

# ***2022 EMS PROFESSIONALS READING LIST***

Evidence Summary

## EXECUTIVE SUMMARY

Influenced by publications such as the National EMS Research Agenda and the Institute of Medicine (now the National Academy of Medicine) “EMS at the Crossroads,” there has been a decades-long effort to incorporate more scientific evidence into EMS personnel education and EMS clinical protocols. Efforts of the National Registry of EMTs (NREMT) and the Prehospital Guidelines Consortium (PGC) have aimed to improve the dissemination of new scientific knowledge among EMS clinicians, including through improved education about EMS research and evidence-based guidelines.

Through a collaborative agreement with the NREMT, the PGC aimed to identify and report key recent published scientific peer-reviewed articles that could be incorporated into certification and continued competency activities for EMS clinicians.

The PGC established an open call for scientific literature of relevance to EMS clinicians published between 2019 and 2021. The open call was disseminated by EMS stakeholder organizations comprising the PGC. Submissions were categorized using the [NREMT Table of Evidence Framework](#). Submitted publications were reviewed and scored using a 1-5 Likert scale. Through additional review by members of the Research and Development Committees of the PGC, a list of ten key articles was selected and recommended by the PGC Board of Directors.

There were 63 submissions, of which 58 unique publications met the inclusion criteria. Submissions included published original research, systematic reviews, position statements and non-peer reviewed sources, such as textbook chapters and blogs. Most submissions were retrospective analyses. Also, most submissions were categorized as primary research with a level of evidence rating of “B-II” using the NREMT Types of Evidence Framework. All three “types of evidence” were represented, and six “quality of evidence” level A sources were submitted. Submissions were rated by 12 EMS stakeholder representatives. The range of average Likert rating for all submissions was 1.5-4.75. A final list of ten articles, all receiving average ratings  $\geq 4$  were selected and supported by the PGC Board of Directors as recommended articles for EMS professionals.

Ten articles published between 2019 and 2021 are reported as important publications that may support certification and continued competency activities for EMS clinicians. These articles comprise randomized clinical trials, large cohort studies, position or consensus statements, and a systematic review of prehospital evidence-based guidelines.

**Table.** Recommended Reading List for EMS Professionals, 2022.  
 (Organized by author)

Authors	Title	Accessibility, with hyperlink	Category	Document Bookmark
<b>Berry, 2021</b>	EMS agencies with high rates of field termination of resuscitation and longer scene times also have high rates of survival	<a href="#">Paid Access</a>	Original Research	<a href="#">Page 3</a>
<b>Grunau, 2020</b>	Association of intra-arrest transport vs continued on-scene resuscitation with survival to hospital discharge among patients with out-of-hospital cardiac arrest	<a href="#">Free Access</a>	Original Research	<a href="#">Page 5</a>
<b>Guyette, 2020</b>	Tranexamic acid during prehospital transport in patients at risk for hemorrhage after injury: A double-blind, placebo-controlled, randomized clinical trial	<a href="#">Free Access</a>	Original Research	<a href="#">Page 7</a>
<b>Jauch, 2021</b>	Recommendations for regional stroke destination plans in rural, suburban, and urban communities	<a href="#">Free Access</a>	Guidance Document	<a href="#">Page 9</a>
<b>Lemkes, 2019</b>	Coronary angiography after cardiac arrest without ST-segment elevation	<a href="#">Free Access</a>	Original Research	<a href="#">Page 11</a>
<b>Morgan, 2021</b>	Ketamine use in prehospital and hospital treatment of the acute trauma patient: a joint position statement	<a href="#">Free Access</a>	Position Statement	<a href="#">Page 13</a>
<b>Spaite, 2019</b>	Association of statewide implementation of the prehospital traumatic brain injury treatment guidelines with patient survival following traumatic brain injury: The excellence in prehospital injury care (EPIC) study	<a href="#">Free Access</a>	Original Research	<a href="#">Page 15</a>
<b>Turner, 2021</b>	Systematic review of evidence-based guidelines for prehospital care	<a href="#">Paid Access</a>	Systematic Review	<a href="#">Page 17</a>
<b>Vigil, 2019</b>	Death by suicide – The EMS profession compared to the general public	<a href="#">Paid Access</a>	Original Research	<a href="#">Page 19</a>
<b>Watanabe, 2019</b>	Is use of warning lights and sirens associated with increased risk of ambulance crashes? A contemporary analysis using National EMS Information System (NEMSIS) data	<a href="#">Paid Access</a>	Original Research	<a href="#">Page 21</a>

## TITLE

*EMS agencies with high rates of field termination of resuscitation and longer scene times also have high rates of survival*

## CATEGORY

Original Research

## EMS MEDICINE CORE CONTENT AREA(S)

- **1.1. Time/Life-Critical Conditions**
  - 1.1.1. Cardiac Arrest

## REFERENCE

Berry CL, Olaf MF, Kupas DF, Berger A, Knorr AC, Group CS. EMS agencies with high rates of field termination of resuscitation and longer scene times also have high rates of survival. Resuscitation. 2021;169:205-13.

PMID: [34666123](#)

## ACCESSIBILITY

Paid Access

## PUBLISHED ABSTRACT

**Aim:** Out-of-hospital cardiac arrest (OOHCA) management dichotomizes strategies to (1) “scoop-and-run” to a higher level of care or (2) “treat on the X” with the goal of return of spontaneous circulation (ROSC) before transport, with field termination of resuscitation (FTOR) of unsuccessful resuscitations. We hypothesized that EMS agencies with greater average time on-scene and higher rates of field termination of resuscitation would have more favorable outcomes.

