



National Trauma and Emergency Preparedness System (NTEPS)

V. 2.0

NTEPS V. 2.0 was approved by the American College of Surgeons (ACS) Board of Regents in February 2025 and the ACS Committee on Trauma Executive Committee (Jeffrey Kerby, MD, PhD, FACS, Chair) in January 2025.

The contributors to NTEPS V. 2.0 are John H. Armstrong, MD, FACS; Eileen Bulger, MD, FACS; and Jeffrey Kerby, MD, PhD, FACS.

NTEPS V. 1.0 was approved by the ACS Board of Regents in February 2022 and the ACS Committee on Trauma Executive Committee (Eileen Bulger, MD, FACS, Chair) in December 2022.

NTEPS V. 1.0 was authored by these ACS Committee on Trauma Advocacy Pillar Members:

John H. Armstrong, MD, FACS, Chair
Kristan Staudenmayer, MD, FACS
Stephen Barnes, MD, FACS
Joseph Sakran, MD, FACS
Elizabeth Scherer, MD, FACS
Michael Suk, MD, FACS
David Zonies, MD, FACS

RESTRICTED USE: Contents of this publication are strictly prohibited from being uploaded, shared, or incorporated in any third-party applications, platforms, software, or websites without prior written authorization from the ACS. This restriction explicitly includes, but is not limited to, the integration of ACS content into tools leveraging artificial intelligence (AI), machine learning, large language models, or generative AI technologies and infrastructures. Violation of this policy may result in immediate revocation of access, termination of user accounts, or legal action as deemed appropriate by the ACS.

Executive Summary

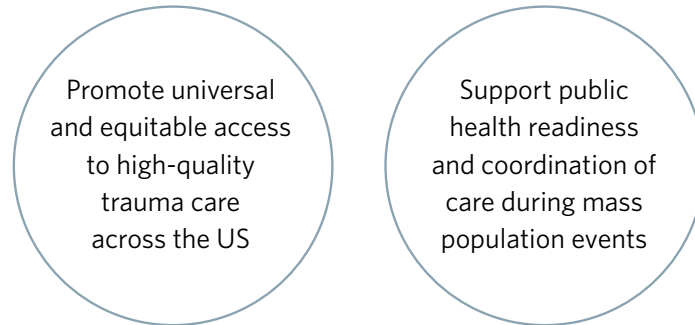
Traumatic injury in the United States is the most common cause of death for children and adults younger than 45 years and the leading cause of potential life lost before the age of 75.¹ Trauma systems are designed to deliver optimal trauma care for injured patients, informed by best evidence and accessible to all injured patients regardless of circumstance. While there are exemplary regional trauma system models that have demonstrated robust access to high-quality trauma care, there is broad variability in the quality, continuity, and access to trauma care.²⁻⁶ In addition, there is no mechanism in place that connects these loco-regional systems of care. This leaves many Americans at increased risk for death and disability resulting from injury. It is estimated that 20% of trauma-related deaths could be prevented if optimal care was available to everyone.⁷ Injury research is a cornerstone for finding new ways to save lives, yet federal support for injury research remains uncoordinated, underfunded, and understudied.⁸⁻¹⁰ This is despite the fact that traumatic injuries rival cancer and heart disease in health and financial impact.¹

Trauma systems also form the backbone for disaster preparedness and response to other time-sensitive emergencies. Trauma surgeons have learned from mass casualty events that regional coordination is vital to match resources with casualty needs.¹¹⁻¹³ Public health agencies, emergency management services, and acute-care health systems do not routinely work together, and there is no overarching body to assist in coordinating the medical response to disasters. This gap became apparent during the COVID-19 pandemic.¹⁴ In response, many trauma surgeons and emergency medicine physicians helped to establish Regional Medical Operation Coordinating Centers (RMOCCs) in their states and regions.¹² RMOCCs enabled a more rapid response to pandemic demands by coordinating the activities of emergency medical services (EMS) agencies, hospitals and healthcare systems, long-term care facilities, public health agencies, and emergency management. Where RMOCCs were established, lives were saved. Where they were not, lives were lost.

