



**Trauma System Consultation
State of Missouri
Jefferson City, Missouri**

June 22nd-25th, 2009

**American College of Surgeons
Committee on Trauma**

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Executive Summary

Overview

Many states are authorized to establish a trauma system to protect its residents by statute. Missouri is required to do so not only by statute but by the very foundation of the State, its motto: *Salus Populi Suprema Lex Esto* – Let the welfare of the people be the supreme law.

Missouri is known as the “Show Me” state. It is heterogeneous with a total population of 5.9 million that has grown about 6% since the last census. About a quarter of the population is under the age of 18 and about 13% are over the age of 65. Although it has urban centers, it is a rural state with population density of 81 people per square mile and about 70,000 square miles. Missouri boasts a highly diversified economy that includes transportation, beer and beverages, defense, farming, aerospace, lead, zinc, and timber. It is comprised of 114 counties which have a number of health care assets including 112 hospitals, 29 of which are “trauma centers”, and 36 of which are Critical Access Hospitals (CAH's). In addition to the acute care facilities, there are 4 rehabilitation hospitals.

History

In 2003, Emergency Medical Services (EMS) and trauma care reform was made a priority through a partnership involving the Missouri Foundation for Health (MFH) and the Department of Health and Senior Services (DHSS). The effort was spearheaded by Dr. Bill Jermyn and the State Advisory Committee on EMS (SAC).

In 2004, a “Summit” was convened to garner input from key stakeholders about the design and scope of a new emergency health care program within the DHSS. In 2005, the MFH funded a position for an EMS Medical Director. Dr. Jermyn was, logically, selected to fill that position. A true visionary, Dr. Jermyn moved the state toward a time critical diagnosis (TCD) concept in which those patients with immediate life threatening injuries that respond well to specific early interventions would be moved through regional systems of care commensurate with their needs. The TCD process included stroke, ST elevated myocardial infarction (STEMI), and trauma. Over the course of the succeeding year, it became clear to some that stroke and STEMI were gaining much more traction than trauma system development. Dr. Huckfeldt presented data in 2006 that helped refocus efforts on trauma system development as the leading cause of death of Missourians between ages 1 and 44 with a greater number of years of productive life lost than stroke and STEMI combined. In 2008, legislation was passed that created the TCD System. The State experienced a loss due to the unexpected death of the TCD visionary, Dr. Jermyn in 2008. In spite of this setback, incremental progress on TCD development continued through writing of the report, hiring a new EMS medical director, and supporting the Trauma Task Force and Stroke/STEMI implementation groups to its current point of development.

Current Status

Trauma stakeholders and DHSS leadership have recognized the need for a reinvigoration of efforts to help the trauma system mature and are motivated to take the next steps. There has been measurable progress by the Trauma Task Force (TTF). Unfortunately, the future status of the TTF is unclear. Clearly, there are dedicated providers at all levels – state officials, prehospital, hospital, rehabilitation and many others who are anxious to make a renewed commitment to trauma system development. As such, the ACS Trauma System Consultation was convened, and the results of this report can and should be used as a roadmap to help focus that renewed commitment.

Advantages & Assets

- The creation of the Trauma Task Force represents a clear and outward sign of commitment to system development
- Missouri Foundation for Health has demonstrated steadfast support for the effort
- Office of Epidemiology and Health Informatics has committed, enthusiastic, and knowledgeable staff
- The Injury and Violence Prevention Program has made important contributions
- The Falls Prevention Program is leading edge
- The rehabilitation capacity is outstanding for a state of its size
- The overall development approach has been both innovative and creative by virtue of:
 - The conceptualization of the TCD System
 - The focus on rural education – Comprehensive Advanced Life Support (CALs)
 - The integration of CAH's as Level IV trauma facilities

Challenges, Vulnerabilities & Opportunities:

- At the same time, the TCD System represents a potential vulnerability:
 - There is no clear Mission and Vision for system development relative to injury care
 - There has been a loss of focus on injury care relative to the other elements of the TCD System
- The current organization and structure lacks integration
 - It is unclear whether or not the State Advisory Council on EMS is both functional and efficacious in the cause of advancing trauma system development
- There is lack of data integration and utility

- Available data is not used for performance improvement or system evaluation
- There is little or no utilization of outside benchmarks for system performance
- While there is a plethora of information on injury epidemiology, little of it is widely disseminated
- Statutes related to injury care lack clarity
- There is fragmentation of the 911 System
- The designation and licensing cycle is too long and out of sync with best practices across the United States
- There is no dedicated and sustainable funding

Priority Recommendations Summary

This report contains more than 85 recommendations. The site visit team identified the following fourteen as the most important for the trauma system's short and long-term success.

