

NATIONAL EMS ADVISORY COUNCIL
COMMITTEE REPORT AND ADVISORY
Current status: FINAL as of December 2, 2016

Committee: Patient Care, QI and General Safety (PCQIGS) Committee

Title: Aligning the Model Trauma System Planning and Evaluation (MTSPE) document with the 2016 NASEM National Trauma Care System Report

Version: FINAL

Issue Synopsis: Modern trauma care would benefit from integration of the recommendations in the NASEM and MTPSE documents into a unified federal strategy.

A. Problem statement

Executive Summary

Injury continues to be a leading cause of death in the United States, occurring every day and in every state of our nation. It is the most common cause of death in children and adults up to the age of 44 years. The threat is magnified when considering the increasing frequency of unexpected natural and man-made incidents. High functioning trauma systems play a vital role in building and maintaining national, state, local, and tribal resilience against these natural and man-made disasters.

The 2004 **Trauma System Agenda for the Future**¹ was coordinated through the American Trauma Society and supported by the U.S. Department of Transportation, National Highway Traffic Safety Administration. The document was designed to provide trauma care professionals, public health officials, and health care policy experts with the direction to use the public health approach, a scientifically proven method, when developing and evaluating trauma systems.

The HRSA 2006 **Model Trauma System Planning and Evaluation (MTSPE)** document served as the basis for trauma system development across the U.S.² The document has been and still is instrumental in providing a foundation to create and maintain systems of care for communities, states and regions in times of emergency, and serves as the foundation for the American College of Surgeons Committee on Trauma's Trauma Systems Consultation program. The guidance was the first to use a public health approach to frame the discussion of trauma system development. This document shifted the emphasis from a focus on individual components of an exclusive trauma system to a more integrated approach. It emphasized the importance of injury control as a public health issue and the need for a trauma system that integrated all aspects of injury control. A significant portion of the MTSPE includes an assessment tool based on the public health model, comprised of a series of **Benchmarks, Indicators and Scoring (BIS)** criteria. The BIS was intended as a self-assessment tool, but its length and complexity, as well as the general lack of familiarity with the Centers for Disease Control (CDC) model among trauma system stakeholders make it challenging to utilize in this fashion. Experience in implementing the BIS has led to the recognition of several changes that would improve the

incremental scoring and make the BIS easier for trauma system stakeholders to understand the scoring statements.

Trauma involves a “continuum of care”, beginning with injury prevention and prehospital care, progressing through acute care, and ending with rehabilitation and community reintegration. The recent release of a report from the National Academies of Sciences, Engineering, and Medicine (NASEM), **A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths**³ confirms the need for stronger integration, particularly the need to more fully integrate military and civilian trauma systems as well as prehospital and trauma center care. These elements are not directly emphasized in the current MTSPE. The document should be updated to align with the recommendations put forward in the recent NASEM report.

Issues in trauma system development have changed over the past decade and have included limited financial support for infrastructure, the expansion of disaster preparedness programs, improved data systems, and strategies for system-wide quality improvement. Pediatric and geriatric trauma system issues were not well addressed in either of the prior documents and both would benefit from integration of these system changes. Recently, the National Association of State EMS Officials (NASEMSO) released a monograph that provides a contemporary snapshot of the status of formal trauma system development in states and their utilization of the system development tools provided in the MTSPE. The report makes two relevant points: 1) formal trauma systems do not exist in all states; and 2) the standards, criteria, and requirements that guide state trauma systems are not directly comparable, including definitions of terms, inclusion and exclusion criteria for data systems, and processes for recognition of trauma centers.⁴

The National EMS Advisory Council (NEMSAC) recommends:

FICEMS should develop an integrated Federal strategy to address both the recommendations of the NASEM report and the need to update the Model Trauma Systems Planning and Evaluation (MTPSE) document and the Benchmarks, Indicators and Scoring (BIS) tool that includes the following concepts:

- An updated approach to trauma care with a more thorough description of methods and opportunities to integrate trauma system programs with public health programs should be outlined, such as sharing common data for injury surveillance, injury reporting, and ongoing performance improvement monitoring
- The coalition involved with the update should include individuals who represent organizations from all segments of trauma care, including but not limited to: prevention, EMS, emergency medicine, acute care, critical care, rehabilitation, the public, the Tribal Health System, and surgeons and surgical subspecialists who represent disciplines in the major areas of trauma care (general, pediatric, geriatric, orthopedic surgery, neurological surgery)
- The need to more fully integrate military and civilian trauma systems including prehospital and trauma center care