In addition, there are growing concerns that the U.S. may face large scale combat operations given current international events. If this occurs, it is likely to result in another mass population event that will exceed the capacity of the Military Health System. Civilian healthcare facilities will be needed to help manage conflict casualties. Without a true regionalized system of care, the intersection of civilian trauma patients and military casualties could lead to significant mismatching of resources, skills, and needs and would result in unnecessary death and disability.

Thus, there is an urgent need to establish a trauma care infrastructure that has the capability to manage the daily injured population in the U.S along with mass population events (mass casualty incidents, public health emergencies, and large scale military conflict). The need for such infrastructure has been reported for decades, and the urgency is driven by existing and growing threats.

The time has come to connect daily injury care and mass casualty readiness as a National Trauma and Emergency Preparedness System (NTEPS). Building on the strengths of highly functional state/regional trauma systems and the development of an interconnected network of RMOCCs, Congress should establish NTEPS to:



Background

Trauma is a neglected public health emergency in the US.¹ Injuries and violence affect everyone, regardless of age, demographics, or economic status. According to the Centers for Disease Control and Prevention (CDC), injury is the leading cause of death among individuals 1 to 45 years old, and overall injury approaches 200,000 deaths per year.^{1,15} Millions more live with long-term disability following injury. Trauma accounts for almost 30% of all life-years lost in the US, more than cancer (16%) and heart disease (12%) combined.¹⁶ Yet injury remains understudied. Injury research is underfunded and uncoordinated and accounts for only 2.9% of the total National Institutes of Health extramural budget.^{8-10,17} Systems-based and patient-centered research is vital for a successful trauma system that saves more lives and restores living.

These facts are not new discoveries. In 1966, the National Academy of Sciences published “Accidental Death and Disability: The Neglected Disease of Modern Society,” its first report on injury as a national public health problem.¹⁸ Fifty years later, the National Academies of Science, Engineering, and Medicine (NASEM) released the report, “A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths After Injury.”¹⁹ This report cited lessons learned from both military and civilian trauma experiences and sought to energize the development of a national trauma care system to reach zero preventable deaths after injury and minimize disability secondary to trauma. It also called for a national trauma research action plan, which the multi-stakeholder Coalition for National Trauma Research has worked to develop with limited resources.

Care for the injured patient has improved substantially over the past 100 years, and the American College of Surgeons (ACS) has helped to accelerate change by defining standards.^{20,21} These are codified as optimal resources for care of the injured patient in trauma centers and are inclusive of prevention, prehospital care, acute care, rehabilitation, and research. Standards are the basis for verification of trauma centers at one of four levels. Studies have shown that patients treated at a verified trauma center have a decreased chance of dying.²²⁻²⁸

The ACS has extended work with standards to metropolitan, state, and regional systems. In collaboration with multiple stakeholders and with approval from NASEM, the Department of Defense, and the National Highway Traffic Safety Administration, twelve essential trauma system elements (Appendix) have been defined for governance, architecture, and function of regional trauma systems. These elements are informed by two decades of trauma systems study, conducted by the ACS Committee on Trauma (COT) Trauma Systems Planning and Evaluation Committee and including 50 regional trauma system consultations across the US. Where regionalization of trauma care has taken place with an organized and inclusive system of care, a reduction in morbidity and mortality has followed.^{24,27}

Trauma systems have sought to function as learning healthcare systems, consistently evaluating their own outcome data to improve care at the local, regional, and state levels.

The ACS supports the National Trauma Databank, which collects uniform data from trauma centers across the US and through the Trauma Quality Improvement Program (TQIP), which provides risk-adjusted benchmarking data to hospitals to support quality improvement. In some states, TQIP collaboratives have formed to share hospital data across a regional trauma system and work on joint quality improvement projects. These efforts have contributed to significant process improvement in trauma centers, yet there is a need to develop data linkage efforts across the continuum of care that includes prehospital care, rehabilitation, and long-term function.

Despite standards, verification, and quality improvement initiatives, significant gaps for injury care remain in our healthcare system that result in unnecessary death and disability. Current trauma systems have been developed at the state level and are highly variable: not all states have an organized system, many have failed to engage rural hospitals as part of a broader system, and interstate regionalization remains sporadic.^{3-6,29-32} As a result our de facto “national trauma system” is a fragmented and disorganized patchwork of healthcare professionals, hospitals, EMS organizations, rehabilitation facilities, and public health agencies without coherence.