**Methods:** The Cardiac Arrest Registry to Enhance Survival (CARES) was used to identify OOHCA cases from 2013 to 2018. Agencies in the top and bottom quartiles of on-scene time were categorized as high (HiOST) and low (LoOST); in the top and bottom quartiles of field termination rate were categorized as high (HiTOR) and low (LoTOR). Generalized estimating equation models compared top and bottom quartiles.

**Results:** We classified 95 agencies as HiOST (average > 25.1 min) or LoOST (average < 19.3 min). We classified 95 agencies as HiTOR (average > 46.5% FTOR) or LoTOR (average < 23.5% FTOR). Controlling for agency characteristics, HiOST had a higher survival to discharge for transported patients (28.1% vs 23.1%, OR = 2.8, 95 %CI 2.1–3.6,  $p < 0.001$ ), ROSC on emergency department arrival, and favorable neurologic outcome than LoOST. HiTOR had a higher survival to discharge for transported patients (25.6% vs 19.3%, OR = 3.3, 95 %CI 2.5–4.4,  $p < 0.001$ ), ROSC on emergency department arrival, and favorable neurologic outcome than LoTOR.

**Conclusion:** EMS agencies with higher rates of FTOR and longer on-scene times for patients with OOHCA have higher overall patient survival, ROSC, and favorable neurologic function.

## SUMMARY OF PUBLICATION

Berry et al. obtained data from the Cardiac Arrest Registry to Enhance Survival (CARES) to evaluate if EMS agencies with greater average time on-scene and higher rates of field termination of resuscitation would have more favorable outcomes. After identifying out-of-hospital cardiac arrest (OHCA) cases from 2013 to 2018, they classified 95 agencies into high on-scene time (HiOST, average >25.1 min) and low on-scene time (LoOST, average <19.3 min) as the top and bottom quartiles.

Controlling for agency characteristics, HiOST had a higher survival to discharge for transported patients (28.1% vs 23.1%, OR 2.8, 95%CI 2.1–3.6,  $P<0.001$ ), ROSC on emergency department arrival, and favorable neurologic outcome than LoOST. HiTOR had a higher survival to discharge for transported patients (25.6% vs 19.3%, OR 3.3, 95 %CI 2.5–4.4,  $P<0.001$ ), ROSC on emergency department arrival, and favorable neurologic outcome than LoTOR.

This study highlights that EMS agencies with higher rates of on-scene resuscitation for OHCA have higher overall patient survival, ROSC, and favorable neurological function.

## TITLE

*Association of intra-arrest transport vs continued on-scene resuscitation with survival to hospital discharge among patients with out-of-hospital cardiac arrest*

## CATEGORY

Original Research

## EMS MEDICINE CORE CONTENT AREA(S)

- **1.1. Time/Life Critical Conditions**
  - 1.1.1. Cardiac Arrest

## REFERENCE

Grunau B, Kime N, Leroux B, Rea T, Van Belle G, Menegazzi JJ, Kudenchuk PJ, Vaillancourt C, Morrison LJ, Elmer J, et al. Association of Intra-arrest Transport vs Continued On-Scene Resuscitation With Survival to Hospital Discharge Among Patients With Out-of-Hospital Cardiac Arrest. JAMA. 2020;324(11):1058-67.

PMID: [32930759](https://pubmed.ncbi.nlm.nih.gov/32930759/)

## ACCESIBILITY

Paid Access

## PUBLISHED ABSTRACT

**Importance:** There is wide variability among emergency medical systems (EMS) with respect to transport to hospital during out-of-hospital cardiac arrest (OHCA) resuscitative efforts. The benefit of intra-arrest transport during resuscitation compared with continued on-scene resuscitation is unclear.

**Objective:** To determine whether intra-arrest transport compared with continued on-scene resuscitation is associated with survival to hospital discharge among patients experiencing OHCA.

**Design, Setting, and Participants:** Cohort study of prospectively collected consecutive nontraumatic adult EMS-treated OHCA data from the Resuscitation Outcomes Consortium (ROC) Cardiac Epidemiologic Registry (enrollment, April 2011-June 2015 from 10 North American sites; follow-up until the date of hospital discharge or death [regardless of when either event occurred]). Patients treated with intra-arrest transport (exposed) were matched with patients in refractory arrest (at risk of intra-arrest transport) at that same time (unexposed), using a time-dependent propensity score. Subgroups categorized by initial cardiac rhythm and EMS-witnessed cardiac arrests were analyzed.

**Exposures:** Intra-arrest transport (transport initiated prior to return of spontaneous circulation), compared with continued on-scene resuscitation.

**Main Outcomes and Measures:** The primary outcome was survival to hospital discharge, and the secondary outcome was survival with favorable neurological outcome (modified Rankin scale <3) at hospital discharge.