- Explore options to link the National EMS Information System (NEMSIS) with the National Trauma Data Bank (NTDB) and to develop a universal patient tracking system that would enable definitive data linking, making it possible to follow the clinical course from the prehospital phase through rehabilitation
- An expansion of trauma registry based outcome data to measure system wide performance with less dependence on process of care measures
- Analyses of population based data that includes patients cared for at non-trauma centers to enable a better understanding of system performance, including calculation of true under and over triage rates
- Addressing the critically important question of how an inclusive trauma system can best serve the rapidly growing proportion of the population over the age of 65, especially those with more minor injuries for whom there is controversy regarding the benefits of trauma center care
- Addressing the needs of children within the trauma system
- FICEMS should partner with the ACSCOT to continue the scientific review and improvement of the field triage criteria and consider adding the activation criteria for continual review and evidence based improvement
- Encourage development of trauma systems in states where they currently do not exist
- Promote standardization of the requirements that guide state trauma systems and discourage system fragmentation across multiple state agencies
- Update of the BIS scoring tool to reduce/consolidate the number of indicators, clarify objectivity of the indicators, improve scoring criteria, update indicators related to emergency and disaster preparedness, and identify a small subset of “essential indicators” that may be useful to facilitate summary comparisons and interim analysis

A. Scope and Definitions of Trauma System Development

TEN MILESTONES IN TRAUMA SYSTEM DEVELOPMENT

1. Military Trauma Care Paradigm

In World War II, the treatment of casualties evolved to a very efficient system. Small surgical teams deployed close to the battlefield resuscitated seriously wounded (10% of all casualties) with blood transfusion, and immediate surgery that controlled hemorrhage and wound contamination. The military extended this forward concept in Korea and Viet Nam with the reliance upon helicopters that rapidly transported the moribund patient from the battlefield to a surgical hospital able to provide immediate care. The Military paradigm was prompt resuscitation combined with immediate life saving surgery.

2. “Accidental Death and Disability” Report

In 1966, the landmark white paper, *Accidental Death and Disability: The Neglected Disease of Modern Society*, was published by the National Academy of Science.⁵ The authors provide evidence that injury was a growing problem with many aspects similar to an infectious disease epidemic. It identified that many prehospital ambulance providers were not trained and were unequipped to manage injured patients. A major problem was that physician response was tardy and ineffective when a seriously injured patient was delivered to most acute care hospitals with emergency departments. This document had an enormous political influence. On September 9, 1966, President Johnson signed into

law the *Highway Safety Act of 1966*⁶ that led to standards for prehospital providers and equipment.

3. State Trauma Systems Established

Three states, Florida, Illinois, and Maryland seized the opportunity to use federal support for trauma system development, and implemented the first systems in the United States. As these first systems were implemented, policy makers and physicians established essential components including designation of tertiary centers, training of prehospital providers and development of triage guidelines, quality assurance review of outcomes, and the early development of trauma care databases.

4. First Field Triage Guidelines

In 1980, the Orange County paradigm for establishing a trauma system was demonstrated. First, there was a report of a high rate of preventable deaths among trauma patients in a community without a trauma system. The public demanded action, and a trauma system was implemented. A few hospitals willing to make an extraordinary effort to care for trauma patients were designated as trauma centers, and prehospital EMS personnel were provided guidelines for triage of “seriously injured” patients from the scene of injury to the trauma centers, even if that meant the ambulance bypassed the emergency departments of non-designated hospitals. Third and final step was a repeat of the preventable death study that demonstrated a substantial reduction in preventable deaths.