Effective daily trauma care requires timely access to a system with optimal resources for pre-hospital interventions, initial evaluation and imaging, operative care, intensive care, post-injury care, rehabilitation, and recovery (to include social and mental health services). With life-threatening injury, time is of the essence; this reality underscores the need to implement a robust system of injury care that reaches every community in the US. Disparities in trauma care are well documented and seen in both rural and urban areas.^{4,6,29,30,32} Racial and ethnic differences in access to trauma care are associated with disparities in geographic access to trauma centers.^{5,6}

COVID-19 represented a mass population event in which a large number of people are ill or injured and overwhelm a region’s ability to care for all. Trauma surgeons have a great deal of experience in systemic management of injuries from mass population events, and trauma systems are standing integrators of care across settings. Thus, for pandemic response, it was only natural for trauma surgeons and systems to develop Regional Medical Operation Coordinating Centers (RMOCCs).¹² RMOCCs are local/regional organizations that bring emergency management, public health, and acute medical care systems together in a mass population event to balance the distribution of resources and patients in the acute healthcare system. RMOCCs are like air traffic control towers for inclusive coordination of the health and medical response in affected areas across all healthcare partners. They enable real-time reporting of critical information, such as EMS and transportation resources, hospital bed capacity, essential logistic availability (e.g., PPE and ventilators), and patient volume and acuity.

RMOCCs can also function daily to coordinate regular community healthcare needs for patients with time-sensitive conditions (e.g., injury, heart attack, and stroke) and existing patients who may need to move between healthcare facilities. An RMOCC can scale more quickly from daily patient management to mass casualty management: the population of patients in need expands with casualties from the surge event while the daily population of emergent patients unrelated to the surge event and inpatients remains. The RMOCC can readily manage casualties in the context of existing healthcare needs and resources. Importantly, an RMOCC may prevent an incident that generates a large number of casualties

from becoming an overwhelming mass population event with scarce resources resulting in regional crisis.

Increased demands on U.S. trauma capabilities may result from U.S. engagement in large scale combat operations resulting in a surge of combat casualties needing care back in the U.S. Modeling of these events suggests that thousands of casualties per day could result, exceeding the capabilities of the Military Health System and requiring the use of civilian healthcare facilities to help manage conflict casualties. RMOCCs could help with the coordination of casualty repatriation into military, Veterans Health Administration, and civilian healthcare facilities.

For optimal, accessible care for daily injuries and mass population events, the common denominator is a national trauma and emergency preparedness system that links local, state, and regional systems with a common data network and drives performance improvement, readiness, and research. The private sector and professional societies have reached the limit of what they can do to structure a national trauma system. The National Trauma and Emergency Preparedness System (NTEPS) is consistent with the mission of the Health and Human Services Administration for Strategic Preparedness and Response (ASPR) to collaborate with multiple stakeholders to improve readiness and response capabilities for 21st century health security threats. Injury and mass population events are such threats. The NTEPS will integrate response and care resources for daily and progressive mass population events and lead to a more unified approach that reduces death and disability.

Request to Congress

Building on the strengths of highly functional state/regional trauma systems and RMOCCs, Congress should establish the National Trauma and Emergency Preparedness System to:

- Promote universal and equitable access to high quality trauma care across the US
- Support public health readiness and coordination of care during mass population events

Congress should emphasize these NTEPS functions:

1. Public health readiness
 - a. Provide daily coordination of patient movement and transport resources, scalable for mass casualty events
 - b. Coordinate public health, emergency management, and healthcare systems regionally, statewide, and nationally, for clinical integration and deployment of medical assets in a mass population event
 - c. Sustain comprehensive, real-time data system of critical data elements, to include EMS and transportation resources, hospital bed capacity, resource availability, and patient/casualty volumes
 - d. Support domestic mutual military-civilian readiness integration
 - e. Establish process for state, regional, and national situational awareness of emerging events

