

ORIGINAL ARTICLES

01. A review of the landscape: Challenges and gaps in trauma response to civilian high threat mass casualty incidents

Callaway DW. J Trauma Acute Care Surg. 2018 Jun;84(6S Suppl 1):S21-S27. doi: 10.1097/TA.0000000000001811.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/29370053>

The ultimate goal of the emergency response and trauma system is to reduce potentially preventable death from trauma. Tremendous advances in trauma care emerged from the past 15 years of United States' combat engagements around the globe. Unfortunately, combat and insurgency tactics have also metastasized to the civilian world, resulting in increasingly complex and dynamic acts of intentional mass violence. These high threat active violent incidents (AVIs) pose significant preparedness, response, and clinical care challenges to the civilian healthcare systems. Currently, there are several operational and policy gaps that limit the successful preparedness and response to AVIs and dynamic MCIs in the United States.

02. Impact of Trauma System Structure on Injury Outcomes: A Systematic Review and Meta-Analysis.

Moore L, et al., International Injury Care Improvement Initiative. World J Surg. 2018 May;42(5):1327-1339. doi: 10.1007/s00268-017-4292-0.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/29071424>

BACKGROUND:

The effectiveness of trauma systems in decreasing injury mortality and morbidity has been well demonstrated. However, little is known about which components contribute to their effectiveness. We aimed to systematically review the evidence of the impact of trauma system components on clinically important injury outcomes.

METHODS:

We searched MEDLINE, EMBASE, Cochrane CENTRAL, and BIOSIS/Web of Knowledge, gray literature and trauma association Web sites to identify studies evaluating the association between at least one trauma system component and injury outcome. We calculated pooled effect estimates using inverse-variance random-effects models. We evaluated quality of evidence using GRADE criteria.

RESULTS:

We screened 15,974 records, retaining 41 studies for qualitative synthesis and 19 for meta-analysis. Two recommended trauma system components were associated with reduced odds of mortality: inclusive design (odds ratio [OR] = 0.72 [0.65-0.80]) and helicopter transport (OR = 0.70 [0.55-0.88]). Pre-Hospital Advanced Trauma Life Support was associated with a significant reduction in hospital days (mean difference [MD] = 5.7 [4.4-7.0]) but a nonsignificant reduction in mortality (OR = 0.78 [0.44-1.39]). Population density of surgeons was associated with a nonsignificant decrease in mortality (MD = 0.58 [-0.22 to 1.39]). Trauma system maturity was associated with a significant reduction in mortality (OR = 0.76 [0.68-0.85]). Quality of evidence was low or very low for mortality and healthcare utilization.

CONCLUSIONS:

This review offers low-quality evidence for the effectiveness of an inclusive design and trauma system maturity and very-low-quality evidence for helicopter transport in reducing injury mortality. Further

research should evaluate other recommended components of trauma systems and non-fatal outcomes and explore the impact of system component interactions.

03. Resuscitative Strategies in the Trauma Patient: The Past, the Present, and the Future.

Eick BG, Denke NJ. J Trauma Nurs. 2018 Jul/Aug;25(4):254-263. doi: 10.1097/JTN.0000000000000383.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/29985861>

Over the last decade, trends in fluid resuscitation have changed dramatically as have our practices. Research is driving trauma centers across the globe to initiate modifications in fluid resuscitation of the hemorrhagic trauma patients both in the prehospital and intrahospital arena. This is being done by combining the theory of permissive hypotension and damage control surgery with hemostatic resuscitation as the preferred methods of resuscitation in patients with hemorrhagic shock. The literature illustrates that previous strategies we considered to be beneficial are actually detrimental to the outcomes of these severely injured patients. This complex and continuously changing adaptation in practice must be made without losing our strategic focus of improvement of outcomes and recognition of the morbidity associated with bleeding of the trauma patient. Designating limits on large-volume crystalloid resuscitation will prevent cellular injury. These wiser resuscitation strategies are key in the efforts to reduce mortality and to improve outcomes. This article is to serve as a review of each of the resuscitative fluid strategies as well as new methods of trauma resuscitation.