**Results:** The full cohort included 43 969 patients with a median age of 67 years (interquartile range, 55-80), 37% were women, 86% of cardiac arrests occurred in a private location, 49% were bystander- or EMS-witnessed, 22% had initial shockable rhythms, 97% were treated by out-of-hospital advanced life support, and 26% underwent intra-arrest transport. Survival to hospital discharge was 3.8% for patients who underwent intra-arrest transport and 12.6% for those who received on-scene resuscitation. In the propensity-matched cohort, which included 27 705 patients, survival to hospital discharge occurred in 4.0% of patients who underwent intra-arrest transport vs 8.5% who received on-scene resuscitation (risk difference, 4.6% [95% CI, 4.0%- 5.1%]). Favorable neurological outcome occurred in 2.9% of patients who underwent intra-arrest transport vs 7.1% who received on-scene resuscitation (risk difference, 4.2% [95% CI, 3.5%-4.9%]). Subgroups of initial shockable and nonshockable rhythms as well as EMS-witnessed and unwitnessed cardiac arrests all had a significant association between intra-arrest transport and lower probability of survival to hospital discharge.

**Conclusions and Relevance:** Among patients experiencing out-of-hospital cardiac arrest, intra-arrest transport to hospital compared with continued on-scene resuscitation was associated with lower probability of survival to hospital discharge. Study findings are limited by potential confounding due to observational design.

## SUMMARY OF PUBLICATION

Grunau et al. performed a cohort study of nontraumatic adult EMS-treated OHCA patients from the Resuscitation Outcomes Consortium registry. They matched and compared patients treated with intra-arrest transport with patients in refractory arrest without transport using a time-dependent propensity score to evaluate survival to hospital discharge and survival with favorable neurological outcome at hospital discharge.

A cohort of 43,969 patients were included, of which 27,705 patients comprised the propensity-matched cohort. Survival to hospital discharge was 3.8% versus 12.6% for patients who did or did not undergo intra-arrest transport, respectively. In the propensity-matched cohort, survival to hospital discharge occurred in 4.0% vs 8.5% of patients who did or did not undergo intra-arrest transport, respectively (risk difference, 4.6% [95%CI, 4.0%-5.1%]). Favorable neurological outcome occurred in 2.9% versus 7.1% of patients who did or did not undergo intra-arrest transport, respectively (risk difference, 4.2% [95%CI, 3.5%-4.9%]).

This study highlights that patients undergoing intra-arrest transport to the hospital compared to continued on-scene resuscitation were associated with lower probability of survival to hospital discharge.

## TITLE

*Tranexamic acid during prehospital transport in patients at risk for hemorrhage after injury: A double-blind, placebo-controlled, randomized clinical trial*

## CATEGORY

Original Research

## EMS MEDICINE CORE CONTENT AREA(S)

- **1.1 Time/Life Critical Conditions**
  - 1.1.3 Hypotension and Shock
- **1.2 Injury**
  - 1.2.1 Trauma

## REFERENCE

Guyette FX, Brown JB, Zenati MS, Early-Young BJ, Adams PW, Eastridge BJ, Nirula R, Vercruyse GA, O'Keeffe T, Joseph B, et al. Tranexamic Acid During Prehospital Transport in Patients at Risk for Hemorrhage After Injury: A Double-blind, Placebo-Controlled, Randomized Clinical Trial. *JAMA surgery*. 2020.

PMID: [33016996](#)

## ACCESIBILITY

Paid Access

## PUBLISHED ABSTRACT

**Importance:** In-hospital administration of tranexamic acid after injury improves outcomes in patients at risk for hemorrhage. Data demonstrating the benefit and safety of the pragmatic use of tranexamic acid in the prehospital phase of care are lacking for these patients.

**Objective:** To assess the effectiveness and safety of tranexamic acid administered before hospitalization compared with placebo in injured patients at risk for hemorrhage.

**Design, Setting, and Participants:** This pragmatic, phase 3, multicenter, double-blind, placebo-controlled, superiority randomized clinical trial included injured patients with prehospital hypotension (systolic blood pressure  $\leq 90$  mm Hg) or tachycardia (heart rate  $\geq 110$ /min) before arrival at 1 of 4 US level 1 trauma centers, within an estimated 2 hours of injury, from May 1, 2015, through October 31, 2019.

**Interventions:** Patients received 1 g of tranexamic acid before hospitalization (447 patients) or placebo (456 patients) infused for 10 minutes in 100 mL of saline. The randomization scheme used prehospital and in-hospital phase assignments, and patients administered tranexamic acid were allocated to abbreviated, standard, and repeat bolus dosing regimens on trauma center arrival.

**Main Outcomes and Measures:** The primary outcome was 30-day all-cause mortality.

**Results:** In all, 927 patients (mean [SD] age, 42 [18] years; 686 [74.0%] male) were eligible for prehospital enrollment (460 randomized to tranexamic acid intervention; 467 to placebo intervention).



After exclusions, the intention-to-treat study cohort comprised 903 patients: 447 in the tranexamic acid arm and 456 in the placebo arm. Mortality at 30 days was 8.1% in patients receiving tranexamic acid compared with 9.9% in patients receiving placebo (difference,  $-1.8\%$ ; 95% CI,  $-5.6\%$  to  $1.9\%$ ;  $P = .17$ ). Results of Cox proportional hazards regression analysis, accounting for site, verified that randomization to tranexamic acid was not associated with a significant reduction in 30-day mortality (hazard ratio, 0.81; 95% CI, 0.59-1.11,  $P = .18$ ). Prespecified dosing regimens and post-hoc subgroup analyses found that prehospital tranexamic acid were associated with significantly lower 30-day mortality. When comparing tranexamic acid effect stratified by time to treatment and qualifying shock severity in a post hoc comparison, 30-day mortality was lower when tranexamic acid was administered within 1 hour of injury ( $4.6\%$  vs  $7.6\%$ ; difference,  $-3.0\%$ ; 95% CI,  $-5.7\%$  to  $-0.3\%$ ;  $P < .002$ ). Patients with severe shock (systolic blood pressure  $\leq 70$  mm Hg) who received tranexamic acid demonstrated lower 30-day mortality compared with placebo ( $18.5\%$  vs  $35.5\%$ ; difference,  $-17\%$ ; 95% CI,  $-25.8\%$  to  $-8.1\%$ ;  $P < .003$ ).