2. Standards
 - a. Establish best practices for prevention, effective and efficient field triage, emergency response, inpatient care, rehabilitation, and recovery
 - b. Establish system for verification of trauma system standards across continuum of care
 - c. Provide clinical expertise with timely consultation across regional and state systems
 - d. Determine optimal resources for the trauma and emergency preparedness system
 - e. Establish rubric for trauma center apportionment
3. Performance improvement
 - a. Conduct annual needs assessment for trauma and emergency preparedness
 - b. Evaluate operational readiness at state and regional levels
 - c. Provide risk-adjusted benchmarking for system improvement
 - d. Support rural hospitals and develop strategies to address the rural medical work force issues
 - e. Support state-level EMS systems
4. Research
 - a. Collect and sustain national trauma dataset spanning the continuum of care
 - b. Coordinate, fund, and disseminate research
5. Public outreach
 - a. Disseminate and support implementation of best practices in injury prevention
 - b. Promote STOP THE BLEED® training and deployment of public access bleeding control equipment
 - c. Inform communities about the role of their trauma systems for daily injury and mass casualty care

NTEPS Strategic Elements

Vision

The vision of the NTEPS is to have timely and high-quality trauma care with equitable access for everyone injured across the entire spectrum of care, from prevention to long-term outcomes and from individual injuries to mass population events.

Mission

The NTEPS will oversee the coordination of resource and patient/casualty distribution in daily and mass population events by supporting an interconnected RMOCC system. NTEPS will develop system standards, benchmark regional system performance, synthesize and disseminate knowledge, and promote uniform community outreach for prevention and resiliency.

Goals

- Reduce rates of injury in the population.
- Ensure timely access to equitable, high-quality care for all.
- Enhance survivability and minimize disability for all injured patients.

- Maximize survival after mass population events.
- Accelerate high-quality research to advance trauma care.

Guiding Principles

- The NTEPS should have administrative and regulatory oversight over RMOCCs.
 - National standards should be established to support state and regional trauma systems. The specific processes, integration, and delivery of care needed to meet these standards should be implemented at a regional level.
 - A national verification process should be established to assess each regional system for timely and equitable access to quality injury care and prevention for all.
- The NTEPS should span the medical response to daily trauma and mass population events. It should:
 - Be unifying in its approach across the US as a multidisciplinary collaborative effort.
 - Optimize resource matching across the entire response system as informed by real-time situational awareness.
 - Support military and civilian trauma care coordination.
- The NTEPS should work to strengthen the role and involvement of EMS. The system will ensure that:
 - EMS is established as an essential service, locally, regionally, and nationally.
 - EMS remains an integral stakeholder in a national system.
- The NTEPS should reflect a collaboration of trauma stakeholders from both the private and public sectors.
- The NTEPS should be a learning healthcare system that continuously improves care based on the best available evidence, cutting-edge research, and concurrent review of system data. This system will include:
 - Data acquisition and analysis to support a robust continuous performance improvement plan.
 - A comprehensive, national, de-identified patient registry that encompasses all phases of trauma and mass population care.
 - Support for trauma care, injury prevention, and patient-reported outcomes research through prioritization and distribution of funding, as well as dissemination of findings for implementation.
 - Regional benchmarks of performance.
 - Interconnectivity of data from all phases of response and care with data sharing agreements for linkage and transparency.

Objectives

1. National Public Health Readiness: Using existing frameworks, such as those developed by FEMA and ASPR, establish and fund a system of care that helps injured patients get to the right hospitals to meet their needs, and that expands during large-scale disasters to prevent overloading any single hospital. ASPR's model for Medical Operations Coordination Cells developed by the FEMA Healthcare Resilience Task Force could serve as a guide.

2. National Standards
 - a. Establish and update national standards for trauma system performance across the continuum of trauma care, from point of injury to community reintegration, and inclusive of injury prevention programs and system readiness benchmarks.
 - b. Support the implementation of evidence-based trauma care practices by all elements of the trauma system.
3. Research: Study the optimal management of injured patients, trauma system design and operation, and public health readiness, and disseminate findings to close critical knowledge gaps in trauma care across military and civilian systems.
4. Outreach: Ensure an even application of community resiliency activities, to include best practices for injury prevention and enhancement of public skills in bleeding control.

Structure

The Regional Medical Operations Coordinating Center (RMOCC) is the unit of action for local and regional organization of NTEPS. As described previously, RMOCCs are private-public entities that coordinate daily trauma patient and mass population event casualty distribution, as well as management of critical resources, by facilitating situational awareness across the acute medical care, emergency management, and public health systems. As a result, the load of trauma patients and casualties in localities and regions is balanced for optimal care and healthcare system function.³⁴ The daily operation of RMOCCs enables rapid scaling for mass casualty response.