04. Prehospital emergency trauma care and management.

Kerby JD, Cusick MV. Surg Clin North Am. 2012 Aug;92(4):823-41, vii. doi: 10.1016/j.suc.2012.04.009.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/22850149>

Prehospital care of the trauma patient is continuing to evolve; however, the principles of airway maintenance, hemorrhage control, and appropriate resuscitative maneuvers remain central to the role of the emergency medical care provider. Recent changes in the regulations for research in emergency settings will allow randomized trials to proceed to test new devices, drugs, and resuscitative strategies in the prehospital environment. The creation of prehospital research networks will provide the appropriate infrastructure to greatly facilitate the development of new protocols and the execution of large-scale randomized trials with the potential to change current prehospital practice

05. Major Trauma Outside a Trauma Center: Prehospital, Emergency Department, and Retrieval Considerations.

Fedor PJ, et al. Emerg Med Clin North Am. 2018 Feb;36(1):203-218.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/29132578>

Care of the critically injured begins well before the patient arrives at a large academic trauma center. It is important to understand the continuum of care from the point of injury in the prehospital environment, through the local hospital and retrieval, until arrival at a trauma center capable of definitive care. This article highlights the important aspects of trauma assessment and management outside of tertiary or quaternary care hospitals. Key elements of each phase of care are reviewed, including management pearls and institutional strategies to facilitate effective and efficient treatment of trauma patients from the point of injury forward.

06. Trauma Systems: Origins, Evolution, and Current Challenges.

Pigneri DA, et al. Surg Clin North Am. 2017 Oct;97(5):947-959. doi: 10.1016/j.suc.2017.06.011.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/28958366>

Trauma is the leading cause of death among patients 46 years or younger, and having a system in place for the care of the injured is of paramount importance to the health of a community. The growth and development of civilian trauma systems has not been an easy process. The concept of regionalized health care that the trauma system models has been emulated by other specialized and time-sensitive areas of medicine, notably stroke and acute cardiac events. Continued process improvement, public education, support and involvement, a sound infrastructure, and integrated technology should remain our focus.

07. Assessment and Resuscitation in Trauma Management.

Gondek S, et al. Surg Clin North Am. 2017 Oct;97(5):985-998. doi: 10.1016/j.suc.2017.06.001.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/28958368>

The golden hour of trauma represents a crucial period in the management of acute injury. In an efficient trauma resuscitation, the primary survey is viewed as more than simple ABCs with multiple processes running in parallel. Resuscitation efforts should be goal oriented with defined endpoints for airway management, access, and hemodynamic parameters. In tandem with resuscitation, early identification of life-threatening injuries is critical for determining the disposition of patients when they leave the trauma bay. Salvage strategies for profoundly hypotensive or pulseless patients include retrograde balloon occlusion of the aorta and resuscitative thoracotomy, with differing populations benefiting from each.

08. Prehospital Assessment of Trauma.

Brown J, et al. Surg Clin North Am. 2017 Oct;97(5):961-983. doi: 10.1016/j.suc.2017.06.007.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/28958367>

The organization of prehospital care for trauma patients began in the military arena. At the urging of multiple stakeholders and providers, these lessons were applied to the civilian setting and emergency medical services were created across the nation. Advances have taken place in the triage, transport, and management of severely injured patients. Many issues remain in the care of trauma patients in the prehospital environment. Collaboration between stakeholders and providers, regionalization of trauma care, and protocol-driven care may be solutions to some of these issues. Further research is necessary to dictate standard of care in this early phase after injury.

09. Trauma Education and Prevention.

Sidwell R, et al. Surg Clin North Am. 2017 Oct;97(5):1185-1197. doi: 10.1016/j.suc.2017.06.010.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/28958365>

Trauma education and injury prevention are essential components of a robust trauma program. Educational programs address specific knowledge gaps and provide focused and structured learning. Advanced Trauma Life Support is the most well-known. Each offering seems to be valid, although it has been difficult to prove improved patient care outcomes owing specifically to any of them. Injury prevention offers the best opportunity to limit death and disability owing to trauma. Injury prevention initiatives have paid tremendous dividends in reducing the mortality rates for motor vehicle crashes. Modern injury prevention efforts focus on reducing distracted driver rates and increasing helmet use.

10. Balanced Resuscitation in Trauma Management.

Cantle PM, et al. Surg Clin North Am. 2017 Oct;97(5):999-1014. doi: 10.1016/j.suc.2017.06.002. Epub 2017 Aug 17.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/28958369>

Over the past decade substantial knowledge has been gained in understanding both the coagulopathy of trauma and the complications associated with aggressive crystalloid-based resuscitation. Balanced resuscitation, which includes permissive hypotension, limiting crystalloid use, and the transfusion of blood products in ratios similar to whole blood, has changed the previous standard of care. Prompt initiation of massive transfusion and the protocolled use of 1:1:1 product ratios have improved the morbidity and mortality of patients with trauma in hemorrhagic shock. Balanced resuscitation minimizes the impact of trauma-induced coagulopathy, limits blood product waste, and reduces the complications that occur with aggressive crystalloid resuscitation.