**Conclusions and Relevance:** In injured patients at risk for hemorrhage, tranexamic acid administered before hospitalization did not result in significantly lower 30-day mortality. The prehospital administration of tranexamic acid after injury did not result in a higher incidence of thrombotic complications or adverse events. Tranexamic acid given to injured patients at risk for hemorrhage in the prehospital setting is safe and associated with survival benefit in specific subgroups of patients.

## SUMMARY OF PUBLICATION

Guyette et al. performed a multicenter, double-blind, placebo-controlled, superiority randomized clinical trial of 927 prehospital trauma patients with hypotension (systolic blood pressure  $\leq 90$  mmHg) or tachycardia (heart rate  $\geq 110$ /min) before arrival at 1 of 4 US level 1 trauma centers, within an estimated 2 hours of injury.

Patients were randomized to receive 1 g of tranexamic acid before hospitalization or placebo. A non-significant decrease in mortality at 30 days was found in patients receiving tranexamic acid compared to placebo ( $8.1\%$  versus  $9.9\%$ ; difference,  $-1.8\%$ ; 95%CI,  $-5.6\%$  to  $1.9\%$ ;  $p=0.17$ ). However, in pre-planned subgroup analyses, 30-day mortality was lower when tranexamic acid was administered within 1 hour of injury ( $4.6\%$  vs  $7.6\%$ ; difference,  $-3.0\%$ ; 95%CI,  $-5.7\%$  to  $-0.3\%$ ;  $p<0.002$ ) and in patients with severe shock (systolic blood pressure  $\leq 70$  mmHg) ( $18.5\%$  vs  $35.5\%$ ; difference,  $-17\%$ ; 95%CI,  $-25.8\%$  to  $-8.1\%$ ;  $p<0.003$ ). Administration did not result in a higher incidence of thrombotic complications or adverse events.

In summary, while use of tranexamic acid before hospitalization in injured patients at risk of hemorrhage did not result in significant lower 30-day mortality, it was demonstrated to be beneficial in the subgroups treated within 1 hour of injury or with severe shock.

## TITLE

*Recommendations for regional stroke destination plans in rural, suburban, and urban communities*

## CATEGORY

Guidance Document

## EMS MEDICINE CORE CONTENT AREA(S)

- **1.3 Medical Emergencies**
  - 1.3.3 Neurological
- **2.2 EMS Systems**
  - 2.2.3 Delivery Systems with Special Considerations

## REFERENCE

Jauch EC, Schwamm LH, Panagos PD, Barbazzeni J, Dickson R, Dunne R, Foley J, Fraser JF, Lassers G, Martin-Gill C, et al. Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities From the Prehospital Stroke System of Care Consensus Conference: A Consensus Statement From the American Academy of Neurology, American Heart Association/American Stroke Association, American Society of Neuroradiology, National Association of EMS Physicians, National Association of State EMS Officials, Society of NeuroInterventional Surgery, and Society of Vascular and Interventional Neurology: Endorsed by the Neurocritical Care Society. *Stroke*. 2021;52(5):e133-e52.

PMID: [33691507](https://pubmed.ncbi.nlm.nih.gov/33691507/)

## ACCESIBILITY

Paid Access

## PUBLISHED ABSTRACT

*No abstract available*

## SUMMARY OF PUBLICATION

Jauch et al. report a consensus statement on behalf of the Prehospital Stroke Systems of Care Consensus Conference, comprised of leading national experts in prehospital acute stroke care, that was convened at the AHA/ASA International Stroke Conference in January 2018.

This statement reviews the current accreditation and certification of health care facilities relevant to the care of acute stroke patients and their distribution across the United States. Three working groups from this consensus panel were established to evaluate and report on specific considerations for the care of prehospital stroke patients in urban, suburban, and rural settings. Common principles for care of stroke patients across settings are provided and include establishing destination plans, engaging in public education, utilizing 911 stroke screening, integration of EMS into hospital systems of care, and use of evidence-based stroke care.

Specific considerations and recommendations are outlined for urban, suburban, and rural areas highlighting common differences and challenges among these settings relevant to available prehospital

care and health care facilities. Specific recommendations tailored to each of these EMS system communities are provided.

In summary, this consensus statement provides concrete recommendations for enhancing stroke care across various EMS settings with consideration of the latest available hospital-based resources for acute stroke care.

## TITLE

*Coronary angiography after cardiac arrest without ST-segment elevation*

## CATEGORY

Original Research

## EMS MEDICINE CORE CONTENT AREA(S)

- **1.3 Medical Emergencies**
  - 1.3.2 Cardiovascular

## REFERENCE

Lemkes JS, Janssens GN, van der Hoeven NW, Jewbali LSD, Dubois EA, Meuwissen M, Rijpstra TA, Bosker HA, Blans MJ, Bleeker GB, et al. Coronary Angiography after Cardiac Arrest without ST-Segment Elevation. *N Engl J Med*. 2019;380(15):1397-407.