Statutory Authority and Administrative Rules

- **Revise trauma center designation regulations to adopt, meet, or exceed, by reference, the current version of "Resources for the Optimal Care of the Injured Patient"; Committee on Trauma, American College of Surgeons.**

System Leadership

- **Create a Division of Emergency Care within the Department of Health and Senior Services which unifies the Time Critical Diagnosis System and Emergency Medical Services. The Division, composed of high level state leaders empowered by law, should delineate the vision for Missouri's trauma system as part of the TCDS.**

Coalition Building and Community Support

- **Provide workshops on community engagement and coalition building, to further develop and enhance the State's ability to work effectively with constituency groups throughout the state.**

Lead Agency and Human Resources Within the Lead Agency

- **Create and fund a full time dedicated trauma nurse manager position within the lead agency.**
 - **The successful candidate should have a strong background in trauma system management and emergency care.**
- **Create a DHSS funded leadership position for an EMS/Trauma Medical Director (qualified by emergency medicine and trauma experience) within the lead agency.**

Trauma System Plan

- **Develop a comprehensive strategic plan for the further design, development, implementation, and ongoing improvement of a statewide, integrated, regional based/driven trauma system plan for Missouri within the next six months.**

Financing

- **Develop a specific budget within DHSS to support trauma system development and oversight.**

Definitive Care Facilities

- **Define roles, responsibilities, and accountabilities for all acute care facilities in an inclusive system related to trauma care.**
- **Establish uniform, clearly defined designation criteria, including critical and non-critical criteria deficiencies for each trauma center level, aligned with the current American College of Surgeons' guidelines.**
 - **Apply criteria consistently to all centers.**
 - **Utilize a broader confidential multidisciplinary group (SAC) to review and act upon designation recommendations.**
 - **Eliminate all waivers.**
 - **Move to a three year verification schedule in line with national standards.**

System-wide Evaluation and Quality Assurance

- **Create a consensus vision and plan for Trauma System Performance Improvement including:**
 - **which forum will be utilized**

- **who will be responsible for it**
- **who will participate in it**
- **which filters/parameters will be utilized first**
- **which data sources will be used**

Trauma Management Information System

- **Require all acute care hospitals to participate in the timely submission of injury data (limited subset) as part of both trauma center designation (participating hospitals) and hospital licensure (non-participating acute care facilities).**
- **Enforce all EMS agencies to complete and submit a MARS compatible record for all patient contacts. (add to regulatory authority as well)**
- **Ensure that TCD Data System and MARS data systems are managed in a manner that assures reliability and validity of data and is capable of producing reports that can be used to inform trauma policy. This could occur by either substantially increasing the capacity of the newly formed Center or by a collaborative relationship with the Office of Epidemiology and Health Informatics.**

Trauma System Assessment

Injury Epidemiology

Purpose and Rationale

Injury epidemiology is concerned with the evaluation of the frequency, rates, and pattern of injury events in a population. Injury pattern refers to the occurrence of injury-related events by time, place, and personal characteristics (for example, demographic factors such as age, race, and sex) and behavior and environmental exposures, and, thus, it provides a relatively simple form of risk-factor assessment.

The descriptive epidemiology of injury among the whole jurisdictional population (geographic area served) within a trauma system should be studied and reported. Injury epidemiology provides the data for public health action and becomes an important link between injury prevention and control and trauma system design and development. Within the trauma system, injury epidemiology has an integral role in describing the root causes of injury and identifying patterns of injury so that public health policy and programs can be implemented. Knowledge of a region's injury epidemiology enables the identification of priorities for directing better allocation of resources, the nature and distribution of injury prevention activities, financing of the system, and health policy initiatives.

The epidemiology of injury is obtained by analyzing data from multiple sources. These sources might include vital statistics, hospital administrative discharge databases, and data from emergency medical services (EMS), emergency departments (EDs), and trauma registries. Motor-vehicle crash data might also prove useful, as would data from the criminal justice system focusing on interpersonal conflict. It is important to assess the burden of injury across specific population groups (for example, children, elderly people and ethnic groups) to ensure that specific needs or risk factors are identified. It is critical to assess rates of injury appropriately and, thus, to identify the appropriate denominator (for example, admissions per 100,000 population). Without such a measure, it becomes difficult to provide valid comparisons across geographic regions and over time.

