route in Out-of-Hospital Cardiac Arrest. N Engl J Med. 2025;392(4):336-348.	Original Research	8
Dorsett et al. Timeline for Repeat EMS Encounters Resulting in Transport Following "Lift Assist" in a Suburban EMS System. Prehosp Emerg Care. 2025;29:1-6.	Original Research	10
Fritz et al. Survival Benefit of Helicopter Scene Response for Patients with an Injury Severity Score of at Least Nine: A Systematic Review and Meta-Analysis. Prehosp Emerg Care. 2024;28(6):841-850.	Original Research	12
Hong et al. Caring for Transgender and Gender Diverse Prehospital Patients: A NAEMSP Position Statement and Resource Document Prehospital Emergency Care 2025;29(3):302-314.	Guideline	14
Jarvis et al. Evidence-Based Guideline for Prehospital Airway Management. Prehospital Emergency Care 2024;28(4):545-557.	Guideline	16
Martin-Gill C et al. 2024 Systematic Review of Evidence-Based Guidelines for Prehospital Care. Prehosp Emerg Care. 2025;29(6):703-712.	Systematic Review	18
Stieglis et al. Association Between Delay to First Shock and Successful First-Shock Ventricular Fibrillation Termination in Patients With Witnessed Out-of-Hospital Cardiac Arrest. Circulation 2025;151(3):235-244.	Original Research	20
Witt et al. Epinephrine in Prehospital Traumatic Cardiac Arrest-Life Saving or False Hope? Prehosp Emerg Care 2026;30(1):153-161.	Original Research	22

* Publications are additionally categorized below based on [The 2026 Core Content of Emergency Medical Services Medicine](#) published by the American Board of Emergency Medicine.

PUBLICATION

[2025 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care](#)

CATEGORY

Guideline

PLAIN LANGUAGE SUMMARY

This set of guidelines from the American Heart Association aims to provide a review of updated evidence-based recommendations for resuscitation and emergency cardiovascular care. The 2025 Guidelines represent the latest comprehensive compilation of guidance since publication of the 2020 Guidelines. These guidelines are based, in part, on evidence reviews conducted by the International Liaison Committee on Resuscitation and associated member councils.

Overall key changes in the 2025 Guidelines include:

- Expansion in the number of writing groups and chapters, with the addition of chapters on ethics, special circumstances, and post-cardiac arrest care.
- Separation of basic and advanced life support recommendations for both adult and pediatric patients.
- A new unified Chain of Survival for adult and pediatric in- and out-of-hospital cardiac arrest, replacing the previous age- and setting-specific Chains.
- An increase in the number of the highest level of recommendation, Class 1, from 161 in 2020 to 233 in 2025.

Key highlights of these guidelines are available from the American Heart Association:

- [Highlights of the 2025 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care](#)

Select major new and updated recommendations relevant to EMS include:

- New recommendations regarding out-of-hospital cardiac arrest team size and composition and intra-arrest transport ([Part 4: Systems of Care](#)).
- Updated recommendations on chest compression hand placement for infants and using back-blows for foreign-body airway obstruction in pediatric patients ([Part 6: Pediatric Basic Life Support](#)).
- Updated recommendations for using back-blows for foreign-body airway obstruction in adult patients and against routine use of mechanical CPR except when high-quality manual compressions may be challenging or dangerous ([Part 7: Adult Basic Life Support](#)).
- New recommendation against the use of specific end-tidal CO₂ values to terminate resuscitation for pediatric patients ([Part 8: Pediatric Advanced Life Support](#)).
- Updated recommendations reaffirming IV access first when possible and universal termination of resuscitation rules for adult patients ([Part 9: Adult Pediatric Life Support](#)).
- New recommendations for treatment of life-threatening asthma exacerbation, chest compression use for patients with left ventricular assist devices, and use of Extracorporeal Cardiopulmonary Resuscitation in pregnant and peripartum patients ([Part 10: Adult and Pediatric Special Circumstances of Resuscitation](#)).
- New recommendations regarding CPR training modalities, including gamified learning and virtual reality ([Part 12: Resuscitation Education Science](#)).

Access the individual guidelines:

- [Part 1: Executive Summary](#)
- [Part 2: Evidence Evaluation and Guidelines Development](#)
- [Part 3: Ethics](#)
- [Part 4: Systems of Care](#)
- [Part 5: Neonatal Resuscitation](#)
- [Part 6: Pediatric Basic Life Support](#)
- [Part 7: Adult Basic Life Support](#)
- [Part 8: Pediatric Advanced Life Support](#)
- [Part 9: Adult Advanced Life Support](#)
- [Part 10: Adult and Pediatric Special Circumstances of Resuscitation](#)
- [Part 11: Post-Cardiac Arrest Care](#)
- [Part 12: Resuscitation Education Science](#)

PUBLICATION

[National Association of EMS Physicians Trauma Compendium](#)

CATEGORY

Position Statement

PLAIN LANGUAGE SUMMARY

This consortium of position statements from the National Association of EMS Physicians (NAEMSP) addresses a variety of topics relevant to prehospital trauma care. The position statements were each created based on a [standard methodology](#) including a structured search of the literature and evidence evaluation. Each position statement was developed by a workgroup comprised of experts in EMS, emergency medicine, and trauma care.