PMID: [30883057](#)

## ACCESSIBILITY

Paid Access

## PUBLISHED ABSTRACT

**Background:** Ischemic heart disease is a major cause of out-of-hospital cardiac arrest. The role of immediate coronary angiography and percutaneous coronary intervention (PCI) in the treatment of patients who have been successfully resuscitated after cardiac arrest in the absence of ST-segment elevation myocardial infarction (STEMI) remains uncertain.

**Methods:** In this multicenter trial, we randomly assigned 552 patients who had cardiac arrest without signs of STEMI to undergo immediate coronary angiography or coronary angiography that was delayed until after neurologic recovery. All patients underwent PCI if indicated. The primary end point was survival at 90 days. Secondary end points included survival at 90 days with good cerebral performance or mild or moderate disability, myocardial injury, duration of catecholamine support, markers of shock, recurrence of ventricular tachycardia, duration of mechanical ventilation, major bleeding, occurrence of acute kidney injury, need for renal-replacement therapy, time to target temperature, and neurologic status at discharge from the intensive care unit.

**Results:** At 90 days, 176 of 273 patients (64.5%) in the immediate angiography group and 178 of 265 patients (67.2%) in the delayed angiography group were alive (odds ratio, 0.89; 95% confidence interval [CI], 0.62 to 1.27; P=0.51). The median time to target temperature was 5.4 hours in the immediate angiography group and 4.7 hours in the delayed angiography group (ratio of geometric means, 1.19; 95% CI, 1.04 to 1.36). No significant differences between the groups were found in the remaining secondary end points.

**Conclusions:** Among patients who had been successfully resuscitated after out-of-hospital cardiac arrest and had no signs of STEMI, a strategy of immediate angiography was not found to be better than a

strategy of delayed angiography with respect to overall survival at 90 days. (Funded by the Netherlands Heart Institute and others; COACT Netherlands Trial Register number, NTR4973).

## **SUMMARY OF PUBLICATION**

Lemkes et al. performed a multicenter, randomized controlled trial of 552 patients who had cardiac arrest without signs of ST-elevation myocardial infarction (STEMI) to undergo immediate or delayed (until neurological recovery) coronary angiography.

The primary and secondary outcomes were survival at 90 days and survival at 90 days with good cerebral performance or mild or moderate disability, myocardial injury, duration of catecholamine support, markers of shock, recurrence of ventricular tachycardia, duration of mechanical ventilation, major bleeding, occurrence of acute kidney injury, need for renal-replacement therapy, time to target temperature, and neurologic status at discharge from the intensive care unit. At 90 days, 64.5% versus 67.2% of the delayed angiography group were alive (OR 0.89, 95% CI 0.62-1.27,  $p=0.51$ ).

There were no significant differences between the groups in the secondary end points. This study identified that among patients who had been resuscitated after OHCA and have no signs of STEMI, a strategy of immediate angiography was not better than delayed angiography with respect to overall survival at 90 days.

## TITLE

*Ketamine use in prehospital and hospital treatment of the acute trauma patient: a joint position statement*

## CATEGORY

Position Statement

## EMS MEDICINE CORE CONTENT AREA(S)

- **1.2 Injury**
  - 1.2.1 Trauma
- **1.4 Special Clinical Considerations**
  - 1.4.3 Pain Assessment and Management in the Field

## REFERENCE

Morgan MM, Perina DG, Acquisto NM, Fallat ME, Gallagher JM, Brown KM, Ho J, Burnett A, Lairet J, Rowe D, et al. Ketamine Use in Prehospital and Hospital Treatment of the Acute Trauma Patient: A Joint Position Statement. *Prehosp Emerg Care.* 2021;25(4):588-92.

PMID: [32776812](https://pubmed.ncbi.nlm.nih.gov/32776812/)

## ACCESIBILITY

Paid Access

## PUBLISHED ABSTRACT

The American College of Surgeons Committee on Trauma (ACS-COT), the American College of Emergency Physicians (ACEP), the National Association of State EMS Officials (NASEMSO), the National Association of EMS Physicians (NAEMSP) and the National Association of EMTs (NAEMT) have previously offered varied guidance on the use of ketamine in trauma patients. The following consensus statement represents the collective positions of the ACS-COT, ACEP, NASEMSO, NAEMSP and NAEMT. This updated uniform guidance is intended for use by emergency medical services (EMS) personnel, EMS medical directors, emergency physicians, trauma surgeons, nurses and pharmacists in their treatment of the trauma patient in both the prehospital and hospital setting.

## SUMMARY OF PUBLICATION

Morgan et al. report a joint position statement on the use of ketamine in prehospital and hospital treatment of the acute trauma patient on behalf of the American College of Surgeons Committee on Trauma (ACS-COT), the American College of Emergency Physicians (ACEP), the National Association of State EMS Officials (NASEMSO), the National Association of EMS Physicians (NAEMSP) and the National Association of EMTs (NAEMT). This position statement identifies appropriate indications for use of ketamine in trauma patients, contraindications, and considerations for dosing and safety. Potential complications and side effects are reviewed, along with specific considerations for use of ketamine in patients with head and eye injuries. Use in combination with other drugs, including non-prescribed drugs, is also reviewed.

Finally, special considerations for geriatric and pediatric patients are included. This consensus overall outlines the role and key considerations for use of ketamine in prehospital and in-hospital trauma patients.