11. Does prehospital management by doctors affect outcome in major trauma? A systematic review.

Wilson SL, et al. J Trauma Acute Care Surg. 2017 Nov;83(5):965-974. doi:

10.1097/TA.0000000000001559.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/28590350>

BACKGROUND:

There is substantial variation worldwide in prehospital management of trauma and the role of doctors is controversial. The objective of this review was to determine whether prehospital management by doctors affects outcomes in major trauma, including the prespecified subgroup of severe traumatic brain injuries when compared with management by other advanced life support providers.

METHODS:

EMBASE, MEDLINE(R), PubMed, SciELO, Trip, Web of Science, and Zetoc were searched for published articles. HSRProj, OpenGrey, and the World Health Organization International Clinical Trials Registry Platform were searched for unpublished data. Relevant reference lists were hand-searched. There were no limits on publication year, but articles were limited to the English language. Authors were contacted for further information as required. Quality was assessed using the Downs and Black criteria. Mortality was the primary outcome, and disability was the secondary outcome of interest. Studies were subjected to a descriptive analysis alone without a meta-analysis due to significant study heterogeneity. All searches, quality assessment, data abstraction, and data analysis was performed by two reviewers independently.

RESULTS:

Two thousand thirty-seven articles were identified, 49 full-text articles assessed and eight studies included. The included studies consisted of one randomized controlled trial with 375 participants and seven observational studies with over 4,451 participants. All included studies were at a moderate to high risk of bias. Six of the eight included studies showed an improved outcome with prehospital management by doctors, five in terms of mortality and one in terms of disability. Two studies found no significant difference.

CONCLUSION:

There appears to be an association between prehospital management by doctors and improved survival in major trauma. There may also be an association with improved survival and better functional outcomes in severe traumatic brain injury. Further high-quality evidence is needed to confirm these findings.

LEVEL OF EVIDENCE:

Systematic review, level III.

12. Prehospital notification for major trauma patients requiring emergency hospital transport: A systematic review

Synnot A, et al. Australia-India Trauma System Collaboration. *J Evid Based Med*. 2017 Aug;10(3):212-221. doi: 10.1111/jebm.12256.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/28467026>

This systematic review aimed to determine the effect of prehospital notification systems for major trauma patients on overall (<30 days) and early (<24 hours) mortality, hospital reception, and trauma team presence (or equivalent) on arrival, time to critical interventions, and length of hospital stay.

METHODS:

Experimental and observational studies of prehospital notification compared with no notification or another type of notification in major trauma patients requiring emergency transport were included. Risk of bias was assessed using the Cochrane ACROBAT-NRSI tool. A narrative synthesis was conducted and evidence quality rated using the GRADE criteria.

RESULTS:

Three observational studies of 72,423 major trauma patients were included. All were conducted in high-income countries in hospitals with established trauma services, with two studies undertaking retrospective analysis of registry data. Two studies reported overall mortality, one demonstrating a reduction in mortality; (adjusted odds ratio (OR) 0.61, 95% confidence interval (CI) 0.39 to 0.94, 72,073 participants); and the other demonstrating a nonsignificant change (OR 0.61, 95% CI 0.23 to 1.64, 81 participants). The quality of this evidence was rated as very low.

CONCLUSION:

Limited research on the topic constrains conclusive evidence on the effect of prehospital notification on patient-centered outcomes after severe trauma. Composite interventions that combine prehospital notification with effective actions on arrival to hospital such as trauma bay availability, trauma team presence, and early access to definitive management may provide more robust evidence towards benefits of early interventions during trauma reception and resuscitation.

13. Effectiveness of regionalization of trauma care services: a systematic review.

Vali Y, et al. *Public Health*. 2017 May;146:92-107. doi: 10.1016/j.puhe.2016.12.006. Epub 2017 Feb 11.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/28404479>

OBJECTIVES:

Improving trauma systems in various forms has always been an important aspect of health policy. While several papers have reported the implementation of a structured trauma system of care, research evidence on the effectiveness of such regionalization for improvement in trauma outcome is limited.

STUDY DESIGN:

Systematic review.

METHOD:

Medline, EMBASE, EconLit and Health Management Information Consortium were searched, using sensitive search terms, for interventional studies that reported a trauma regionalization system as their intervention, and compared important outcomes such as mortality and preventable deaths. At least two authors assessed eligibility for inclusion and risk of bias, and extracted data from the included studies. As meta-analysis was not possible for all studies, two controlled before-after studies were included in the meta-analysis, and a narrative analysis was conducted for the other studies.