To establish injury policy and develop an injury prevention and control plan, the trauma system, in conjunction with the state or regional epidemiologist, should complete a risk assessment and gap analysis using all available data. These data allow for an assessment of the "injury health" of the population (community, state, or region) and will allow for the assessment of whether injury prevention programs are available, accessible, effective, and efficient.

An ongoing part of injury epidemiology is public health surveillance. In the case of injury surveillance, the trauma system provides routine and systematic data collection and, along with its partners in public health, uses the data to complete injury analysis, interpretation, and dissemination of the injury information. Public health officials and trauma leaders should use injury surveillance data to describe and monitor injury events and emerging injury trends in their jurisdictions; to identify emerging threats that will call for a reassessment of priorities and/or reallocation of resources; and to assist in the planning, implementation, and evaluation of public health interventions and programs.

OPTIMAL ELEMENTS

- I. There is a thorough description of the epidemiology of injury in the system jurisdiction using population-based data and clinical databases. **(B-101)**
 - a. There is a through description of the epidemiology of injury mortality in the system jurisdiction using population-based data. **(I-101.1)**
 - b. There is a description of injuries within the trauma system jurisdiction, including the distribution by geographic area, high-risk populations (pediatric, elderly, distinct cultural/ethnic, rural, and others), incidence, prevalence, mechanism, manner, intent, mortality, contributing factors, determinants, morbidity, injury severity (including death), and patient distribution using any or all the following: vital statistics, ED data, EMS data, hospital discharge data, state police data (data from law enforcement agencies), medical examiner data, trauma registry, and other data sources. The description is updated at regular intervals. **(I-101.2)**
Note: Injury severity should be determined through the consistent and system-wide application of one of the existing injury scoring methods, for example, Injury Severity Score (ISS).
 - c. There is comparison of injury mortality using local, regional, statewide, and national data. **(I-101.3)**
 - d. Collaboration exists among EMS, public health officials, and trauma system leaders to complete injury risk assessments. **(I-101.4)**
 - e. The trauma system works with EMS and public health agencies to identify special at-risk populations. **(I-101.7)**
- II. Collected data are used to evaluate system performance and to develop public policy. **(B-205)**
 - a. Injury prevention programs use trauma management information system data to develop intervention strategies. **(I-205.4)**
- III. The trauma, public health, and emergency preparedness systems are closely linked. **(B-208)**

- a. The trauma system and the public health system have established linkages, including programs with an emphasis on population based public health surveillance and evaluation for acute and chronic traumatic injury and injury prevention. **(I-208.1)**

IV. The jurisdictional lead agency, in cooperation with the other agencies and organizations, uses analytic tools to monitor the performance of population based prevention and trauma care services. **(B-304)**

- a. The lead agency, along with partner organizations, prepares annual reports on the status on injury prevention and trauma care in the state, regional, or local areas. **(I-304.1)**
- b. The trauma system management information system database is available for routine public health surveillance. There is concurrent access to the databases (ED, trauma, prehospital, medical examiner, and public health epidemiology) for the purpose of routine surveillance and monitoring of health status that occurs regularly and is a shared responsibility. **(I-304.2)**

CURRENT STATUS

Missouri Department of Health and Senior Services (DHSS) has an extremely strong epidemiology program led by an enthusiastic and committed state epidemiologist, Dr. Sarah Patrick. Dr. Patrick understands injuries as a key public health issue and is eager to support efforts to target injury prevention and control initiatives so as to most effectively address this multifaceted problem. She leads a staff of approximately 100 FTE's and has a total budget of more than \$9 million, much of which comes from federal grants. Her section's Community Education unit, which has graphic arts and writing expertise, provided graphics assistance for the Time Critical Diagnosis System report (August 2008) that was written by the State EMS Medical Director and consultant. Many site visit attendees were unaware of this rich resource and expressed an interest in working with Dr. Patrick and her staff to learn more about the epidemiology of injury in their locales.