Position Statement	Key Recommendations
Antibiotic Use	• Prehospital prophylactic antibiotics for trauma appear safe and may be considered in specific patient populations. • Universal and widespread adoption of this intervention needs further study to identify the true impact on patient-centered outcomes. • Local practice may support adoption of protocols incorporating the use of prophylactic antibiotics for some trauma patients such as those with open fractures or those with significant delays in transport to definitive care.
Blood Product Transfusion	In EMS agencies/systems that can support a high-quality prehospital blood transfusion program: • Use blood components over crystalloids for the first-line treatment of prehospital patients with traumatic life-threatening bleeding. • Use low titer group O whole blood (LTOWB) as the first-choice blood product. • Use a combination of prehospital transfusion indications, focused on physiologic abnormalities and/or injury patterns with significant blood loss. • Use active monitoring for transfusion-related adverse events. • Recycle unused blood product units nearing their expiration date.
Entrapment and Crush injury	• EMS clinicians should ○ Perform timely and thorough primary and secondary assessments and reassessments in parallel with dynamic extrication planning ○ Establish early, clear, and ongoing communications with rescue personnel. ○ Prevent and manage hypothermia. • In entrapped patients at risk for crush syndrome: ○ Initiate large-volume (i.e., 1-1.5 L/h for adults and 20 mL/kg/h for pediatric patients for the initial 3-4 h) fluid resuscitation with crystalloid, preferably normal saline, as early as possible and prior to extrication. ○ Administer medications to mitigate risks of hyperkalemia, infection, and renal failure, early and prior to extrication. • Tourniquet application should be considered in the setting of a crushed extremity as a potential adjunct before extrication.
Femur Fracture Care	• Use either static or traction splinting to immobilize femoral shaft fractures. ○ Traction splinting carries contraindications, additional risks, and technical complexities that are not present with static splinting. ○ Static splinting may be the preferred method of immobilizing midshaft femur fractures in the prehospital setting.
Fluid Resuscitation	• Isotonic crystalloid solutions should be the preferred fluids for use in prehospital trauma management (compared to hypertonic solutions and colloids). • Permissive hypotension is reasonable in patients without traumatic brain injury.

	- Avoiding or correcting hypotension in polytrauma patients with traumatic brain injury (TBI) may be a higher priority than restricting fluid use. - Large volume crystalloid resuscitation should be generally avoided.
<u>Geriatric Trauma Care</u>	- Use age-adjusted, physiologic criteria to guide transport decisions to the most appropriate trauma center. - Evaluate and treat pain using weight-based dosing and consider drug interactions. - Consult advance care planning documents, when available. - Exercise judgment regarding spinal motion restriction if spinal injury.
<u>Pediatric Trauma Care</u>	- EMS clinicians should assess vital signs in all pediatric patients with trauma. - EMS clinicians should be trained to identify likely inflicted injuries, with an emphasis on cutaneous injuries and injuries in children with comorbidities. - EMS clinicians should be trained to identify physiological factors and mechanisms of injury associated with more severe trauma. - Key prehospital interventions should include judicious use of crystalloid fluids, administration of blood for hemorrhagic shock when available, prevention of hypoxia and hypotension especially in patients with TBI, adequate assessment and treatment of pain, and appropriate transport to a pediatric trauma center.
<u>Pelvic Fracture Care</u>	- Evaluate for other sources of shock in the hemodynamically unstable trauma patient with suspected pelvic fractures. - There are challenges in accurately identifying pelvic fractures by physical exam alone; manual stability testing of the pelvis is neither sensitive nor specific and may cause harm. - Prehospital use of pelvic circumferential compression devices (PCCDs) should be reconsidered given lack of proven clinical benefit. - If PCCDs are used, care must be taken to ensure they are placed in an anatomically appropriate position over the trochanters, and that the legs are internally rotated.
<u>Pneumothorax Care</u>	- EMS clinicians should not perform pleural decompression in patients with simple pneumothoraxes but should perform pleural decompression in patients with tension pneumothorax. - EMS clinicians should use needle thoracostomy as the primary strategy for pleural decompression of tension pneumothorax in most cases. - Simple thoracostomy and tube thoracostomy may be used by highly trained EMS clinicians in select clinical settings with appropriate medical oversight. - In patients receiving positive pressure ventilation who have open pneumothoraxes, chest seals may be harmful and are not recommended.
<u>Obstetrical Trauma Care</u>	- For injured pregnant patients who are at least 20 weeks gestation (or fundal height at the level of the umbilicus), manual left lateral uterine displacement should be performed whenever possible. - Hemorrhagic shock may be subtle or delayed in injured pregnant patients. - EMS clinicians should be aware of clinical characteristics unique to the pregnant patient population that require modification of typical lifesaving interventions including hemorrhage control and resuscitation, airway and ventilation management, tension pneumothorax decompression, management of burn and inhalational injuries, and pain management. - For traumatic out-of-hospital circulatory arrest (TOHCA) in injured pregnant patients of at least 20 weeks' gestation, after correctable causes of TOHCA have been addressed and spontaneous circulation has not returned, if an EMS physician is present, a resuscitative hysterotomy should be initiated, ideally within four minutes of maternal arrest.
<u>Traumatic Out-of-Hospital Circulatory Arrest, Adult</u>	EMS resuscitation of adults with TOHCA should: Prioritize prompt identification of patients who may benefit from transport to definitive care at trauma centers when safe and appropriate.

	• Emphasize the identification of reversible causes of traumatic circulatory arrest and timely use of clinically indicated life-saving interventions (LSIs), including: ○ Managing the airway using the least-invasive approach. ○ Performing chest decompression if clinical concern for a tension pneumothorax. Empiric bilateral decompression, however, is not indicated. ○ External chest compressions may be considered secondary to other LSIs. ○ Epinephrine should not be routinely used, and not before other LSIs. • Resuscitation attempts should be withheld if presence of: ○ Injuries are incompatible with life. ○ Evidence of prolonged circulatory arrest. ○ Do Not Resuscitate (DNR) / Do Not Attempt Resuscitation (DNAR) orders. • Discontinuation of resuscitation should consider that: ○ Mechanism of injury or electrical rhythm should not be used as the sole determinant. ○ There are no specific universal standardized time-based cutoffs to discontinue resuscitation efforts. • Implementation of protocols for TOHCA should consider safety, cost, potential organ donation, and local resources associated with resuscitation attempts.
<u>Tranexamic Acid Use</u>	• Prehospital TXA administration may reduce mortality in adult trauma patients with hemorrhagic shock when administered after lifesaving interventions. • TXA appears safe, with low risk of thromboembolic events or seizure. • The ideal dose, rate, and route of prehospital TXA have not been determined. • If used for adult trauma patients, TXA should be given to those with clinical signs of hemorrhagic shock and no later than 3 hours post-injury. • The role of prehospital TXA in pediatric trauma patients has not been studied.
<u>Vasopressor Use</u>	• Current evidence does not support the routine use of vasopressors by EMS clinicians for traumatic hemorrhagic shock and suggests the possibility of harm. • Current evidence does not address the use of vasopressors by EMS clinicians in the treatment of patients with severe spinal cord injury presenting with neurogenic shock or to achieve specific mean arterial pressure goals in spine injured patients in the prehospital setting. • There is currently no evidence to support or refute the use of vasopressors by EMS clinicians in the setting of TBI.