## TITLE

*Association of statewide implementation of the prehospital traumatic brain injury treatment guidelines with patient survival following traumatic brain injury: The excellence in prehospital injury care (EPIC) study*

## CATEGORY

Original Research

## EMS MEDICINE CORE CONTENT AREA(S)

- **1.2 Injury**
  - 1.2.3 Traumatic Brain Injuries

## REFERENCE

[Spaite DW, Bobrow BJ, Keim SM, Barnhart B, Chikani V, Gaither JB, Sherrill D, Denninghoff KR, Mullins T, Adelson PD, et al. Association of Statewide Implementation of the Prehospital Traumatic Brain Injury Treatment Guidelines With Patient Survival Following Traumatic Brain Injury: The Excellence in Prehospital Injury Care \(EPIC\) Study. JAMA surgery. 2019;154\(7\):e191152.](#)

PMID: [31066879](#)

## ACCESIBILITY

Paid Access

## PUBLISHED ABSTRACT

**Importance:** Traumatic brain injury (TBI) is a massive public health problem. While evidence-based guidelines directing the prehospital treatment of TBI have been promulgated, to our knowledge, no studies have assessed their association with survival.

**Objective:** To evaluate the association of implementing the nationally vetted, evidence-based, prehospital treatment guidelines with outcomes in moderate, severe, and critical TBI.

**Design, Setting, and Participants:** The Excellence in Prehospital Injury Care (EPIC) Study included more than 130 emergency medical services systems/agencies throughout Arizona. This was a statewide, multisystem, intention-to-treat study using a before/after controlled design with patients with moderate to critically severe TBI (US Centers for Disease Control and Prevention Barell Matrix-Type 1 and/or Abbreviated Injury Scale Head region severity  $\geq 3$ ) transported to trauma centers between January 1, 2007, and June 30, 2015. Data were analyzed between October 25, 2017, and February 22, 2019.

**Interventions:** Implementation of the prehospital TBI guidelines emphasizing avoidance/treatment of hypoxia, prevention/correction of hyperventilation, and avoidance/treatment of hypotension.

**Main Outcomes and Measures:** Primary: survival to hospital discharge; secondary: survival to hospital admission.

**Results:** Of the included patients, the median age was 45 years, 14 666 (67.1%) were men, 7181 (32.9%) were women; 16 408 (75.1%) were white, 1400 (6.4%) were Native American, 743 (3.4%) were Black, 237 (1.1%) were Asian, and 2791 (12.8%) were other race/ethnicity. Of the included patients,



21 852 met inclusion criteria for analysis (preimplementation phase [P1]: 15 228; postimplementation [P3]: 6624). The primary analysis (P3 vs P1) revealed an adjusted odds ratio (aOR) of 1.06 (95% CI, 0.93-1.21;  $P = .40$ ) for survival to hospital discharge. The aOR was 1.70 (95% CI, 1.38-2.09;  $P < .001$ ) for survival to hospital admission. Among the severe injury cohorts (but not moderate or critical), guideline implementation was significantly associated with survival to discharge (Regional Severity Score–Head 3-4: aOR, 2.03; 95% CI, 1.52-2.72;  $P < .001$ ; Injury Severity Score 16-24: aOR, 1.61; 95% CI, 1.07-2.48;  $P = .02$ ). This was also true for survival to discharge among the severe, intubated subgroups (Regional Severity Score–Head 3-4: aOR, 3.14; 95% CI, 1.65-5.98;  $P < .001$ ; Injury Severity Score 16-24: aOR, 3.28; 95% CI, 1.19-11.34;  $P = .02$ ).

**Conclusions and Relevance:** Statewide implementation of the prehospital TBI guidelines was not associated with significant improvement in overall survival to hospital discharge (across the entire, combined moderate to critical injury spectrum). However, adjusted survival doubled among patients with severe TBI and tripled in the severe, intubated cohort. Furthermore, guideline implementation was significantly associated with survival to hospital admission. These findings support the widespread implementation of the prehospital TBI treatment guidelines.

## SUMMARY OF PUBLICATION

Spaite et al. evaluated implementation of the Excellence in Prehospital Injury Care (EPIC) Study prehospital traumatic brain injury (TBI) guidelines across more than 130 EMS agencies throughout Arizona.

These guidelines emphasize avoidance/treatment of hypoxia, prevention/correction of hyperventilation, and avoidance/treatment of hypotension. There were 21,852 patients that met inclusion criteria for analysis. Comparison of the post-implementation versus pre-implementation phases revealed an adjusted odds ratio (aOR) of 1.06 (95%CI, 0.93-1.21;  $P=0.40$ ) for survival to hospital discharge. The aOR was 1.70 (95%CI, 1.38-2.09;  $p<0.001$ ) for survival to hospital admission. Among the severe injury cohorts (but not moderate or critical), guideline implementation was significantly associated with survival to discharge (Regional Severity Score–Head 3-4: aOR, 2.03; 95%CI, 1.52-2.72;  $p<0.001$ ; Injury Severity Score 16-24: aOR, 1.61; 95%CI, 1.07-2.48;  $P=0.02$ ). This was also true for survival to discharge among the severe, intubated subgroups (Regional Severity Score–Head 3-4: aOR, 3.14; 95%CI, 1.65-5.98;  $p<0.001$ ; Injury Severity Score 16-24: aOR, 3.28; 95%CI, 1.19-11.34;  $p=0.02$ ).

This study highlights the potential positive impact of implementation of the EPIC TBI guidelines on survival to hospital discharge for patients with severe TBI.