RESULTS:

After title and abstract sifting, 66 papers were retrieved. After reading the full texts, a total of 24 studies from the USA, UK, Canada, Australia, and the Netherlands were included in this review. In spite of variation in study specifications, most were before-after studies with a high risk of bias. Although a reduction in mortality was shown in most studies, only two studies were eligible for meta-analysis, and the results showed a significant reduction in mortality after implementation of an organized trauma system (odds ratio 0.840, 95% confidence interval 0.756-0.924; P = 0.00).

CONCLUSION:

Correlation was found between a regionalized network of trauma care and a reduction in trauma-related mortality, based on studies that did not exclude the effects of other concurrent changes on observed reductions. It is recommended that more studies with robust research designs should be conducted in a more diverse range of countries to assess the effectiveness of regionalization. Despite this limitation, the present findings support the regionalization of trauma care services.

14. Pre-hospital management of mass casualty civilian shootings: a systematic literature review.

Turner CD, et al. Crit Care. 2016 Nov 8;20(1):362.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/27825363>

BACKGROUND:

Mass casualty civilian shootings present an uncommon but recurring challenge to emergency services around the world and produce unique management demands. On the background of a rising threat of transnational terrorism worldwide, emergency response strategies are of critical importance. This study aims to systematically identify, describe and appraise the quality of indexed and non-indexed literature on the pre-hospital management of modern civilian mass shootings to guide future practice.

METHODS:

Systematic literature searches of PubMed, Cochrane Database of Systematic Reviews and Scopus were conducted in conjunction with simple searches of non-indexed databases; Web of Science, Open DOAR and Evidence Search. The searches were last carried out on 20 April 2016 and only identified those papers published after the 1 January 1980. Included documents had to contain descriptions, discussions or experiences of the pre-hospital management of civilian mass shootings.

RESULTS:

From the 494 identified manuscripts, 73 were selected on abstract and title and after full text reading 47 were selected for inclusion in analysis. The search yielded reports of 17 mass shooting events, the majority from the USA with additions from France, Norway, the UK and Kenya. Between 1994 and 2015 the shooting of 1649 people with 578 deaths at 17 separate events are described. Quality appraisal demonstrated considerable heterogeneity in reporting and revealed limited data on mass shootings globally.

CONCLUSION:

Key themes were identified to improve future practice: tactical emergency medical support may harmonise inner cordon interventions, a need for inter-service education on effective haemorrhage control, the value of senior triage operators and the need for regular mass casualty incident simulation.

15. A Call for Consensus on Methodology and Terminology to Improve Comparability in the Study of Preventable Prehospital Trauma Deaths: A Systematic Literature Review.

Oliver GJ, Walter DP. Acad Emerg Med. 2016 Apr;23(4):503-10. doi: 10.1111/acem.12932. Epub 2016 Mar 25.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/26844807>

OBJECTIVES:

The study of preventable deaths is essential to trauma research for measuring service quality and highlighting avenues for improving care and as a performance indicator. However, variations in the terminology and methodology of studies on preventable prehospital trauma death limit the comparability and wider application of data. The objective of this study was to describe the heterogeneity in terminology and methodology.

METHODS:

We performed a systematic literature review and report this using the PRISMA guidelines. Searches were conducted using PubMed (including Medline), Ovid, and Embase databases. Studies, with a full text available in English published between 1990 and 2015, meeting the following inclusion criteria were included: analysis of 1) deaths from trauma, 2) occurring in the prehospital phase of care, and 3) application of criteria to ascertain whether deaths were preventable. One author screened database results for relevance by title and abstract. The full text of identified papers was reviewed for inclusion. The reference list of included papers was screened for studies not identified by the database search. Data were extracted on predefined core elements relating to preventability reporting and definitions using a standardized form.

RESULTS:

Twenty-seven studies meeting the inclusion criteria were identified: 12 studies used two categories to assess the preventability of death while 15 used three categories. Fifteen variations in the terminology of these categories and combination with death descriptors were found. Eleven different approaches were used in defining what constituted a preventable death. Twenty-one included survivability of injuries as a criterion. Methods used to determine survivability differed and eight variations in parameters for categorization of deaths were used. Nineteen used panel review in determining preventability with six implementing panel blinding. Panel composition varied greatly by expertise of personnel. Separation of prehospital deaths differed with 10 separating those dead at scene (DAS) and dead on arrival, three excluding those DAS, three excluding deaths prior to EMS arrival, and 11 not separating prehospital deaths.

CONCLUSIONS:

The heterogeneity in methodology, terminology, and definitions of "preventable" between studies render data incomparable. To facilitate common understanding, comparability, and analysis, a commonly agreed ontology by the prehospital research community is required.