5. Trauma System Components Defined

In 1987 West and colleagues developed a list of eight essential criteria for a trauma system.⁷ Eight key criteria for a regional trauma system to be considered fully operational were: 1. A lead government agency had authority to categorize trauma centers. 2. A formal process was published for designation of trauma centers. 3. There were standards for designation of trauma centers into two or more categories. 4. Out of area and presumably independent survey teams were used to determine trauma center compliance with standards. 5. The lead agency had statutory authority to limit the number of trauma centers based upon need. 6. The prehospital care providers used triage protocols and guidelines to decide where a patient would be treated. 7. There was a system for monitoring the quality of care delivered to seriously injured patients. 8. There was statewide coverage of seriously injured patients. In 1987, West et al reported that only two states met all eight criteria. In 1993, Bazzoli et al conducted a nationwide survey of regional trauma systems, and concluded that only five states met all criteria.⁸ In 1998, Bass et al reported another survey, and concluded five states met all five criteria, but 28 states met six or seven criteria, and concluded there was an improvement in trauma system coverage.⁹ This series of manuscripts indicate that over the period of 1980 to 2000, trauma systems as public health care policy were increasingly accepted.

6. Efficacy of Level I Trauma Centers

A fundamental hypothesis of those advocating trauma systems was that treatment of seriously injured patients in tertiary care Level I trauma centers reduced their risk of death and improved their recovery. A landmark study was published by MacKenzie, et al in 2006 that provided compelling evidence that the hypothesis was true.¹⁰ MacKenzie and colleagues used a huge database of regions around the United States to record detailed

information on seriously (defined as an ISS of 9 or greater excluding burn and hip fractures) injured patients. The strength of their study was one year follow up and economic data. They concluded that patients who were aged 18 to 54 had a 25% reduction in relative risk of death if they were admitted to a Level I trauma center, and that the cost of care in a Level I was higher. An additional observation of the MacKenzie, et al study was that patients between ages 56 and 80 did not have a reduction in risk of death; this observation had implications for triage criteria of who should be transported to a Level I trauma center.

7. Economics of Trauma Systems

Advocates of trauma systems have encountered the issue of whether or not trauma systems are economical. A recurrent issue has been that designated trauma centers will drop their categorization as trauma centers because the reimbursement is insufficient.¹¹ In contrast, current economic conditions (since about 2005) have favored a rapid growth in the number of Level II centers in many urban/suburban areas, leading to concern that these are over-served in a way that puts system stability at risk.

8. Exclusivity vs. Inclusivity

Scholars debated optimal trauma systems design and whether trauma systems should be inclusive or exclusive. States have varied in their approaches.¹²

9. Trauma Data Collection Standardized

A major achievement of trauma system advocates has been a refinement in both methodologies and data collection regarding trauma care. The earliest trauma registry data covered four aspects; the number and severity of injuries in an Injury Severity Score, the admission physiologic dysfunction, the treatments and outcome –essentially survival at hospital discharge. As trauma registry data improved, the American College of Surgeons Committee on Trauma took the lead in collecting data from multiple trauma centers and with the combined data and advanced statistical methods published risk adjusted expected odds of death. The National Trauma Data Bank became the widely accepted standard for determining the expected number of survivors in a population that could be compared to the observed number of survivors, and thus generate a trauma center performance.

10. At Risk Populations Defined

Two populations among hospitalized injured patients emerge in importance; the pediatric population and the elderly with associated medical conditions. Both of these were under recognized in initial development of trauma centers and systems.

B. Crosswalk with other standards documents or past recommendations

Timeline of Federal Initiatives in Trauma Care:

In **1990**, the **Trauma Care Systems Planning and Development Act** was enacted [P.L. No. 101-590, 104 Stat. 2915].¹

In **1992**, HRSA released the **Model Trauma Care System Plan**.¹³

In **2001**, Congress appropriated funding for the Health Resources and Services Administration (HRSA) to administer the **Trauma-Emergency Medical Services (EMS) Systems Program** as authorized by the Trauma Care Systems Planning and Development Act of 1990.¹⁴ At that time, a decision was made to revise the existing trauma plan to coordinate with the 3 Core Functions and 10 Essential Services of Public Health developed by the U.S. Department of Health and Human Services (HHS) with the public health community in the mid-1990s.

In **2002**, HRSA released the **National Assessment of State Trauma System Development, Emergency Medical Services Resources, and Disaster Readiness for Mass Casualty Events**.¹⁵ This national assessment revealed that those States with the most developed or comprehensive trauma systems were the States most ready to respond to and medically manage day-to-day as well as mass casualty incidents.