## TITLE

*Systematic review of evidence-based guidelines for prehospital care*

## CATEGORY

Systematic Review

## EMS MEDICINE CORE CONTENT AREA(S)

- **3.1 Quality Improvement Principles and Programs**
  - *3.1.3 Evidence-based Practice*
- **3.2 Research**
  - *3.2 EMS Research Design*

## REFERENCE

Turner S, Lang ES, Brown K, Franke J, Workun-Hill M, Jackson C, Roberts L, Leyton C, Bulger EM, Censullo EM, et al. Systematic Review of Evidence-Based Guidelines for Prehospital Care. *Prehosp Emerg Care*. 2021;25(2):221-34.

PMID: [32286899](https://pubmed.ncbi.nlm.nih.gov/32286899/)

## ACCESIBILITY

Paid Access

## PUBLISHED ABSTRACT

**Introduction:** Multiple national organizations have identified a need to incorporate more evidence-based medicine in emergency medical services (EMS) through the creation of evidence-based guidelines (EBGs). Tools like the Appraisal of Guidelines for Research and Evaluation (AGREE) II and criteria outlined by the National Academy of Medicine (NAM) have established concrete recommendations for the development of high-quality guidelines. While many guidelines have been created that address topics within EMS medicine, neither the quantity nor quality of prehospital EBGs have been previously reported.

**Objectives:** To perform a systematic review to identify existing EBGs related to prehospital care and evaluate the quality of these guidelines using the AGREE II tool and criteria for clinical guidelines described by the NAM.

**Methods:** We performed a systematic search of the literature in MEDLINE, EMBASE, PubMed, Trip, and guidelines.gov, through September 2018. Guideline topics were categorized based on the 2019 Core Content of EMS Medicine. Two independent reviewers screened titles for relevance and then abstracts for essential guideline features. Included guidelines were appraised with the AGREE II tool across 6 domains by 3 independent reviewers and scores averaged. Two additional reviewers determined if each guideline reported the key elements of clinical practice guidelines recommended by the NAM via consensus.

**Results:** We identified 71 guidelines, of which 89% addressed clinical aspects of EMS medicine. Only 9 guidelines scored >75% across AGREE II domains and most (63%) scored between 50 and 75%.

Domain 4 (Clarity of Presentation) had the highest (79.7%) and domain 5 (Applicability) had the lowest average score across EMS guidelines. Only 38% of EMS guidelines included a reporting of all criteria identified by the NAM for clinical practice guidelines, with elements of a systematic review of the literature most commonly missing.

**Conclusions:** EBGs exist addressing a variety of topics in EMS medicine. This systematic review and appraisal of EMS guidelines identified a wide range in the quality of these guidelines and variable reporting of key elements of clinical guidelines. Future guideline developers should consider established methodological and reporting recommendations to improve the quality of EMS guidelines.

## SUMMARY OF PUBLICATION

Turner et al. report the first systematic review of prehospital evidence-based guidelines by the Prehospital Guidelines Consortium. This systematic review identified all existing evidence-based guidelines relevant to prehospital care since inception of several scientific databases through September 2018. A total of 71 evidence-based guidelines were identified and the quality of their evidence evaluation was graded using the Appraisal of Guidelines for Research and Evaluation (AGREE) II tool. Guidelines were also categorized based on meeting the National Academy of Medicine (NAM) criteria for high-quality guidelines. This review identified only 38% of guidelines met all NAM criteria for high-quality guidelines and 9 scored >75% across AGREE II domains. This systematic review provides the first aggregate report of existing prehospital EBGs and highlights key high-quality guidelines that were published prior to September 2018.

This work has since been supplemented by a second systematic review completed for guidelines published between 2018 through mid-2021, reported separately as part of the collaborative agreement between the PGC and NREMT.

## TITLE

*Death by suicide – The EMS profession compared to the general public*

## CATEGORY

Original Research

## EMS MEDICINE CORE CONTENT AREA(S)

- **2.3 EMS Personnel**
  - 2.3.3 EMS Provider Health and Wellness

## REFERENCE

Vigil NH, Grant AR, Perez O, Blust RN, Chikani V, Vadeboncoeur TF, Spaite DW, Bobrow BJ. Death by Suicide-The EMS Profession Compared to the General Public. *Prehosp Emerg Care*. 2019;23(3):340-5.

PMID: [30136908](https://pubmed.ncbi.nlm.nih.gov/30136908/)

## ACCESSIBILITY

Paid Access

## PUBLISHED ABSTRACT

**Background:** In 2016, nearly 45,000 deaths in the United States were attributed to suicide making this the 10th leading cause of death for all ages. National survey data suggest that among Emergency Medical Technicians (EMTs), including firefighters and Paramedics, rates of suicide are significantly higher than among the general public. EMTs face high levels of acute and chronic stress as well as high rates of depression and substance abuse, which increase their risk of suicide.

**Objective/Aim:** To determine the statewide Mortality Odds Ratio (MOR) of suicide completion among EMTs as compared to non-EMTs in Arizona.

**Methods:** We analyzed the Arizona Vital Statistics Information Management System Electronic Death Registry of all adult ( $\geq 18$ ) deaths between January 1, 2009 and December 31, 2015. Manual review of decedent occupation was performed to identify the EMT cohort; all other deaths were included in the non-EMT cohort. Using the underlying cause of death as the outcome, we calculated the MOR of both the EMT and non-EMT cohorts.