16. Helicopter emergency medical services for adults with major trauma.

Galvagno SM Jr, et al. Cochrane Database Syst Rev. 2015 Dec 15;(12):CD009228. doi: 10.1002/14651858.CD009228.pub3.

PDF: [Read PDF HERE](#)

URL: Not available

BACKGROUND:

Although helicopters are presently an integral part of trauma systems in most developed nations, previous reviews and studies to date have raised questions about which groups of traumatically injured people derive the greatest benefit.

OBJECTIVES:

To determine if helicopter emergency medical services (HEMS) transport, compared with ground emergency medical services (GEMS) transport, is associated with improved morbidity and mortality for adults with major trauma.

SEARCH METHODS:

We ran the most recent search on 29 April 2015. We searched the Cochrane Injuries Group's Specialised Register, The Cochrane Library (Cochrane Central Register of Controlled Trials; CENTRAL), MEDLINE

(OvidSP), EMBASE Classic + EMBASE (OvidSP), CINAHL Plus (EBSCOhost), four other sources, and clinical trials registers. We screened reference lists.

SELECTION CRITERIA:

Eligible trials included randomized controlled trials (RCTs) and nonrandomized intervention studies. We also evaluated nonrandomized studies (NRS), including controlled trials and cohort studies. Each study was required to have a GEMS comparison group. An Injury Severity Score (ISS) of at least 15 or an equivalent marker for injury severity was required. We included adults age 16 years or older.

DATA COLLECTION AND ANALYSIS:

Three review authors independently extracted data and assessed the risk of bias of included studies. We applied the Downs and Black quality assessment tool for NRS. We analyzed the results in a narrative review, and with studies grouped by methodology and injury type. We constructed 'Summary of findings' tables in accordance with the GRADE Working Group criteria.

MAIN RESULTS:

This review includes 38 studies, of which 34 studies examined survival following transportation by HEMS compared with GEMS for adults with major trauma. Four studies were of inter-facility transfer to a higher level trauma center by HEMS compared with GEMS. All studies were NRS; we found no RCTs. The primary outcome was survival at hospital discharge. We calculated unadjusted mortality using data from 282,258 people from 28 of the 38 studies included in the primary analysis. Overall, there was considerable heterogeneity and we could not determine an accurate estimate of overall effect. Based on the unadjusted mortality data from six trials that focused on traumatic brain injury, there was no decreased risk of death with HEMS. Twenty-one studies used multivariate regression to adjust for confounding. Results varied, some studies found a benefit of HEMS while others did not. Trauma-Related Injury Severity Score (TRISS)-based analysis methods were used in 14 studies; studies showed survival benefits in both the HEMS and GEMS groups as compared with MTOS. We found no studies evaluating the secondary outcome, morbidity, as assessed by quality-adjusted life years (QALYs) and disability-adjusted life years (DALYs). Four studies suggested a small to moderate benefit when HEMS was used to transfer people to higher level trauma centers. Road traffic and helicopter crashes are adverse effects which can occur with either method of transport. Data regarding safety were not available in any of the included studies. Overall, the quality of the included studies was very low as assessed by the GRADE Working Group criteria.

AUTHORS' CONCLUSIONS:

Due to the methodological weakness of the available literature, and the considerable heterogeneity of effects and study methodologies, we could not determine an accurate composite estimate of the benefit of HEMS. Although some of the 19 multivariate regression studies indicated improved survival associated with HEMS, others did not. This was also the case for the TRISS-based studies. All were subject to a low quality of evidence as assessed by the GRADE Working Group criteria due to their nonrandomized design. The question of which elements of HEMS may be beneficial has not been fully answered. The results from this review provide motivation for future work in this area. This includes an ongoing need for diligent reporting of research methods, which is imperative for transparency and to maximize the potential utility of results. Large, multicenter studies are warranted as these will help produce more robust estimates of treatment effects. Future work in this area should also examine the costs and safety of HEMS, since multiple contextual determinants must be considered when evaluating the effects of HEMS for adults with major trauma.

17. Does the use of dedicated dispatch criteria by Emergency Medical Services optimise appropriate allocation of advanced care resources in cases of high severity trauma? A systematic review.

McQueen C, et al. Injury. 2015 Jul;46(7):1197-206. doi: 10.1016/j.injury.2015.03.033. Epub 2015 Apr 2.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/25863418>

BACKGROUND AND OBJECTIVES:

The deployment of Enhanced Care Teams (ECTs) capable of delivering advanced clinical interventions for patients at the scene of incidents is commonplace by Emergency Medical Services in most developed countries. It is unclear whether primary dispatch models for ECT resources are more efficient at targeting deployment to patients with severe trauma than secondary dispatch, following requests from EMS personnel at scene. The objective of this study was to review the evidence for primary and secondary models in the targeted dispatch of ECT resources to patients with severe traumatic injury.