PUBLICATION

[Couper et al. A Randomized Trial of Drug Route in Out-of-Hospital Cardiac Arrest. N Engl J Med. 2025;392\(4\):336-348.](#)

CATEGORY

Original Research

PUBLISHED ABSTRACT

Background: In patients with out-of-hospital cardiac arrest, the effectiveness of drugs such as epinephrine is highly time-dependent. An intraosseous route of drug administration may enable more rapid drug administration than an intravenous route; however, its effect on clinical outcomes is uncertain.

Methods: We conducted a multicenter, open-label, randomized trial across 11 emergency medical systems in the United Kingdom that involved adults in cardiac arrest for whom vascular access for drug administration was needed. Patients were randomly assigned to receive treatment from paramedics by means of an intraosseous-first or intravenous-first vascular access strategy. The primary outcome was survival at 30 days. Key secondary outcomes included any return of spontaneous circulation and favorable neurologic function at hospital discharge (defined by a score of 3 or less on the modified Rankin scale, on which scores range from 0 to 6, with higher scores indicating greater disability). No adjustment for multiplicity was made.

Results: A total of 6082 patients were assigned to a trial group: 3040 to the intraosseous group and 3042 to the intravenous group. At 30 days, 137 of 3030 patients (4.5%) in the intraosseous group and 155 of 3034 (5.1%) in the intravenous group were alive (adjusted odds ratio, 0.94; 95% confidence interval [CI], 0.68 to 1.32; $P = 0.74$). At the time of hospital discharge, a favorable neurologic outcome was observed in 80 of 2994 patients (2.7%) in the intraosseous group and in 85 of 2986 (2.8%) in the intravenous group (adjusted odds ratio, 0.91; 95% CI, 0.57 to 1.47); a return of spontaneous circulation at any time occurred in 1092 of 3031 patients (36.0%) and in 1186 of 3035 patients (39.1%), respectively (adjusted odds ratio, 0.86; 95% CI, 0.76 to 0.97). During the trial, one adverse event, which occurred in the intraosseous group, was reported.

Conclusions: Among adults with out-of-hospital cardiac arrest requiring drug therapy, the use of an intraosseous-first vascular access strategy did not result in higher 30-day survival than an intravenous-first strategy. (Funded by the National Institute for Health and Care Research; PARAMEDIC-3 ISRCTN Registry number, ISRCTN14223494.).

PLAIN LANGUAGE SUMMARY

As part of the PARAMEDIC-3 trial, Couper et al. examined the route of drug administration during cardiac arrest as it affects patient outcomes. This was a multi-center, randomized control trial comparing the effects of intraosseous (IO) and intravenous (IV) medications administered during out of hospital cardiac arrest. The primary study outcome was 30-day survival rate, and secondary outcomes included incidence of return of spontaneous circulation (ROSC) and return to desirable neurologic function at time of hospital discharge, defined as Rankin scale equal to or less than 3 (no significant disability, able to manage own affairs without assistance). The study authors hypothesized that an IO-first strategy would improve the 30-day survival rate by facilitating a shorter time to epinephrine administration and subsequent shorter time to achieve ROSC.

From 2021 to 2024, across 11 emergency medical systems in the United Kingdom, adult patients who suffered an out of cardiac arrest were randomly placed into one of two groups: an intraosseous first or intravenous first strategy for emergent medication administration during prehospital cardiopulmonary resuscitation (CPR). This assigned route of medication administration was used until ROSC was achieved, resuscitation was terminated, or patient care was transferred at the receiving hospital. Outcomes were analyzed by use of logistic-regression models, with adjustments made for patient age, sex, initial cardiac rhythm, witness status, bystander CPR, time from emergency call to drug administration, and cause of cardiac arrest.

Of the 6000 patients enrolled, a similar number of patients were alive at 30 days in each group, 4.5% of patients in the IO cohort and 5.1% of patients in the IV cohort (adjusted odds ratio, 0.94; 95% confidence interval [CI], 0.68-1.32). The incidence of ROSC between both groups was slightly lower in the IO group than the IV group, at 36.0% and 39.1% respectively (adjusted odds ratio, 0.86; 95% CI, 0.76-0.97%). The incidence of desirable neurologic outcomes was similar between groups, with Rankin scores <3 in 2.7% of the IO group and 2.8% of the IV group (adjusted odds ratio, 0.91; 95% CI, 0.57-1.47). Post hoc sensitivity analyses showed that the median EMS scene response time, time to drug administration, and dose of epinephrine administered were not significantly different between groups. The only adverse event reported during the trial was “ongoing mild leg pain” endorsed by one patient from the intraosseous cohort. There were no serious events reported.

In this trial of patients with out of hospital cardiac arrest, an IO-first strategy for emergent medication administration did not result in a higher 30-day survival rate.