The **2004 Trauma System Agenda for the Future** was coordinated through the American Trauma Society and supported by the U.S. Department of Transportation, National Highway Traffic Safety Administration.¹⁶ The document was designed to provide trauma care professionals, public health officials, and health care policy experts with the direction to use the public health approach, a scientifically proven method, when developing and evaluating trauma systems.

The **2006 Model Trauma System Planning and Evaluation (MTSPE)** document by the Health Resources and System Administration (HRSA) was drafted by expert consensus, and proposed that the ideal trauma system be based on the CDC's public health framework with three core functions and 10 essential services (see Figure 1).² This framework was based upon recommendations put forward in the 1988 Institute of Medicine report *The Future of Public Health*.¹⁷ The advantages of using a public health model for the trauma system include: developing a common language with other public health programs, integrating trauma into local public health assessments, closer linkages with all-hazards planning and response efforts, and the possibility of increased funding support for trauma systems.



Figure 1. The Public Health Model, from <http://www.cdc.gov/nphpsp/essentialServices.html>

C. Analysis

The **Model Trauma System Planning and Evaluation (MTSPE)**:

- Recommended integration and coordination with the state health plan and with the state's emergency response plan
- Illustrated the need for inclusion of all acute care facilities in the trauma system
- Reflected the consistency of trauma system operational components with the public health framework of assessment, policy development, and assurance
- Provided guidance on comprehensive trauma system development
- Addressed trauma system operational requirements
- Allowed for variations in rural versus urban needs and resources based on assessment results
- Demonstrated an all-encompassing approach across the continuum of trauma care from injury prevention to post-acute care rehabilitation and community reintegration

The American College of Surgeons (ACS) used the MTSPE as the foundation for its Trauma System Consultation (TSC) program that provides recommendations to states or regions about priorities and strategies for the next stage of trauma system development. This consultation process has been requested across the country by more than 35 states, regions, and counties.

A significant portion of the MTSPE includes an assessment tool based on the public health model, comprised of a series of **Benchmarks, Indicators and Scoring (BIS)** criteria. A series of more than 100 indicators were developed along with associated benchmarks and scoring criteria for use in assessing a trauma system. The BIS tool has been used in several states to assess trauma system attributes and identify priorities for trauma system development. Several states have rescored the BIS to measure progress over time. A subset of indicators from the BIS tool has been used to document the stage of development, and follow up with states and regions visited have used the same indicators to mark progress after 2 to 3 years. Separate from those

consultations, the ACS has facilitated BIS evaluations using all indicators in six states.

Challenges to the Current Trauma System Agenda for the Future:

The trauma system agenda emphasized process of care measures with concentration on evaluating a state's trauma functionality through its trauma center network rather than looking at outcomes between trauma and non-trauma centers for specific populations. For example, more recent evidence suggests that there are improved outcomes for badly hurt children cared for in trauma centers but perhaps not for the elderly when compared with non-trauma centers. Currently, formal trauma systems do not exist in all states and, in states where they do, significant components of the system may be housed in different administrative entities, resulting in silos of care that communicate less effectively. The standards, criteria, and requirements that guide state trauma systems are not directly comparable, including definitions of terms, inclusion and exclusion criteria for data systems, and processes for recognition of trauma centers.

Challenges to the BIS:

The BIS is organized along the lines of the public health core functions of Assessment, Policy Development, and Assurance, and is further focused around the ten essential services identified in the public health model adapted to trauma systems. The BIS was intended as a self-assessment tool, but its length and complexity, as well as the general lack of familiarity with the CDC model among trauma system stakeholders make it challenging to utilize in this fashion. There is no published data on the independent use of the BIS, and in the experience of the Trauma System Consultation program the BIS has rarely been used independently by trauma systems. Experience in implementing the BIS has led to the recognition of several changes that would improve the incremental scoring and make the BIS easier for trauma system stakeholders to understand the scoring statements. The revision could also more thoroughly incorporate and promote the needs of children and the elderly within the global concept of trauma system development.