METHODS:

This review was completed in accordance with a protocol developed using the PRISMA guidelines. We conducted a search of the MEDLINE, EmBase, Web of Knowledge/Science databases and the Cochrane library, focussed on subject headings and keywords involving the dispatch of ECT resources by Emergency Medical Services. Design and results of each study were described. Heterogeneity in the design of the included studies precluded the completion of a meta-analysis. A narrative synthesis of the results therefore was performed.

RESULTS:

Five hundred and forty-eight articles were screened, and 16 were included. Only one study compared the performance of the different models of dispatch. A non-statistically significant reduction in the length of time for HEMS resources to reach incident scenes of 4min was found when primary dispatch protocols were utilised compared to requests from EMS personnel at scene. No effect on mortality; severity of injury or proportion of patients admitted to intensive care was observed. The remaining studies examined the processes utilised within current primary dispatch models but did not perform any comparative analysis with existing secondary dispatch models.

CONCLUSIONS:

This review identifies a lack of evidence supporting the role of primary dispatch models in targeting the deployment of Enhanced Care Teams to patients with severe injuries. It is therefore not possible to identify a model for ECT dispatch within pre-hospital systems that optimises resource utilisation. Further studies are required to assess the efficiency of systems utilised at each stage of the process used to dispatch Enhanced Care Team resources to incidents within regionalised pre-hospital trauma systems.

18. Impact of prehospital transfer strategies in major trauma and head injury: systematic review, meta-analysis, and recommendations for study design.

Pickering A, et al. J Trauma Acute Care Surg. 2015 Jan;78(1):164-77. doi: 10.1097/TA.0000000000000483.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/25539218>

BACKGROUND:

It is unclear whether trauma patients should be transferred initially to a trauma center or local hospital.

METHODS:

A systematic review and meta-analysis assessed the evidence for direct transport to specialist centers (SCs) versus initial stabilization at non-SCs (NSCs) for major trauma or moderate-to-severe head injury. Nine databases were searched from 1988 to 2012. Limitations in the study design informed recommendations for future studies.

RESULTS:

Of 19 major trauma studies, five (n = 19,910) included patients not transferred to SCs and adjusted for case mix. Meta-analysis showed no difference in mortality for initial triage to NSCs versus SCs (odds ratio [OR] 1.03; 95% confidence interval [CI], 0.85-1.23). Within studies excluding patients not transferred to

SCs, unadjusted analyses of mortality nonsignificantly favored transfer via NSCs (16 studies; n = 37,079; OR, 0.83; 95% CI, 0.68-1.01), whereas adjusted analysis nonsignificantly favored direct triage to SCs (9 studies; n = 34,266; OR, 1.18; 95% CI, 0.96-1.44). Of 11 head injury studies, all excluded patients not transferred to SCs and half were in remote locations. There was no significant mortality difference between initial triage to NSCs versus SCs within adjusted analyses (3 studies; n = 1,507; OR, 0.74; 95% CI, 0.31-1.79) or unadjusted analyses (10 studies; n = 3,671; OR, 0.87; 95% CI, 0.62-1.23).

CONCLUSION:

This systematic review demonstrated no difference in outcomes for direct transport to a trauma center versus initial triage to a local hospital. Many studies had significant limitations in the design, and heterogeneity was high. Recommendations for future studies include the following: (i) inclusion of patients not transferred to SCs and those dying during transport; (ii) clear description of centers plus transport distances/times; (iii) adjustments for case mix; and (iv) assessment of morbidity and mortality.

LEVEL OF EVIDENCE:

Systematic review, level IV.

19. Factors Impacting Patient Outcomes Associated with Use of Emergency Medical Services Operating in Urban Versus Rural Areas: A Systematic Review.

Alanazy ARM, et al. *Int J Environ Res Public Health*. 2019 May 16;16(10). pii: E1728. doi: 10.3390/ijerph16101728.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/31100851>