PUBLICATION

[Dorsett et al. Timeline for Repeat EMS Encounters Resulting in Transport Following "Lift Assist" in a Suburban EMS System. Prehosp Emerg Care. 2025;29:1-6.](#)

CATEGORY

Original Research

PUBLISHED ABSTRACT

Objective: When emergency medical services (EMS) clinicians provide mobilization assistance to geriatric fall patients without transport, this is often coded as a "lift assist." Previous research has shown many of these patients are subsequently transported, suggesting the "lift assist" may signal the presence of underlying medical illness or decline in functional condition. Understanding the timeline for repeat visits requiring transport is critical to improvement initiatives seeking to reduce diagnostic delays for this population. The primary objective of this study was to describe the timeline and factors associated with subsequent transport following an index EMS encounter for lift assist.

Methods: This was a retrospective analysis of one year (2022) of patient encounters in a suburban EMS system with ~120K dispatches per year. Patients ≥ 60 years of age were included if they had at least one repeat EMS encounter within 7 days of a non-transport with a primary impression of lift assist. The population was described using descriptive statistics. Associations between assessment completeness and abnormal vital signs with odds of subsequent transport versus non-transport were evaluated using logistic regression analysis.

Results: In total, 1054 EMS encounters were analyzed, accounting for 574 repeat encounters involving 428 unique patients and 480 patient clusters. Number of repeat encounters within 7 days ranged from one to six, with 84% ($n = 406$) having only one. Of initial EMS encounters, 14% were missing at least one vital sign, and abnormal vital signs were observed (HR >100 :10% ($n = 459$), SBP <110 :8% ($n = 448$), SpO₂ <90 %.4% ($n = 425$)). On repeat encounter, patients were transported in 76% of cases. The primary impression indicated a medical etiology in 61% of repeat encounters and 1% were for cardiac arrest. Median time to first repeat encounter resulting in transport was 1.13 days (IQR 0.33 to 3.33 days). No association was found between abnormal vital signs or ambulation assessment with odds of transport on subsequent encounter.

Conclusions: Most repeat patient encounters following index lift assist occur within 72 h and result in transport, most commonly for presumed medical etiology. Ambulation assessment, abnormal or missing vital signs were not associated with increased odds of transport on repeat visits in this limited patient sample.

PLAIN LANGUAGE SUMMARY

"Lift assist" dispatches may be indicative of underlying illness or functional decline. Without an adequate medical evaluation, patients who are not transported after a "lift assist" may require additional encounters from prehospital clinicians until the patient is eventually transported for definitive medical care. This study's objectives were to identify the timeline over which these repeat encounters occur and the factors associated with patient transport.

The authors reviewed over 128,000 EMS calls that occurred in 2020 involving several suburban EMS services. Data were collected on "lift assist only" patients age 60 and older, and when repeat call(s)

occurred within seven days of the initial call. Of the 428 patients identified, a total of 480 repeat encounters occurred. Of these repeat encounters, 439 (76%) resulted in transport on subsequent encounters, with 78% transported on the second visit. Primary impressions coded on return visits were “medical” (61%), “trauma” (29%), “lift assist” (9%), and “cardiac arrest” (1%). Median time to the second patient encounter was 1.13 days (IQR 0.33 to 3.33 days). The authors noted these numbers may actually be higher, as data involving mutual aid or non-study services were not always available.

Additional data collected during this study identified that “lift assist” patients often had potential for missed or delayed diagnoses and poor outcomes. A full set of vital signs (heart rate, oxygenation saturation, respiratory rate, systolic and diastolic blood pressure) was only found in 85% of the documented patient encounters. Ambulatory ability was only documented in 37% of encounters, and a baseline ability to ambulate was documented in 12% of all patients. The authors noted that while concerns about abnormal vital signs were documented related to oxygen saturation (50%) and blood pressure (75%), tachycardia was not mentioned as a concern in any refusal of transport or “lift assist only” documentation, while 10% of non-transported patients had heart rates of greater than 100. The authors found that missing or abnormal vital signs and/or lack of ability to ambulate did not predict subsequent calls and transport, suggesting that either the patient’s condition worsened or under-recognition of an acute medical condition occurred. The authors comment on poor geriatric education, complexity of geriatric assessment, ageism, and patient autonomy as primary factors contributing to the utilization of a “lift assist” code during these encounters. They suggest that providing a more thorough evaluation and discussion, facilitating informed decision-making regarding patient transport, which may be beneficial to the patient.

While the authors acknowledged that many “lift assist” patients do not require transport to the hospital, they also recommended a more thorough assessment and evaluation of these patients, including the ability to ambulate, prior to determining that they only require a lift assist. Patients who are unable to self-ambulate and require a “lift assist” should be considered at risk for underlying causes of general weakness such as stroke, cardiac events, or sepsis. Informed decision making, as well as a thorough exam and documentation of findings were recommended, despite the debate that “lift assists” are often not considered a patient encounter.

PUBLICATION

[Fritz et al. Survival Benefit of Helicopter Scene Response for Patients with an Injury Severity Score of at Least Nine: A Systematic Review and Meta-Analysis. Prehosp Emerg Care. 2024;28\(6\):841-850.](#)

CATEGORY

Original Research

PUBLISHED ABSTRACT

Background and aim: Helicopter EMS (HEMS) is a well-established mode of rapid transportation for patients with need for time-sensitive interventions, especially in patients with significant traumatic injuries. Traditionally in the setting of trauma, HEMS is often considered appropriate when used for patients with "severe" injury as defined by Injury Severity Score (ISS) >15. This may be overly conservative, and patients with a lower ISS may benefit from HEMS-associated speed or care quality. Our objective was to perform a meta-analysis of trauma HEMS transports to evaluate for possible mortality benefit in injured cases defined by an ISS score >8, lower than the customary ISS cutoff of >15.

Methods: A broad search of the literature was performed including PubMed, EMBASE, SCOPUS, Cochrane Central Register of Controlled Trials, and Google Scholar from the years 1970 to 2022. The gray literature and reference lists of included publications were also examined. We included studies with the outcome of mortality in HEMS vs control in trauma transports from scene of injury for patients (adult or pediatric) with ISS >8.