RMOCCs fit well into Emergency Support Function #8 (Public Health and Medical Services) of the National Response Framework and may be connected horizontally and vertically to form state and federal levels of medical operations coordination. These “neural” RMOCC networks then become state and federal MOCCs, with the latter being the NTEPS framework upon which to accomplish the objectives in public health readiness, standards, performance improvement, research, and outreach.

Optimal resources for RMOCCs include

1. Agreements among all stakeholders for data-sharing and decision-making.
2. Liability protection.
3. Administrative staff, to include a director.
4. Physical space that connects to the emergency operations center.
5. Information technology platform for secure and rapid information flow across stakeholders.
6. Communication system that connects the RMOCC, EOC, and stakeholders.
7. Performance improvement and research staff
8. Funding to sustain day-to-day and surge operations. Sources include the Hospital Preparedness Program under ASPR, state and local public appropriations, and health care facilities and systems. Annual operating costs range from \$1.3 million to \$4.5 million depending on the population covered.

RMOCC proliferation with state and national integration is the most effective and efficient way to achieve the NTEPS and thus save more lives and restore living from daily injury and mass population events.

Essential Trauma system Element #1: Statutory Authority

Statutory authority to enable development and implementation of a trauma system should exist. A lead agency with sufficient authority to implement policy, maintain well-defined administrative rules, and allocate trauma system funds, should be established or identified. A multidisciplinary advisory group, consisting of stakeholders representing the full spectrum of trauma care, should guide the lead agency.

Essential Trauma System Element #2: Funding

The lead agency should establish a sustained funding mechanism for trauma system infrastructure. Funding should include physical and staffing resources for program administration and oversight, data collection, data storage, data analysis, quality improvement activities, education, and support for disaster response and military integration.

Essential Trauma System Element #3: Multidisciplinary Advisory Group

A multidisciplinary advisory group, consisting of stakeholders representing the full spectrum of trauma care, should be established. The role of the advisory group should be to guide the lead agency regarding trauma system development and operations. Representation should be diverse, with respect to geography, population (rural/urban, adult/pediatric, burn), phases of care (prehospital and rehabilitative) and trauma center level designation.

Essential Trauma System Element #4: Trauma System Plan

An integrated trauma system plan should be created and implemented. This plan should be reviewed annually and updated every three years at a minimum, under the direction of the lead agency and the multidisciplinary advisory group.

Essential Trauma System Element #5: Continuum of Care

The trauma system should address the full continuum of injury from prevention and pre-hospital/interfacility emergency medical services, to acute hospital care (referring and accepting facility) through rehabilitation. The system should address all injured patients with special attention to pediatric, geriatric, and other vulnerable populations.

Essential Trauma System Element #6: Needs Based Designation

The lead agency should develop and administer a trauma center designation process, which is based upon population needs.

Essential Trauma System Element #7: Trauma System Registry

The lead agency should have the authority to establish and maintain a trauma system registry to collect, validate, and analyze injury surveillance data. Data collection should include the full continuum of care from point of injury through rehabilitation. These data should include all care facilities that treat injured patients. These data should be integrated with other data collection systems (i.e., vital records, medical examiner, law enforcement, and rehabilitation). Data definitions and patient inclusion criteria should be standardized to a national standard. Data sharing should be inclusive of system stakeholders to support quality improvement, research efforts, and legislative outreach pertaining to trauma.

Essential Trauma System Element #8: Injury Epidemiology

The lead agency should have systems and processes in place to regularly track and report on injury frequency, rates, and patterns across the entire jurisdictional population. Analysis and reporting should be based on multiple pertinent data sources (e.g., vital statistics, hospital discharge data, EMS, ED data, and trauma registries), including information obtained through surveillance activities. Data from these sources should be synthesized to provide a comprehensive description of injury and analyzed to identify trends and patterns to inform system development, injury prevention, and performance improvement efforts.