The goal of this systematic review was to examine the existing literature base regarding the factors impacting patient outcomes associated with use of emergency medical services (EMS) operating in urban versus rural areas. A specific subfocus on low and lower-middle-income countries was planned but acknowledged in advance as being potentially limited by a lack of available data. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed during the preparation of this systematic review. A comprehensive literature search of PubMed, EBSCO (Elton B. Stephens Company) host, Web of Science, ProQuest, Embase, and Scopus was conducted through May 2018. To appraise the quality of the included papers, the Critical Appraisal Skills Programme Checklists (CASP) were used. Thirty-one relevant and appropriate studies were identified; however, only one study from a low or lower-middle-income country was located. The research indicated that EMS in urban areas are more likely to have shorter prehospital times, response times, on-scene times, and transport times when compared to EMS operating in rural areas. Additionally, urban patients with out-of-hospital cardiac arrest or trauma were found to have higher survival rates than rural patients. EMS in urban areas were generally associated with improved performance measures in key areas and associated higher survival rates than those in rural areas. These findings indicate that reducing key differences between rural and urban settings is a key factor in improving trauma patient survival rates. More research in rural areas is required to better understand the factors which can predict these differences and underpin improvements. The lack of research in this area is particularly evident in low- and lower-middle-income countries.

20. Triage Systems in Mass Casualty Incidents and Disasters: A Review Study with A Worldwide Approach.

Bazyar J, et al. *Open Access Maced J Med Sci*. 2019 Feb 12;7(3):482-494. doi: 10.3889/oamjms.2019.119. eCollection 2019 Feb 15.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/30834023>

BACKGROUND:

Injuries caused by emergencies and accidents are increasing in the world. To prioritise patients to provide them with proper services and to optimally use the resources and facilities of the medical centres during accidents, the use of triage systems, which are one of the key principles of accident management, seems essential.

AIM:

This study is an attempt to identify available triage systems and compare the differences and similarities of the standards of these systems during emergencies and disasters through a review study.

METHODS:

This study was conducted through a review of the triage systems used in emergencies and disasters throughout the world. Accordingly, all articles published between 1990 and 2018 in both English and Persian journals were searched based on several keywords including Triage, Disaster, Mass Casualty Incidents, in the Medlib, Scopus, Web of Science, PubMed, Cochrane Library, Science Direct, Google scholar, IranDoc, Magiran, Iranmedex, and SID databases in isolation and in combination using both and/or conjunctions.

RESULTS:

Based on the search done in these databases, twenty different systems were identified in the primary adult triage field including START, Homebush triage Standard, Sieve, CareFlight, STM, Military, CESIRA Protocol, MASS, Revers, CBRN Triage, Burn Triage, META Triage, Mass Gathering Triage, SwiFT Triage, MPTT, TEWS Triage, Medical Triage, SALT, mSTART and ASAV. There were two primary triage systems including Jump START and PTT for children, and also two secondary triage systems encompassing SAVE and Sort identified in this respect. ESI and CRAMS were two other cases distinguished for hospital triage systems.

CONCLUSION:

There are divergent triage systems in the world, but there is no general and universal agreement on how patients and injured people should be triaged. Accordingly, these systems may be designed based on such criteria as vital signs, patient's major problems, or the resources and facilities needed to respond to patients' needs. To date, no triage system has been known as superior, specifically about the patients' clinical outcomes, improvement of the scene management or allocation of the resources compared to other systems. Thus, it is recommended that different countries such as Iran design their triage model for emergencies and disasters by their native conditions, resources and relief forces.

21. Uptake of the World Health Organization's trauma care guidelines: a systematic review.

LaGrone L, et al. Bull World Health Organ. 2016 Aug 1;94(8):585-598C. doi: 10.2471/BLT.15.162214. Epub 2016 May 13.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/27516636>

OBJECTIVE:

To understand the degree to which the trauma care guidelines released by the World Health Organization (WHO) between 2004 and 2009 have been used, and to identify priorities for the future implementation and dissemination of such guidelines.

METHODS:

We conducted a systematic review, across 19 databases, in which the titles of the three sets of guidelines - Guidelines for essential trauma care, Prehospital trauma care systems and Guidelines for trauma quality improvement programmes - were used as the search terms. Results were validated via citation analysis and expert consultation. Two authors independently reviewed each record of the guidelines' implementation.

FINDINGS:

We identified 578 records that provided evidence of dissemination of WHO trauma care guidelines and 101 information sources that together described 140 implementation events. Implementation evidence could be found for 51 countries - 14 (40%) of the 35 low-income countries, 15 (32%) of the 47 lower-middle income, 15 (28%) of the 53 upper-middle-income and 7 (12%) of the 59 high-income. Of the 140 implementations, 63 (45%) could be categorized as needs assessments, 38 (27%) as endorsements by stakeholders, 20 (14%) as incorporations into policy and 19 (14%) as educational interventions.

CONCLUSION:

Although WHO's trauma care guidelines have been widely implemented, no evidence was identified of their implementation in 143 countries. More serial needs assessments for the ongoing monitoring of capacity for trauma care in health systems and more incorporation of the guidelines into both the formal education of health-care providers and health policy are needed.