Dr. Patrick's section houses vital records (birth, death, etc) and hospital discharge data, including Emergency Department (ED) data, which is mandated to be reported by all 140 acute care hospitals in the state. ED data and death data were used to create the web-based Missouri Information for Community Assessment (MICA) program and the Injuries in Missouri report. Participants were largely unaware of this source of information about injuries in the state and counties. Local health departments have been educated on the MICA program by Dr. Patrick and her staff, and the MICA website is a public site available for use by trauma stakeholders.

Dr. Patrick has succeeded in securing an EIS (Epidemiologic Investigation Service) officer for Missouri, who will begin work in the near future. She is also

trying to secure a Centers for Disease Control and Prevention (CDC) Masters-prepared epidemiology officer.

The Division of Senior and Disability Programs has written an annual report on falls among older adults and has identified this mechanism as a major cause of injuries in this population.

Missouri has multiple significant injury prevention-related federal grants, including the CODES (Crash Outcome Data Evaluation System) grant, the CDC Traumatic Brain Injury grant, Public Health and Maternal Child Health block grants, and CDC grants to support sexual assault prevention and forensic examination. These projects are specific to the service requesting the grant and do not appear to be integrated with the trauma system. Dr. Patrick plans to apply for a CDC National Violent Death Reporting System grant in the future.

Dr. Sharmini Rogers is chief of the Bureau of Genetics and Healthy Children within the Division of Community and Public Health of DHSS. The Missouri Injury and Violence Prevention Advisory Committee (MIVPAC) is also under her aegis. There is one FTE devoted entirely to injury prevention in this section, and this person uses both national and MICA data to support the activities of the MIVPAC. This coalition addresses injury prevention and control activities for multiple mechanisms of injury and has members from across the state, including some trauma centers. They are in the process of partnering with the St. Louis School of Public Health on the development of a strategic plan for injury prevention and control, anticipated to be completed in August 2009. About 40 local health departments chose injury prevention activities as one of their top three priorities for projects funded with Maternal Child Health (MCH) block grant funds.

Many trauma centers analyze their own trauma registry data and use it to identify injury prevention priorities in their catchment areas. Some engage partners such as the local prehospital community in injury prevention activities.

MOSTORM, now the Missouri Time Critical Diagnosis System database, could potentially provide injury demographic data to trauma stakeholders. This data is currently not used by trauma system participants partially because of concerns regarding confidentiality. The data is not inclusive of all trauma centers and some participating trauma centers are not reporting quarterly with the maximum 90 day lag time required by current regulation. The quality/accuracy of the data has not been validated.

Head and spinal cord injury data are mandated to be reported by all acute care hospitals to a database housed in the BEMS. Issues of quality and accuracy have not been tested, and some hospitals report only annually by paper.

RECOMMENDATIONS

- Meet with key data owners and analysts within DHSS to identify injury epidemiology resources and initiate networking to support injury prevention and control activities statewide.
- Educate all trauma system partners on the use of widely available injury prevention resources such as the MICA website.
- Strengthen the partnership between the trauma system participants and the Missouri Injury and Violence Prevention Advisory Committee to: increase networking, utilize existing prevention partnerships, decrease redundancy related to injury prevention, and to match injury resources to targeted injury prevention needs.
- Seek financial support from such entities as the Missouri Foundation for Health for education on data access and its use to prioritize injury prevention needs and evaluate prevention program effectiveness for all statewide trauma system participating agencies and staff.
- Provide regular aggregated regional injury demographic reports from the Missouri Time Critical Diagnosis Data System (TCDDS) to the SAC and all trauma system stakeholders.

Indicators as a Tool for System Assessment

Purpose and Rationale

In the absence of validated national benchmarks, or norms, the benchmarks, indicators and scoring (BIS) process included in the Health Resources and Services Administration's *Model Trauma System Planning and Evaluation* document provides a tool for each trauma system to define its system-specific health status benchmarks and performance indicators and to use a variety of community health and public health interventions to improve the community's health status. The tool also addresses reducing the burden of injury as a community-wide public health problem, not strictly as a trauma patient care issue.