**Results:** There were a total of 350,998 deaths during the study period with 7,838 categorized as suicide. The proportion of deaths attributed to suicide among EMTs was 5.2% (63 of 1,205 total deaths) while the percentage among non-EMTs was 2.2% (7,775/349,793) ( $p < 0.0001$ ). The crude Mortality Odds Ratio for EMTs compared with non-EMTs was [cMOR 2.43; 95% CI (1.88–3.13)]. After adjusting for gender, age, race, and ethnicity, EMTs had higher odds that their death was by suicide than non-EMTs [aMOR: 1.39; 95% CI (1.06–1.82)].

**Conclusion:** In this statewide analysis, we found that EMTs had a significantly higher Mortality Odds Ratio due to suicide compared to non-EMTs. Further research is necessary to identify the underlying causes of suicide among EMTs and to develop effective prevention strategies.

## SUMMARY OF PUBLICATION

Vigil et al. highlight that in 2016, nearly 45,000 deaths in the United States were attributed to suicide, making this the 10th leading cause of death for all ages and that national survey data suggests that EMS personnel (firefighters, EMTs, and paramedics) may have higher rates of suicide compared to the general public.

This study aimed to determine the statewide Mortality Odds Ratio (MOR) of suicide completion among EMS personnel compared to non-EMS personnel in Arizona. In a 7-year analysis (2009-2015) of the Arizona Vital Statistics Information Management System Electronic Death Registry for adult deaths, EMS occupation was determined by manual review. A total of 7,838 of 350,998 deaths were categorized as suicide; 5.2% of deaths were attributable to suicide among EMS personnel versus 2.2% among non-EMS personnel ( $p < 0.001$ ). After adjusting for gender, age, race, and ethnicity, EMS personnel had higher odds of death by suicide compared to the general public (aMOR 1.39, 95%CI 1.06–1.82).

This study highlights a significantly higher Mortality Odds Ratio among EMS personnel compared to the general public and the need for future research and effective prevention strategies to address the underlying causes of suicide among EMS personnel.

## TITLE

*Is use of warning lights and sirens associated with increased risk of ambulance crashes? A contemporary analysis using National EMS Information System (NEMSIS) data*

## CATEGORY

Original Research

## EMS MEDICINE CORE CONTENT AREA(S)

- **2.3 EMS Personnel**
  - 2.3.3 EMS Provider Health and Wellness
- **2.2 EMS Systems**
  - 2.2.1 Public Safety Answering Points
  - 2.2.2 Design of System Components

## REFERENCE

[Watanabe BL, Patterson GS, Kempema JM, Magallanes O, Brown LH. Is Use of Warning Lights and Sirens Associated With Increased Risk of Ambulance Crashes? A Contemporary Analysis Using National EMS Information System \(NEMSIS\) Data. \*Ann Emerg Med.\* 2019;74\(1\):101-9.](#)

PMID: [30648537](#)

## ACCESSIBILITY

Paid Access

## PUBLISHED ABSTRACT

**Study objective:** We compare reported crash rates for US ambulances responding to or transporting patients from a 911 emergency scene with or without lights and sirens. Our null hypothesis is that there will be no difference in the rate of ambulance crashes whether lights and sirens are used.

**Methods:** For this retrospective cohort study, we used the 2016 National EMS Information System data set to identify 911 scene responses and subsequent patient transports by transport-capable emergency medical services (EMS) units. We used the system's "response mode to scene" and "transport mode from scene" fields to determine lights and sirens use. We used the "type of response delay" and "type of transport delay" fields to identify responses and transports that were delayed because of a crash involving the ambulance. We calculated the rate of crash-related delays per 100,000 responses or transports and used multivariable logistic regression with clustered (by agency) standard errors to calculate adjusted odds ratios (AORs) (with 95% confidence intervals [CIs]) for the association between crash-related delays and lights and sirens use for responses and transports separately.

**Results:** Among 19 million included 911 scene responses, the response phase crash rate was 4.6 of 100,000 without lights and sirens and 5.4 of 100,000 with lights and sirens (AOR 1.5; 95% CI 1.2 to 1.9). For the transport phase, the crash rate was 7.0 of 100,000 without lights and sirens and 17.1 of 100,000 with lights and sirens (AOR 2.9; 95% CI 2.2 to 3.9). Excluding responses and transports with only partial

lights and sirens use did not meaningfully alter the results (response AOR 1.5, 95% CI 1.2 to 1.9; transport AOR 2.8, 95% CI 2.1 to 3.8).

**Conclusion:** Ambulance use of lights and sirens is associated with increased risk of ambulance crashes. The association is greatest during the transport phase. EMS providers should weigh these risks against any potential time savings associated with lights and sirens use.

## **SUMMARY OF PUBLICATION**

Watanabe et al. performed a retrospective cohort study using the 2016 National EMS Information System data set to identify 911 scene responses and subsequent patient transports by transport-capable EMS units. They calculated the rate of crash-related delays per 100,000 responses or transports and used multivariable logistic regression to evaluate the association between crash-related delays and lights and siren use for responses and transports. Among 19 million 911 scene responses, the study identified a higher rate of crashes during responses with lights and siren use (5.4 per 100,000) versus without lights and siren use (4.6 per 100,000; AOR 1.5, 95%CI 1.2-1.9). Similarly, there was a higher rate of crashes during transport with lights and siren use (17.1 per 100,000) versus without lights and siren use (7.0 per 100,000; AOR 2.9, 95%CI 2.2-3.9).

This large nationally representative study identified an increased risk of ambulance crashes in both the response and transport phases with use of lights and siren and highlights the need to weight these risks against the potential time savings associated with lights and siren use.