Results: Nine eligible studies were used in the final analysis: six in the primary analysis and three in sensitivity analysis due to patient overlap. All studies reported statistically significant survival benefit in HEMS compared to control group. The minimum survival odds ratio (OR) benefit observed was OR 1.15 (95% CI 1.06-1.25) and maximum was OR 2.04 (95% CI 1.18-3.57). Risk of bias tool (ROBINS-I) application yielded moderate to low risk of bias, mainly due to the observational nature of the studies included.

Conclusions: There was a statistically significant survival benefit in patients with ISS >8 when HEMS was used over traditional ground ambulance transportation, although novel and more inclusive trauma triage criteria may be more appropriate in the future to guide HEMS utilization decision-making. Restricting HEMS to trauma patients with ISS >15 likely misses survival benefit that could be afforded to the subset of trauma patients with serious injury.

PLAIN LANGUAGE SUMMARY

Fritz et al. conducted a systematic review and meta-analysis to evaluate the possible mortality benefit of helicopter EMS (HEMS) transport from scenes when compared to ground EMS in cases of severe traumatic injury, defined as an Injury Severity Score (ISS) >8; this ISS threshold is notably lower than the traditionally utilized ISS >15 to define "severe" injury in trauma. The primary study outcome was defined as survival to hospital discharge.

Nine eligible studies were identified in total. Each were retrospective analyses of regional trauma data, with 6 studies included in the primary analysis and 3 in sensitivity analysis due to data overlap. All studies in both analyses reported statistically significant survival benefit associated with HEMS transport in acute severe traumatic injury, with a minimum survival odds ratio (OR) benefit of 1.15 (95% confidence interval [CI], 1.06-1.25) and maximum OR of 2.04 (95% CI, 1.18-3.57).

Due to the non-randomized design of the included studies, the application of a risk of bias tool (ROBINS-I) resulted in an overall assignment of “moderate to low risk of bias.” Along with the potential for confounding and selection bias inherent to mortality analyses of scene trauma, the inclusion of patients in traumatic cardiac arrest may have significantly biased study results against ground transport. Clinical protocols generally tend to favor ground EMS transport in cases of traumatic cardiac arrest, and only 2 studies excluded patients who were pronounced dead on scene or at time of hospital arrival.

Significant study limitations include the lack of exclusions for EMS crew configuration and transportation destination, including crew scope of practice (e.g. physician-led crew), clinical capabilities (e.g. ability to perform rapid-sequence intubation), and receiving facility capabilities. These factors increase study heterogeneity, which inhibits the generation of a pooled effect estimate.

Despite these limitations, the results of this study suggest that HEMS scene transport may provide a statistically significant benefit to clinical outcomes in patients with acute traumatic injury, even in those with an ISS less than the traditional cutoff of 15.

PUBLICATION

[Hong et al. Caring for Transgender and Gender Diverse Prehospital Patients: A NAEMSP Position Statement and Resource Document Prehospital Emergency Care 2025;29\(3\):302-314.](#)

CATEGORY

Guideline

PUBLISHED ABSTRACT

Transgender and gender diverse (TGD) people have long faced significant barriers to safely accessing medical care-especially gender-affirming care, which has been shown to strikingly improve health outcomes like suicidality and depression. In the prehospital setting, gender-affirming care amounts to showing respect for the TGD patient's identified gender and maintaining a safe environment that fosters a positive therapeutic relationship throughout the encounter. This represents a challenge for many Emergency Medical Services (EMS) systems due to the lack of TGD-specific training for EMS clinicians, a paucity of TGD-specific research to inform EMS education and clinical care, and in some cases the resistance of EMS clinicians to such training. Transgender and gender diverse people are facing a regression in legal access to essential medical care. With this position statement, NAEMSP joins other professional medical societies in providing recommendations to improve care for TGD patients, thereby affirming TGD individuals' right to exist as their authentic selves, as well as their entitlement to the same high-quality prehospital medical care as their cisgender peers.

PLAIN LANGUAGE SUMMARY

This document represents the first position statement from the National Association of EMS Physicians (NAEMSP) regarding the provision of healthcare to TGD patients. For the purposes of this position statement, the term TGD refers to all people who have gender identities or expressions that differ from the sex/gender that was assigned to them at birth. This definition was chosen to ensure alignment with the World Professional Association for Transgender Health and other medical societies.

This position statement was developed following a structured rapid review of EMS literature on this topic. Given the paucity of EMS-specific studies identified, additional resources outside of the EMS setting were also used. Overall, the following nine recommendations were produced that are intended to improve the care provided to TGD in the prehospital setting:

- EMS clinicians should maintain basic cultural competency regarding TGD populations, including familiarity with TGD-related health and health care disparities, consideration of TGD populations as underserved, and understanding the centrality of stigma and transphobia in creating disparities and other challenges which complicate daily life for TGD people.
- EMS clinicians should demonstrate cultural humility toward the TGD community, which includes self-assessment of knowledge gaps, as well as openness to new or unfamiliar ideas, information, and advice from those with different lived experiences.
- EMS clinicians should understand basic TGD-specific terminology and use appropriate language—including patient-identified names and pronouns—during direct patient care, in handoffs, and in documentation.

- EMS clinicians should treat a patient's TGD status as sensitive health information and take care not to inadvertently disclose this information without the patient's express permission.
- EMS clinicians should have a basic understanding of social transitioning and of gender-affirming medical and surgical treatments.
- EMS clinicians should employ a trauma-informed approach when caring for TGD patients.
- EMS education and training should incorporate learning domains that address comprehensive care for TGD patients, with educational content providing the specific knowledge and skills required to promote equitable care.
- EMS workplaces should implement policies to improve recruitment and retention of TGD personnel, covering harassment protection, nondiscrimination practices, inclusive working environments, equal advancement opportunity, and tailored employee benefits.
- Future EMS research should focus on elucidating the disparities in and barriers to prehospital care of the TGD patient population with emphasis on patient experience and education of prehospital clinicians.