This BIS tool provides the instrument and process for a relatively objective state and substate (regional) trauma system self-assessment. The BIS process allows for the use of state, regional, and local data and assets to drive consensus responses to the BIS. It is essential that the BIS process be completed by a multidisciplinary stakeholder group, most often the equivalent of a state trauma advisory committee. The BIS process can help focus the discussion on various system strengths and weaknesses, can be used to set goals or benchmarks, and provides the opportunity to target often limited resources and energies to the areas identified as most critical during the consensus process. The BIS process is useful to develop a snapshot of any given system at a moment in time. However, its true usefulness is in repeated assessments that reveal progress toward achieving various benchmarks identified in the previous application of the BIS. This process further permits the trauma system to refine goals to be attained before future reassessments using the tool.

OPTIMAL ELEMENT

- I. Assurance to constituents that services necessary to achieve agreed-on goals are provided by encouraging actions of others (public or private), requiring action through regulation, or providing services directly. **(B-300)**

CURRENT STATUS

To date, the Benchmarks, Indicators, and Scoring tool has not been completed by a multi-disciplinary group of stakeholders in Missouri. When the group was queried about their awareness of the availability of the *Model Trauma System Planning and Evaluation* document, fewer than a dozen stakeholders indicated in the affirmative. When further questioned about their knowledge of the BIS tool, even fewer acknowledged awareness of the product.

Currently, there is not an existing multidisciplinary group of trauma stakeholders whose responsibility it would be to complete the BIS. The trauma subcommittee of the SAC is a possible starting point for such a group. However, assurances of broad representation across disciplines, geography, and resource types need to be affirmed. State personnel should avoid “overloading” the group charged with the completion of the BIS to ensure that it is a reflective assessment of the current state of the trauma system in Missouri, not presumptive about the way things will be in the future.

A facilitated completion of the BIS has proven to be a useful exercise in many states since it encourages examination of the system from a broad public health perspective and helps to break down silos. The results of the BIS can be used to help craft the trauma system plan and allow targeting of specific opportunities for improvement.

RECOMMENDATIONS

- Identify a multidisciplinary group of 30-40 stakeholders to participate in a review of the HRSA *Model Trauma System Planning and Evaluation* document and completion of the BIS.
- Schedule and convene the group, led by a qualified facilitator to complete the BIS.
- Use BIS results to assist with plan development, establishing baseline system benchmarks, and focusing specific talent and resources to capture “low hanging fruit” identified during the process.
- Create a schedule for periodic reassessment using the BIS tool to mark progress against original benchmark scores and to refocus priorities on the next set of issues of concern.

Trauma System Policy Development

Statutory Authority and Administrative Rules

Purpose and Rationale

Reducing morbidity and mortality due to injury is the measure of success of a trauma system. A key element to this success is having the legal authority necessary to improve and enhance care of injured people through comprehensive legislation and through implementing regulations and administrative code, including the ability to regularly update laws, policies, procedures, and protocols. In the context of the trauma system, comprehensive legislation means the statutes, regulations, or administrative codes necessary to meet or exceed a prescribed set of standards of care. It also refers to the operating procedures necessary to continually improve the care of injured patients from injury prevention and control programs through postinjury rehabilitation. The ability to enforce laws and rules guides the care and treatment of injured patients throughout the continuum of care.

There must be sufficient legal authority to establish a lead trauma agency and to plan, develop, maintain, and evaluate the trauma system during all phases of care. In addition, it is essential that as the development of the trauma system progresses, included in the legislative mandate are provisions for collaboration, coordination, and integration with other entities also engaged in providing care, treatment, or surveillance activities related to injured people. A broad approach to policy development should include the building of system infrastructure that can ensure system oversight and future development, enforcement, and routine monitoring of system performance; the updating of laws, regulations or rules, and policies and procedures; and the establishment of best practices across all phases of intervention. The success of the system in reducing morbidity and mortality due to traumatic injury improves when all service providers and system participants consistently comply with the rules, have the ability to evaluate performance in a confidential manner, and work together to improve and enhance the trauma system through defined policies.