The American College of Surgeons' **Trauma Systems Evaluation and Planning Committee (TSEPC)** likely has the most experience in utilizing the BIS tool to evaluate trauma systems, having been involved in seven statewide evaluations to date. The most recent BIS assessment was conducted in Nebraska in July 2016. Additionally, the TSEPC has used a subset of the BIS (16 indicators) to evaluate progress made by 20 regions and states following a trauma system consultation. The evaluations performed with these 16 indicators were published:

- An assessment of the impact of trauma systems consultation on the level of trauma system development. Robert J Winchell, RJ, Ball, JW, Cooper, GF, Sanddal, ND, Rotondo, MF, *Journal of American College of Surgeons*, 2008, 207(5): 623-29.¹⁸
- A reassessment of the impact of trauma systems consultation on regional trauma system development. Winchell RJ, Sanddal N, Ball J, Michaels H, Kaufmann CR, Gupta R, Esposito TJ, Subacius H., *J Trauma Acute Care Surg*. 2015, 78(6): 1102-10.¹⁹

Findings in these two peer-reviewed papers noted measurable progress, as evaluated by BIS scores, over a period of up to five years after the region or state had received a trauma system consultation. Beyond that threshold, progress was stalled or even deteriorated. These studies illustrate one way the BIS indicators can be used to measure progress in trauma system development over time. In addition, the experience from the consultation program has shown that a regional or statewide BIS assessment is best performed with a knowledgeable facilitator who can assist key trauma system stakeholders to navigate the 113 indicators in the BIS and to help them achieve consensus regarding correct indicator scoring and interpreting aggregated scores for each of the indicators.

D. Committee conclusion

Current Needs Surrounding Trauma System Development

Using the tenets of the pre-existing Trauma System Agenda for the Future, a new vision for Trauma System development should promote:

1. A primary focus on implementation of the recommendations outlined in the recent NASEM report.³
2. An expansion of trauma registry based outcome data to measure system wide performance with less dependence on process of care measures.
3. Analyses of population based data that includes non-trauma center patients and enables calculation of under and over triage rates, and the critically important question of whether an inclusive trauma system is going to include the rapidly growing proportion of the population over the age of 65, for whom data suggests trauma center care does not improve survival.
4. More direct involvement by state trauma program managers and advisory councils (i.e. the end users) in the process of trauma system development.

Current Needs Surrounding the MTSPE

The MTSPE document is now 10 years old. The landscape of trauma system planning has changed substantially during the past decade. In addition, the 2006 MTSPE represents a first attempt to adapt the public health model to trauma system structure and experience with the approach suggests a benefit from refinements in the adaptation. Specific examples include:

1. The document should be updated to align with the recommendations put forward in the recent NASEM report.
2. The current document has a dual focus; it outlines the structure for designing a trauma system within a public health framework while at the same time working to persuade trauma stakeholders to adopt this approach. A more clear separation of these goals and a stronger focus on the operational elements will be beneficial.
3. An updated approach with a more thorough description of methods and opportunities to integrate trauma system programs with public health programs

should be outlined, such as sharing common data for injury surveillance, injury reporting, and ongoing performance improvement monitoring.

Strategic Goals

Relating specifically to the BIS tool, the ACS has identified areas in need of updating and improvement including the following:

1. The sheer number of indicators (113) is daunting to many states and jurisdictions desiring to complete a baseline BIS assessment. The ACS has demonstrated that a subset of the indicators can be successfully applied to measure trauma system progress. The exact number of indicators needed for a comprehensive trauma system BIS assessment is not known, but many duplicate indicators with minor distinguishing language could be collapsed or combined.
2. Indicator language overall needs review and revision to increase clarity, consistency, and objectivity.
3. Many indicators need scoring criteria improvements so that options are more incremental and less confusing to stakeholders.
4. Indicators related to emergency and disaster preparedness require updating since the approaches, science, and terminology in this field have changed substantially since the MTSPE document was published.
5. The identification of a small subset of “essential indicators” that focus on broad elements of system development may be useful to facilitate summary comparisons and interim analysis.

Recommended Actions/Strategies:

Injury continues to be a major public health epidemic. It is the leading cause of death for persons aged 1 to 44 years costing the American economy millions of dollars in lost wages and direct health care costs.

NEMSAC Recommends to the:

Federal Interagency Committee on Emergency Medical Services

Recommendation 1: The NEMSAC recommends that FICEMS develop an integrated Federal strategy to address both the recommendations of the NASEM report and the need to update the Model Trauma Systems Planning and Evaluation (MTPSE) document and the Benchmarks, Indicators and Scoring (BIS) tool. The revision should include careful consideration of all elements of this recommendation as detailed in the Executive Summary on pages 2-3 of this Advisory.