Essential Trauma System Element #9: System-wide Performance Improvement

The lead agency should establish a system-wide trauma performance improvement (PI) process to evaluate all aspects of the trauma system. The plan should define audit filters to monitor and track specific processes and outcomes, such as access to care, availability of services, and effectiveness of injury prevention initiatives. In addition, the plan should define a process for tracking of the audit filters, addressing performance gaps, and determining loop closure.

Essential Trauma System Element #10: Confidentiality and Discoverability

The lead agency should establish a process to ensure confidentiality and provide statutory protection from discoverability to support trauma system performance improvement and research efforts.

Essential Trauma System Element #11: Disaster Preparedness

A comprehensive emergency disaster preparedness and response plan should be established and reviewed annually. This plan should integrate all components of the trauma system and coordinate with all existing response entities including local, state, federal and particularly military partners. There should be a developed and operational network of Regional Medical Operations Centers (RMOCCs) as a major component of the disaster preparedness plan. The plan should be exercised at least semiannually. One of these exercises should be operationally based (not tabletop) and test all components of the system.

Essential Trauma System Element #12: Military Integration

The trauma system should actively support integration and cooperation with military personnel, medical treatment facilities, and transport capabilities. This should include patient care, education, data collection, performance improvement, research, training, disaster response, and clinical readiness.

References

1. 10 Leading Causes of Death, United States 2019, Both Sexes, All Ages, All Races. Centers for Disease Control. WISQARS Website. Available at: <https://wisqars.cdc.gov/data/lcd/home>. Accessed November 23, 2021.
2. Brown JB, Rosengart MR, Billiar TR, Peitzman AB, Sperry JL. Geographic distribution of trauma centers and injury-related mortality in the United States. *J Trauma Acute Care Surg*. 2016;80(1):42-49; discussion 49-50.
3. Alber DA, Dalton MK, Uribe-Leitz T, et al. A Multistate Study of Race and Ethnic Disparities in Access to Trauma Care. *J Surg Res*. 2021;257:486-492.
4. Deeb AP, Phelos HM, Peitzman AB, Billiar TR, Sperry JL, Brown JB. Disparities in rural versus urban field triage: Risk and mitigating factors for undertriage. *J Trauma Acute Care Surg*. 2020;89(1):246-253.
5. Haider AH, Chang DC, Efron DT, Haut ER, Crandall M, Cornwell EE, 3rd. Race and insurance status as risk factors for trauma mortality. *Arch Surg*. 2008;143(10):945-949.
6. Tung EL, Hampton DA, Kolak M, Rogers SO, Yang JP, Peek ME. Race/Ethnicity and Geographic Access to Urban Trauma Care. *JAMA Netw Open*. 2019;2(3):e190138.
7. Kwon AM, Garbett NC, Kloecker GH. Pooled preventable death rates in trauma patients : Meta analysis and systematic review since 1990. *Eur J Trauma Emerg Surg*. 2014;40(3):279-285.
8. Moses H, 3rd, Matheson DH, Cairns-Smith S, George BP, Palisch C, Dorsey ER. The anatomy of medical research: US and international comparisons. *JAMA*. 2015;313(2):174-189.
9. Rhee P, Joseph B, Pandit V, et al. Increasing trauma deaths in the United States. *Ann Surg*. 2014;260(1):13-21.
10. Holcomb JB, Hoyt DB. Comprehensive injury research. *JAMA*. 2015;313(14):1463-1464.
11. Lewis AM, Sordo S, Weireter LJ, et al. Mass Casualty Incident Management Preparedness: A Survey of the American College of Surgeons Committee on Trauma. *Am Surg*. 2016;82(12):1227-1231.
12. Epley EE, Stewart RM, Love P, et al. A regional medical operations center improves disaster response and inter-hospital trauma transfers. *Am J Surg*. 2006;192(6):853-859.
13. Hamilton DR, Gavagan TF, Smart KT, et al. Houston's medical disaster response to Hurricane Katrina: part 1: the initial medical response from Trauma Service Area Q. *Ann Emerg Med*. 2009;53(4):505-514.
14. Kadri SS, Sun J, Lawandi A, et al. Association Between Caseload Surge and COVID-19 Survival in 558 U.S. Hospitals, March to August 2020. *Ann Intern Med*. 2021;174(9):1240-1251.
15. WISQARS Website. <https://www.cdc.gov/injury/wisqars/animated-leading-causes.html>. Accessed November 21, 2021.
16. Centers for Disease Control. WISQARS Website. Accessed November 23, 2021.
17. Glass NE, Riccardi J, Farber NI, Bonne SL, Livingston DH. Disproportionally low funding for trauma research by the National Institutes of Health: A call for a National Institute of Trauma. *J Trauma Acute Care Surg*. 2020;88(1):25-32.
18. National Research Council (U.S.). Committee on Trauma., National Research Council (U.S.). Committee on Shock. *Accidental death and disability: the neglected disease of modern society*. Rockville, Md.: Reprinted by the U.S. Division of Emergency Health Services; 1971.