OPTIMAL ELEMENTS

- I. Comprehensive state statutory authority and administrative rules support trauma system leaders and maintain trauma system infrastructure, planning, oversight, and future development. **(B-201)**
 - a. The legislative authority states that all the trauma system components, emergency medical services (EMS), injury control, incident management,

- and planning documents work together for the effective implementation of the trauma system (infrastructure is in place). **(I-201.2)**
- b. Administrative rules and regulations direct the development of operational policies and procedures at the state, regional, and local levels. **(I-201.3)**
- II. The lead agency acts to protect the public welfare by enforcing various laws, rules, and regulations as they pertain to the trauma system. **(B-311)**
- a. Laws, rules, and regulations are routinely reviewed and revised to continually strengthen and improve the trauma system. **(I-311.4)**

CURRENT STATUS

The Missouri Department of Health and Senior Services (DHSS) administers the statewide emergency medical services and trauma care system under the authority of the “Comprehensive Emergency Medical Services Systems Act” of 1998. This Act was amended in 2008 to define the powers and duties of regional EMS medical directors and to give the department authority to promulgate regulations pertaining to the care of trauma, stroke, and ST-Elevation Myocardial Infarction (STEMI) patients. With this expanded legislative authority, the department is creating the Time Critical Diagnosis System (TCDS).

The new TCD system legislation provides authority for establishing stroke and STEMI protocols, but state officials and others expressed concern that DHSS doesn’t have the authority to require trauma care providers to use standard treatment protocols.

Within DHSS, the lead agency for trauma system development is the Bureau of Emergency Medical Services (BEMS) in the Division of Regulation and Licensure, Section of Health Care Standards and Licensure.

In accordance with state statutes, the BEMS, in collaboration with the State Advisory Council for Emergency Medical Services appointed by the Governor, has responsibility for promulgating, amending, and enforcing regulations. These regulations provide for the licensing of: EMS providers (emergency medical technicians and paramedics); ambulance services, air ambulance services; and EMS training courses; and the designation of hospital trauma centers. Currently, trauma centers can be designated as Levels I, II, or III. Recently, a Trauma Task Force recommended that regulations be promulgated to provide for the designation of rural, Level IV trauma care facilities.

A state statute also provides for establishment of six Regional EMS Advisory Councils. These organizations currently have no legal mechanisms to receive direct funding.

Statutes and regulations address a variety of other issues, including: duties of EMS medical directors; the collection and confidentiality of EMS and trauma

data; the confidentiality of quality improvement processes; and standards of care and protocols.

Missouri has broad legal authority to govern its EMS and trauma care system, with a couple of exceptions. It also has comprehensive administrative rules (regulations) which are reviewed and updated periodically in consultation with the State Advisory Council on EMS. It takes approximately one to two years to amend regulations.

Missouri regulations define, in detail, all criteria for trauma center designation.

Licenses for EMS providers and services, and hospital trauma center designations are in effect for five years. In most states, EMS licenses are valid for two to three years, and trauma center designations are usually valid for three years. EMS agencies are sometimes audited to determine if they continue to meet licensing standards, but license revocations are seldom done and waivers are granted for non-compliance with both EMS licenses and trauma center designation.

Hospital trauma centers that fail to meet standards during their designation period may be granted waivers for up to one year. The loop closure process on these waivers to ensure full compliance was not described. The rationale and consistency in applying waivers for trauma centers was not explained.

There is no clear statutory authority to provide for licensure/designation waivers for EMS providers or Trauma Centers.

Missouri state regulations require a medical director for dispatch agencies providing pre-arrival instructions to callers. However, there currently is no licensure of Emergency Medical Dispatchers (EMDs) or dispatch agencies.

Missouri EMS officials and providers also expressed concern about the lack of 9-1-1 coverage in a few rural counties and the fragmentation of 9-1-1 systems in some parts of the state resulting from overlapping oversight of 9-1-1 systems by the Departments of Public Safety, DHSS, and the State Office of Administration.

There also is widespread concern, and possible confusion, about legal issues regarding the use of confidential EMS data for peer reviews of EMS providers. This lack of clear definition is hampering EMS and trauma system performance improvement efforts.

Under current regulations, in-patient trauma data is collected from designated trauma centers but not from other hospitals, except for brain and spinal cord injury data. Because all hospitals are not providing trauma data, an overall picture of trauma care in Missouri cannot be formulated.