References and Resources:

1. H.R.1602 - Trauma Care Systems Planning and Development Act of 1990 H.R.1602 - 101st Congress (1989-1990): Trauma Care Systems.
2. Model Trauma System Planning & Evaluation. The Health Resources and Services Administration. U.S. Department of Health and Human Services Program Support Center, Visual Communications Branch. Released February 2006.

3. National Academies of Sciences, Engineering, and Medicine. 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.
<http://www.nationalacademies.org/hmd/Reports/2016/A-National-Trauma-Care-System-Integrating-Military-and-Civilian-Trauma-Systems.aspx>
4. The National Association of State EMS Officials. Status of state trauma system planning and development: Trauma System Planning and Development: Utilization of the HRSA Model Trauma System Planning and Evaluation Document. September 2016.
<https://www.nasemso.org/Resources/Monographs/documents/Status-of-State-Trauma-System-Planning-and-Development-Sept2016.pdf>.
5. NAS/NRC66 Accidental Death and Disability: The Neglected Disease of Modern Society. Washington, D.C., National Academy of Sciences/National Research Council, 1966.
6. National Highway Safety Act of 1966
7. West JG, Williams JM, Trunkey DD, Wolferth CC. Trauma systems: current status-future challenges. JAMA 1988; 259:3597-3600.
8. Bazzoli GJ, Madura KJ, Cooper GF et al. Progress in the development of trauma systems in the United States. Results of a national survey. JAMA 1995; 27:395-401.
9. Bass RR, Gainer PS, Carlinia AR. Update on trauma system development in the United States. J Trauma 1999; 47:S15-S21.
10. MacKenzie EJ, Rivara FP, Jurkovich GJ et al. The value of trauma center care. N Engl J Med 2006; 354: 366-78.
11. Hsia, RY, Shen YC. Rising closures of hospital trauma centers disproportionately burden vulnerable populations. Health Aff (Millwood) 2011; 30:1912-20.
12. Utter GH, Maier RV, Rivara FP, et al. Inclusive trauma systems: do they improve triage or outcomes of the severely injured? Journal of Trauma Acute Care Surg 2006; 60(3):529-37. doi: 10.1097/01.ta.0000204022.36214.9e
13. U.S. Department of Health and Human Services, Public Health Service, Health Resources and Services Administration, Bureau of Health Resources Development, Division of Trauma and Emergency Medical Systems. Model Trauma Care System Plan. Rockville, Maryland: Public Health Service, 1992.
14. Trauma-Emergency Medical Services (EMS) Systems Program as authorized by the Trauma Care Systems Planning and Development Act of 1990 [P.L. No. 101-590, 104 Stat. 2915].
15. U.S. Department of Health and Human Services, Health Resources and Services Administration. A 2002 National Assessment of State Trauma System Development, Emergency Medical Services Resources, and Disaster Readiness for Mass Casualty Events. Washington, DC: Health Resources and Services Admin. 2002.
16. American Trauma Society and U.S. Department of Transportation, National Highway Traffic Safety Administration. Trauma System Agenda for the Future. National Highway Traffic Safety Administration; October 2002. Report #3P0138.

17. Walker, B Jr. The Future of Public Health: the Institute of Medicine's 1988 report. J Public Health Policy. 1989 Spring; 10(1):19-31. <http://www.ncbi.nlm.nih.gov/pubmed/2715336>
18. <http://www.sciencedirect.com/science/article/pii/S1072751508009198> Winchell RJ, Ball JW, Cooper GF, Sanddal ND, Rotondo, MF. An assessment of the impact of trauma systems consultation on the level of trauma system development. Journal of American College of Surgeons 2008, 207(5): 623-29
19. <http://www.ncbi.nlm.nih.gov/pubmed/26151508> Winchell RJ, Sanddal N, Ball J, Michaels H, Kaufmann CR, Gupta R, Esposito TJ, Subacius H. A reassessment of the impact of trauma systems consultation on regional trauma system development. J Trauma Acute Care Surg 2015; 78(6): 1102-10.