PUBLICATION

[Jarvis et al. Evidence-Based Guideline for Prehospital Airway Management. Prehospital Emergency Care 2024;28\(4\):545-557.](#)

CATEGORY

Guideline

PUBLISHED ABSTRACT

Airway management is a cornerstone of emergency medical care. This project aimed to create evidence-based guidelines based on the systematic review recently conducted by the Agency for Healthcare Research and Quality (AHRQ). A technical expert panel was assembled to review the evidence using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) methodology. The panel made specific recommendations on the different PICO (population, intervention, comparison, outcome) questions reviewed in the AHRQ review and created good practice statements that summarize and operationalize these recommendations. The recommendations address the use of ventilation with bag-valve mask ventilation alone vs. supraglottic airways vs. endotracheal intubation for adults and children with cardiac arrest, medical emergencies, and trauma. Additional recommendations address the use of video laryngoscopy and drug-assisted airway management. These recommendations, and the associated good practice statements, offer EMS agencies and clinicians an opportunity to review the available evidence and incorporate it into their airway management strategies.

PLAIN LANGUAGE SUMMARY

A panel of experts evaluated a systematic review by AHRQ utilizing GRADE methodology to help identify supporting evidence or absence thereof and subsequently recommend best practices surrounding airway management in prehospital care. Recommendations were provided regarding bag-valve-mask ventilation (BVM), supraglottic airways (SGA), endotracheal intubation (ETI), and use of rapid sequence intubation (RSI). Twenty-two recommendations were provided with consideration of indications for airway management, patient age, and device type. Of the evidence evaluated, authors identified very low certainty of evidence, low certainty of evidence, and low-moderate certainty of evidence, or no evidence at all to make a recommendation. Absence of sufficient evidence was supplemented with panel discussion and consensus for development of recommendations.

ADULT	Out-of-Hospital Cardiac Arrest	Trauma	Medical Emergencies
BVM vs SGA	Either	Either	No recommendation
BVM vs ETI	Either	Either	No recommendation
SGA vs ETI	SGA if low proficiency with ETI Either if high proficiency with ETI	Either*	Either, depending on ETI proficiency

* Priorities for airway management in trauma include optimization of ventilation and oxygenation and avoidance of hypoxia, hypotension, and hyperventilation.

PEDIATRIC	Out-of-Hospital Cardiac Arrest	Trauma	Medical Emergencies
BVM vs SGA	Either	No recommendation	No recommendation
BVM vs ETI	Limited evidence, BVM preferred by panel consensus*	Either, insufficient data*	No recommendation
SGA vs ETI	Limited evidence, SGA preferred by panel consensus*	SGA preferred**	SGA preferred**

* Considerations for these recommendations include varying anatomy with pediatric age groups, decreasing success with younger age, and fewer opportunities for initial learning and continued practice. It is important to note that both endotracheal intubation and BVM ventilation can be very challenging in pediatric patients.

** Evidence demonstrates lower first-pass success in ETI versus SGA in children.

TECHNIQUE MODIFIERS – Medications to facilitate intubation	
RSI vs no medication	RSI recommended*
RSI vs sedation-only	RSI recommended*
Sedation-only vs no medications	No recommendation

* There are inherent risks with RSI, including hypoxia and hypotension, however, intubation success is higher with RSI, and first-pass success can also affect outcomes.

TECHNIQUE MODIFIERS – Use of video laryngoscopy	
Direct laryngoscopy vs video laryngoscopy	No recommendation*

*Comparison of direct laryngoscopy vs video laryngoscopy based on out-of-hospital data alone yielded no recommendation of one over the other, but in-hospital data favors video laryngoscopy increasing first-pass success, and continued research in this area is recommended.

Key take-home points:

EMS clinicians should become proficient with BVM ventilation, should always use end-tidal CO₂ for device placement confirmation, and should train endotracheal intubation to avoid adverse outcomes of peri-intubation hypoxia and hypotension.

PUBLICATION

[Martin-Gill C et al. 2024 Systematic Review of Evidence-Based Guidelines for Prehospital Care. Prehosp Emerg Care. 2025;29\(6\):703-712.](#)

CATEGORY

Systematic Review

PUBLISHED ABSTRACT

Objectives: Evidence-based guidelines (EBGs) are widely recognized as valuable tools to aggregate and translate scientific knowledge into clinical care. High-quality EBGs can also serve as important components of dissemination and implementation efforts focused on educating emergency medical services (EMS) clinicians about current evidence-based prehospital clinical care practices and operations. We aimed to perform the third biennial systematic review of prehospital EBGs to identify and assess the quality of prehospital EBGs published since 2021.

Methods: We systematically searched Ovid Medline and EMBASE from January 1, 2021, to June 6, 2023, for publications relevant to prehospital care, based on an organized review of the literature, and focused on providing recommendations for clinical care or operations. Included guidelines were appraised using the National Academy of Medicine (NAM) criteria for high-quality guidelines and scored using the Appraisal of Guidelines for Research and Evaluation (AGREE) II Tool.

Results: We identified 33 new guidelines addressing clinical and operational topics of EMS medicine. The most addressed EMS core content areas were time-life critical conditions ($n = 17$, 51.5%), special clinical considerations ($n = 15$, 45%), and injury ($n = 12$, 36%). Seven (21%) guidelines included all elements of the National Academy of Medicine (NAM) criteria for high-quality guidelines, including the full reporting of a systematic review of the evidence. Guideline appraisals by the Appraisal of Guidelines for Research and Evaluation (AGREE) II tool demonstrated modest compliance to reporting recommendations and similar overall quality compared to previously identified guidelines (mean overall domain score 67%, SD 12%), with Domain 5 ("Applicability") scoring the lowest of the six AGREE II domains (mean score of 53%, SD 13%).