RECOMMENDATIONS

- **Revise trauma center designation regulations to adopt, meet, or exceed, by reference, the current version of “Resources for the Optimal Care of the Injured Patient”; Committee on Trauma, American College of Surgeons.**
- Consult the Missouri General Counsel’s Office to determine if Missouri EMS statutes (Section 190.243) authorize the development of trauma transport protocols.
- Consider revising EMS licensure regulations to require license renewals every three years and eliminate waivers except as specifically allowed by Statute/Regulation (i.e. expanded scope of practice).
- Establish a formal process to review trauma centers that fail to meet criteria during the designation period, with input from qualified trauma care providers.
 - Work toward reducing and eliminating waivers for trauma centers not in compliance with standards for designation.
- Develop regulations to license Emergency Medical Dispatchers (EMDs).
- Coordinate with the Department of Public Safety and the State Office of Administration to resolve issues regarding fragmentation of 9-1-1 systems, and to develop a plan to provide 911 systems in counties that are not served by 9-1-1.
- Seek clarification from the General Counsel’s Office on authority to provide peer review of EMS providers using confidential EMS information, including the authority of EMS medical directors to provide peer review of treatment and transport of EMS providers they supervise.
- Seek clarification from the General Counsel on the authority to require in-patient trauma data from every hospital to be used for epidemiology reporting and quality assurance purposes.
 - If authority exists, amend regulations to require all hospitals to provide trauma registry data to the state
 - If authority doesn’t exist, consider seeking legislative authority or ask non-trauma designated hospitals to voluntarily participate in the trauma registry system.

- Work with EMS Regions to achieve non-profit agency status so they can seek public private funding.

System Leadership

Purpose and Rationale

In addition to lead agency staff and consultants (for example, trauma system medical director), there are other significant leadership roles essential to developing mature trauma systems. A broad constituency of trauma leaders includes trauma center medical directors and nurse coordinators, prehospital personnel, injury prevention advocates, and others. This broad group of trauma leaders works with the lead agency to inform and educate others about the trauma system, implements trauma prevention programs, and assists in trauma system evaluation and research to ensure that the right patient, right hospital, and right time goals are met. There is a strong role for the trauma system leadership in conveying trauma system messages, building communication pathways, building coalitions, and collaborating with relevant individuals and groups. The marketing communication component of trauma system development and maintenance begins with a consensus-built public information and education plan. The plan should emphasize the need for close collaboration between coalitions and constituency groups and increased public awareness of trauma as a disease. The plan should be part of the ongoing and regular assessment of the trauma system and be updated as frequently as necessary to meet the changing environment of the trauma system.

When there are challenges to providing the optimal care to trauma patients within the system, the leadership needs to effect change to produce the desired results. Broad system improvements require the ability to identify challenges and the resources and authority to make changes to improve system performance. However, system evaluation is a shared responsibility. Although the leadership will have a key role in the acquisition and analysis of system performance data, the multidisciplinary trauma oversight committee will share the responsibility of interpreting those data from a broad systems perspective to help determine the efficiency and effectiveness of the system in meeting its stated performance goals and benchmarks. All stakeholders have the responsibility of identifying opportunities for system improvement and bringing them to the attention of the multidisciplinary committee or the lead agency. Often, subtle changes in system performance are noticed by clinical care providers long before they become apparent through more formal evaluation processes.

Perhaps the biggest challenge facing the lead agency is to synergize the diversity, complexity, and uniqueness of individuals and organizations into a finely tuned system for prevention of injury and for the provision of quality care for injured patients. To meet this challenge, leaders in all phases of trauma care must demonstrate a strong desire to work together to improve care provided to injured victims.

OPTIMAL ELEMENTS

- I. Trauma system leaders (lead agency, trauma center personnel, and other stakeholders) use a process to establish, maintain, and constantly evaluate and improve a comprehensive trauma system in cooperation with medical, professional, governmental, and other citizen organizations. **(B-202)**
- II. Collected data are used to evaluate system performance and to develop public policy. **(B-205)**
- III. Trauma system leaders, including a trauma-specific statewide multidisciplinary, multiagency advisory committee, regularly review system performance reports. **(B-206)**
- IV. The lead agency informs and educates state, regional, and local, constituencies and policy makers to foster collaboration and cooperation for system enhancement and injury control. **(B-207)**