19. Berwick DM, Downey AS, Cornett E, National Academies of Sciences Engineering and Medicine (U.S.). Committee on Military Trauma Care's Learning Health System and Its Translation to the Civilian Sector. *A national trauma care system: integrating military and civilian trauma systems to achieve zero preventable deaths after injury*. Washington, DC: The National Academies Press; 2016.
20. Alexander RH, Proctor HJ, American College of Surgeons. Committee on Trauma. *Advanced trauma life support program for physicians: ATLS*. 5th ed. Chicago, IL: American College of Surgeons; 1993.
21. American College of Surgeons. Committee on Trauma. *Resources for optimal care of the injured patient*. Chicago, Ill.: American College of Surgeons, Committee on Trauma; 1990.
22. Haas B, Jurkovich GJ, Wang J, Rivara FP, Mackenzie EJ, Nathens AB. Survival advantage in trauma centers: expeditious intervention or experience? *J Am Coll Surg*. 2009;208(1):28- 36.
23. Mackenzie EJ, Rivara FP, Jurkovich GJ, et al. The impact of trauma-center care on functional outcomes following major lower-limb trauma. *J Bone Joint Surg Am*. 2008;90(1):101-109.
24. MacKenzie EJ, Rivara FP, Jurkovich GJ, et al. A national evaluation of the effect of trauma-center care on mortality. *N Engl J Med*. 2006;354(4):366-378.
25. Mackenzie EJ, Rivara FP, Jurkovich GJ, et al. The National Study on Costs and Outcomes of Trauma. *J Trauma*. 2007;63(6 Suppl):S54-67; discussion S81-56.
26. MacKenzie EJ, Steinwachs DM, Ramzy AI. Evaluating performance of statewide regionalized systems of trauma care. *J Trauma*. 1990;30(6):681-688.
27. MacKenzie EJ, Weir S, Rivara FP, et al. The value of trauma center care. *J Trauma*. 2010;69(1):1-10.
28. Rivara FP, Koepsell TD, Wang J, Nathens A, Jurkovich GA, Mackenzie EJ. Outcomes of trauma patients after transfer to a level I trauma center. *J Trauma*. 2008;64(6):1594-1599.
29. Carr BG, Bowman AJ, Wolff CS, et al. Disparities in access to trauma care in the United States: A population-based analysis. *Injury*. 2017;48(2):332-338.
30. Delgado MK, Yokell MA, Staudenmayer KL, Spain DA, Hernandez-Boussard T, Wang NE. Factors associated with the disposition of severely injured patients initially seen at non-trauma center emergency departments: disparities by insurance status. *JAMA Surg*. 2014;149(5):422-430.
31. Jarman MP, Castillo RC, Carlini AR, Kodadek LM, Haider AH. Rural risk: Geographic disparities in trauma mortality. *Surgery*. 2016;160(6):1551-1559.
32. Jarman MP, Haut ER, Curriero FC, Castillo RC. Mapping areas with concentrated risk of trauma mortality: A first step toward mitigating geographic and socioeconomic disparities in trauma. *J Trauma Acute Care Surg*. 2018;85(1):54-61.
33. Department of Homeland Security, National Response Coordination Center Healthcare Resilience Task Force and Department of Health and Human Services Administration for Strategic Preparedness and Response Technical Resources, Assistance Center, and Information Exchange. Medical Operations Coordination Centers Toolkit, Third Edition, April 2024. Available from <https://files.asprtracie.hhs.gov/documents/fema-mocc-toolkit.pdf>, accessed on December 17, 2024.



facs.org