Conclusions: This updated systematic review identified and appraised recent guidelines addressing prehospital care and identifies important targets for education of EMS personnel. Continued opportunities exist for prehospital guideline developers to include comprehensive evidence-based reporting into guideline development to facilitate widespread implementation of high-quality EBGs in EMS systems and incorporate the best available scientific evidence into initial education and continued competency activities.

PLAIN LANGUAGE SUMMARY

This review aimed to identify and appraise all evidence-based guidelines (defined as involving an organized review of scientific literature) relevant to the provision of prehospital care that were published between January 1, 2021, and June 6, 2023. This review identified 33 guidelines that addressed various clinical and operational topics. In alignment with the methodology used for prior reviews conducted in [2020](#) and [2022](#), guidelines were appraised using the AGREE II guideline evaluation instrument and against specific criteria adapted from the National Academy of Medicine (NAM).

Overall, 7 of 33 guidelines (21%) met all NAM criteria indicative of a high-quality guideline, which was slightly lower than prior reviews. Most guidelines that failed to meet all adapted NAM criteria did not report a description of the search strategy used or did not conduct a synthesis of the evidence that informed the guidelines' recommendations. Guidelines scored similarly across the six domains of the AGREE II instrument, with the exception of domain 5 which regards 'applicability'. This domain essentially quantifies how the guideline can be implemented, audited, and monitored when used in actual clinical practice.

This review represents a significant body of work that has relevance to all clinicians involved in delivering prehospital emergency healthcare. For frontline EMS clinicians, this review presents a list of newly developed guidelines on various topics that may be helpful in informing their practice. For EMS administrators and medical directors, it presents a list of guidelines that may be adopted and/or adapted for use in a local context. For individuals involved in developing prehospital guidelines, it highlights opportunities for guideline improvement that should be addressed in future efforts to ensure future guidelines are high-quality.

The guidelines included in this review are included in the [Prehospital Guideline Consortium's EMS Guideline Registry](#). This living repository represents the largest collection of prehospital guidelines globally and supports the Consortium's overarching mission of promoting evidence-based guidelines for prehospital care.

PUBLICATION

[Stieglis et al. Association Between Delay to First Shock and Successful First-Shock Ventricular Fibrillation Termination in Patients With Witnessed Out-of-Hospital Cardiac Arrest. *Circulation* 2025;151\(3\):235-244.](#)

CATEGORY

Original Research

PUBLISHED ABSTRACT

Background: In patients with out-of-hospital cardiac arrest who present with an initial shockable rhythm, a longer delay to the first shock decreases the probability of survival, often attributed to cerebral damage. The mechanisms of this decreased survival have not yet been elucidated. Estimating the probability of successful defibrillation and other factors in relation to the time to first shock may guide prehospital care systems to implement policies that improve patient survival by decreasing time to first shock.

Methods: Patients with a witnessed out-of-hospital cardiac arrest and ventricular fibrillation (VF) as an initial rhythm were included using the prospective ARREST registry (Amsterdam Resuscitation Studies). Patient and resuscitation data, including time-synchronized automated external defibrillator and manual defibrillator data, were analyzed to determine VF termination at 5 seconds after the first shock. Delay to first shock was defined as the time from initial emergency call until the first shock by any defibrillator. Outcomes were the proportion of VF termination, return of organized rhythm, and survival to discharge, all in relation to the delay to first shock. A Poisson regression model with robust standard errors was used to estimate the association between delay to first shock and outcomes.

Results: Among 3723 patients, the proportion of VF termination declined from 93% when the delay to first shock was <6 minutes to 75% when that delay was >16 minutes (Ptrend<0.001). Every additional minute in VF from emergency call was associated with 6% higher probability of failure to terminate VF (adjusted relative risk, 1.06 [95% CI, 1.04-1.07]), 4% lower probability of return of organized rhythm (adjusted relative risk, 0.96 [95% CI, 0.95-0.98]), and 6% lower probability of surviving to discharge (adjusted relative risk, 0.94 [95% CI, 0.93-0.95]).

Conclusions: Every minute of delay to first shock was associated with a significantly lower proportion of VF termination and return of organized rhythm. This may explain the worse outcomes in patients with a long delay to defibrillation. Reducing the time interval from emergency call to first shock to ≤6 minutes could be considered a key performance indicator of the chain of survival.

PLAIN LANGUAGE SUMMARY

The American Heart Association advocates for initiating chest compressions and using a defibrillator as soon as one becomes available for patients with cardiac arrest who present or develop a shockable rhythm. Any delay in delivering the first shock reduces the likelihood of successfully restoring an organized rhythm. Stieglis et al. analyzed the association between delay to first shock and termination of ventricular fibrillation and restoration of an organized rhythm.

The analysis involved prospectively collected data from the ARREST registry in the North Holland province of the Netherlands. The researchers collected data from 3,723 adult and pediatric patients with a witnessed out-of-hospital cardiac arrest presenting with ventricular fibrillation, which included 206 (6%) patients whose cardiac arrest was witnessed by EMS. Every first shock delivered in this province used a

biphasic 200 joule shock. The primary outcome was termination of ventricular fibrillation for 5 seconds or more resulting from the first shock.

During a nine-year period from 2009 through 2018, the EMS system treated 12,877 patients for out-of-hospital cardiac arrest. After excluding 9,154 patients who did not meet the inclusion criteria, 3,723 patients remained in the study sample. Of those, 3,448 (93%) patients had an analyzable rhythm five seconds after receiving the first shock. The first shock successfully terminated VF in 3,014 (87%) of the cases.