GUIDELINES/POSITION STATEMENTS

22. Guidelines for field triage of injured patients: recommendations of the National Expert Panel on Field Triage, 2011.

Sasser SM, et al. Centers for Disease Control and Prevention (CDC). MMWR Recomm Rep. 2012 Jan 13;61(RR-1):1-20.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/22237112>

In the United States, injury is the leading cause of death for persons aged 1-44 years. In 2008, approximately 30 million injuries were serious enough to require the injured person to visit a hospital emergency department (ED); 5.4 million (18%) of these injured patients were transported by Emergency Medical Services (EMS). On arrival at the scene of an injury, the EMS provider must determine the severity of injury, initiate management of the patient's injuries, and decide the most appropriate destination hospital for the individual patient. These destination decisions are made through a process known as "field triage," which involves an assessment not only of the physiology and anatomy of injury but also of the mechanism of the injury and special patient and system considerations. Since 1986, the American College of Surgeons Committee on Trauma (ACS-COT) has provided guidance for the field triage process through its "Field Triage Decision Scheme." This guidance was updated with each version of the decision scheme (published in 1986, 1990, 1993, and 1999). In 2005, CDC, with financial support from the National Highway Traffic Safety Administration, collaborated with ACS-COT to convene the initial meetings of the National Expert Panel on Field Triage (the Panel) to revise the decision scheme; the revised version was published in 2006 by ACS-COT (American College of Surgeons; Resources for the optimal care of the injured patient: 2006. Chicago, IL: American College of Surgeons; 2006). In 2009, CDC published a detailed description of the scientific rationale for revising the field triage criteria (CDC. Guidelines for field triage of injured patients: recommendations of the National Expert Panel on Field Triage. MMWR 2009;58[No. RR-1]). In 2011, CDC reconvened the Panel to review the 2006 Guidelines in the context of recently published literature, assess the experiences of states and local communities working to implement the Guidelines, and recommend any needed changes or modifications to the Guidelines. This report describes the dissemination and impact of the 2006 Guidelines; outlines the methodology used by the Panel for its 2011 review; explains the revisions and modifications to the physiologic, anatomic, mechanism-of-injury, and special considerations criteria; updates the schematic of the 2006 Guidelines; and provides the rationale used by the Panel for these changes. This report is intended to help prehospital-care providers in their daily duties recognize individual injured patients who are most likely to benefit from specialized trauma center resources and

is not intended as a mass casualty or disaster triage tool. The Panel anticipates a review of these Guidelines approximately every 5 years.

23. EAST Guidelines for prehospital fluid resuscitation in the injured patient.

Cotton BA, et al. Eastern Association for the Surgery of Trauma Practice Parameter Workgroup for Prehospital Fluid Resuscitation. J Trauma. 2009 Aug;67(2):389-402. doi:

10.1097/TA.0b013e3181a8b26f.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/19667896>

Although the need and benefit of prehospital interventions has been controversial for quite some time, an increasing amount of evidence has stirred both sides into more frequent debate. Proponents of the traditional "scoop-and-run" technique argue that this approach allows a more timely transfer to definitive care facilities and limits unnecessary (and potentially harmful) procedures. However, advocates of the "stay-and-play" method point to improvement in survival to reach the hospital and better neurologic outcomes after brain injury. Given the lack of consensus, the Eastern Association for the Surgery of Trauma convened a Practice Management Guideline committee to answer the following questions regarding prehospital resuscitation: (1) should injured patients have vascular access attempted in the prehospital setting? (2) if so, what location is preferred for access? (3) if access is achieved, should intravenous fluids be administered? (4) if fluids are to be administered, which solution is preferred? and (5) if fluids are to be administered, what volume and rate should be infused?

24. The Hartford Consensus: THREAT, a medical disaster preparedness concept.

Jacobs LM, et al. J Am Coll Surg. 2013 Nov;217(5):947-53. doi: 10.1016/j.jamcollsurg.2013.07.002.

PDF: [Read PDF HERE](#)

URL: <https://www.ncbi.nlm.nih.gov/pubmed/24139220>

No abstract

25. Practice Management Guidelines for the Appropriate Triage of the Victim of Trauma

The EAST Practice Management Guidelines Work Group, 2010

PDF: [Read PDF HERE](#)

URL: <https://www.east.org/education/practice-management-guidelines/triage-of-the-trauma-patient>

26. Mass Casualty Management Systems: Strategies and guidelines for building health sector capacity

World Health Organization, April 2007

PDF: [Read PDF HERE](#)

URL: https://www.who.int/hac/techguidance/MCM_inside_Jul07.pdf