- In 49 cases, a member of the lay public delivered the first shock before placing the emergency call to the dispatch center. Of those, 47 (96%) cases successfully terminated VF with the first shock.
- In 130 cases, a member of the lay public delivered the first shock within the first minute after placing the emergency call. Of those, 124 (95%) cases successfully terminated VF with the first shock.
- When the first shock was delayed by more than 16 minutes, the first shock successfully terminated VF in only 75% of cases (109/146, $P_{\text{trend}} < 0.001$).
- Over the course of the prehospital resuscitation periods, every additional minute delay from the emergency call to the dispatch center until someone delivered the first shock resulted in a 6% higher probability of an unsuccessful first shock (adjusted relative risk, 1.06 [95% CI, 1.04-1.07]).

In the subgroup of patients whose onset of cardiac arrest was witnessed by EMS professionals:

- VF was successfully terminated in 139 out of 157 patients (88%) when the first shock was delivered in under 2 minutes. In these cases, the first shock produced an organized rhythm in 62% of the cases and asystole in 27% of the cases.
- VF was successfully terminated in 22 out of 26 patients (85%) when the first shock was delivered between 2 and 4 minutes after the onset of the VF. In these cases, the first shock produced an organized rhythm in 46% of the cases and asystole in 39% of the cases.

Key points:

The authors concluded that for every additional minute of delay from the emergency call until delivery of the first shock, there would be a 6% lower proportion of successful defibrillation with the first shock. In addition, a shorter delay to first shock delivery also is associated with an increased likelihood of conversion to an organized rhythm.

PUBLICATION

[Witt et al. Epinephrine in Prehospital Traumatic Cardiac Arrest-Life Saving or False Hope? Prehosp Emerg Care 2026;30\(1\):153-161.](#)

CATEGORY

Original Research

PUBLISHED ABSTRACT

Objectives: While epinephrine is widely used for medical cardiac arrests, there is a knowledge gap regarding its utility for traumatic arrests. Traumatic arrests result from hypovolemia, hypoxia, or anatomic impairment of cardiac function such that the inotropic and vasoconstrictive effects of epinephrine may be ineffective or harmful. We hypothesized that epinephrine does not improve survival among patients with traumatic cardiac arrest.

Methods: This was a multicenter retrospective cohort study of trauma patients sustaining prehospital cardiac arrest who were treated at seven level I and II trauma centers over 6 years (2011-2017), ascertained via trauma registry data and chart abstraction. The primary outcome was survival to hospital discharge; patients treated with or without epinephrine were compared. Multivariable analyses were performed using Poisson regression. Time to event analyses were conducted using Cox proportional hazard models.

Results: We included 1,631 adult and pediatric trauma patients with prehospital cardiac arrest. Prehospital epinephrine was administered to 844 (52%). The median age was 35 years, 335 (21%) were female, 712 (44%) sustained blunt trauma, and 58 (4%) had a shockable initial rhythm. Survival to hospital discharge was significantly lower in the prehospital epinephrine cohort compared to the no epinephrine cohort in univariable analysis [43/844 (5%) vs. 125/787 (16%), $p < 0.001$]. Among patients with blunt mechanism, survival was significantly lower in the prehospital epinephrine cohort [12/382 (3%) vs. 54/330 (16%), $p < 0.001$]. Among patients with penetrating mechanism, survival was not statistically different [10/276 (4%) with epinephrine vs. 22/374 (6%) without, $p = 0.19$]. In multivariable analyses adjusting for age, sex, mechanism, and initial rhythm, epinephrine was associated with lower likelihood of survival in the overall and blunt cohorts; there was no significant difference in the penetrating cohort (overall aRR 0.33, 95% CI 0.23-0.46; blunt aRR 0.20, 95% CI 0.11-0.37; penetrating aRR 0.62, 95% CI 0.30-1.28). Adjusted and unadjusted time to event analyses across each of these cohorts showed that epinephrine was associated with either statistically inferior or indistinct hazard ratios.

Conclusions: Epinephrine was not associated with improved survival following traumatic cardiac arrest, and in multiple subanalyses, it was associated with inferior outcomes. These results may inform prehospital traumatic arrest protocols.

PLAIN LANGUAGE SUMMARY

The cardiac arrest guidelines published by the American Heart Association primarily focus on cardiac arrest with an underlying medical etiology. Although specific traumatic events that can result in cardiac arrest, such as electrocution and gas embolism, are mentioned in a special circumstances chapter, there is no specific algorithm for traumatic cardiac arrest.

Witt et al. retrospectively reviewed six years of data from six Level 1 trauma centers and one Level 2 trauma center to evaluate whether epinephrine administered to patients suffering from traumatic out-of-

hospital cardiac arrest resulted in improved survival to hospital discharge. Although primarily interested in the prehospital administration of epinephrine, the authors also collected data on whether epinephrine was given at any point during the resuscitation, including epinephrine administered in the emergency department.

Of the included 1,631 patients, survival to hospital discharge was significantly lower for patients who received epinephrine in the prehospital environment compared to those who did not receive prehospital epinephrine (5% vs. 16%, $p < 0.001$). The researchers observed similar results in patients who received epinephrine in the prehospital environment or the ED compared to those who did not receive prehospital epinephrine in either setting (6% vs. 18%, $p < 0.001$). The median out-of-hospital interval was slightly longer in the cohort who received epinephrine compared to those who did not receive epinephrine (20 vs. 25 min, $p < 0.001$).

In the multivariate analysis to assess the relative risk of survival, prehospital epinephrine was associated with worse survival to hospital discharge in the following groups: overall, blunt and/or penetrating mechanism, blunt mechanism, age < 18 , and initial shockable rhythm.

Because this was a retrospective analysis, the researchers were unable to control some of the variables that could have impacted the results. These include the duration of the arrest period, whether or when ROSC occurred, time to epinephrine administration, route of epinephrine administration, whether the arrest was witnessed, bystander cardiopulmonary resuscitation (CPR), and CPR duration. These data are also subject to the inherent potential bias of retrospective observational analyses, including patient selection by indication and confounding.