CURRENT STATUS

Missouri has a long history of trauma system development and has benefited from dedicated emergency medical, trauma, and hospital communities. Since 2003, there has been a heightened statewide awareness and an uptick in intensity by leadership related to trauma system development. This has occurred as a result of a shift in overarching philosophy relative to all time sensitive disease entities which the state has deemed the “Time Critical Diagnosis System” (TCDS). In a forward thinking move, state leadership seized on the time sensitive commonality of stroke, myocardial infarction, and injury to create the TCD System. Conceived by visionary leader and Chair of the State Advisory Committee on EMS (SAC) Dr. Bill Jermyn, the Department of Health and Senior Services (DHSS) and the Bureau of Emergency Medical Services (BEMS) came together with the Missouri Foundation for Health (MFH) in 2004 and conducted a statewide summit for key stakeholders to define the planning process for creation of the system. By 2005, plans were compiled and MFH agreed to fund a DHSS-based Medical Director of Emergency Medical Care Services to which Dr. Jermyn was named. Efforts were made across all constituencies in the state to increase awareness relative to the importance of the TCD System and the initiative was branded with the slogan – “*Right Care, Right Place, Right Time*”. In 2006, a report was delivered by Dr. Roger Huckfeldt, then Chairman of the Trauma Subcommittee of the State Advisory Committee (SAC), which provided an evaluation of the Missouri Trauma System and proposed a funding base for support of the system. However, it is unclear what if any specific action was taken relative to this proposal. By 2007, DHSS, under the direction of the State EMS Medical Director, decided to utilize the trauma system framework to address stroke and myocardial infarction. Moreover, then DHSS Director Jane Drummond and Samar Muzaffar, MD, MPH, State EMS Medical Director in 2008,

called for the creation of a Steering Committee and Trauma Task Force (TTF) to compile recommendations for the TCD System to address stroke and myocardial infarction in an integrated fashion with trauma care. In 2008, legislation was passed creating the new TCD System in Missouri. The intent was that the TCDS approach would provide the trauma community with an opportunity to seriously evaluate the current state of the trauma system, strengthen the existing infrastructure, and enhance system components. Importantly, it was recognized that this system evaluation was integral to performance improvement of the TCD System as a whole. Roles and responsibilities of the Trauma Task Force included:

1. Review current status of trauma system, complete work on priority projects, and compile recommendations for long-term actions to improve care delivery.
2. Represent organization or agency perspectives at task force meetings and regularly communicate with respective organizational members or agency colleagues regarding the planning process and work of the task force.
3. Commit time to compile recommendations and complete projects.
4. Inform and approve measures of system components.

Furthermore, the group was asked to evaluate the TCD System components from prevention through quality improvement and was charged with the creation of the following “end products”, to be completed by September of 2009:

1. Recommendations to DHSS to advance trauma care delivery beyond the ad hoc task force time frame.
2. Review of regional committees, regional structure and function, and recommendations for regional process to support trauma system development and Quality Improvement (QI).
3. Updated Pre-Arrival Instructions (PAI)/Emergency Medical Dispatch (EMD) protocols.
4. Increased use of on- and off-line medical control for out-of-hospital emergency medical care.
5. Helicopter early launch protocols.
6. Updated triage/transfer protocols.
7. Review of need for level IV trauma centers, and, if needed, plan of action established.
8. Updated QI/process evaluation.
9. Plan for QI for trauma system on statewide and regional basis that includes out-of-hospital agencies and both designated and non-designated hospital centers.
10. State classification scheme with regional variables.

Steering Committee roles and responsibilities included:

1. Advise the DHSS on process to support work of the TCD-Trauma System Task Force.
2. Assure that key stakeholders are invited and encourage participation in Task Force meetings.
3. Commit time to compile recommendations and complete end products.
4. Help resolve problems or issues that may arise from full Task Force.

However, over the course of this time period, a series of seminal events have occurred, all of which have had a significant impact on the progress relative to this plan. They include:

- The untimely death of physician champion and visionary leader Dr. Jermyn
- Change in leadership in the Governor's Office
- Change in Leadership in DHSS
- Change in Leadership in the BEMS
- Significant change in the national, regional, and local economy
- Significant staff downsizing within the lead agency
- Change in leadership in the Missouri State Committee on Trauma (COT)

Moreover, while the activities of the TTF began with over 80 participants statewide, meeting attendance steadily waned. Through a series of six meetings (one by conference call), work was completed on drafts of most of the end products. Due to the completion of the key charges for the task force by May of this year, the decision was made by the group to fold this group and these responsibilities into the functions of the existing Trauma Subcommittee of the SAC since many of the Task Force members were also members of this subcommittee. It is unclear if this tactic will be successful or if the Trauma Subcommittee has the support, capacity, and ability to accomplish the broad range of tasks outlined above.

Most importantly, it is unclear if the leadership structure, overall, within the lead agency, has the capability to carry out the critical functions necessary for system oversight and development. At the time of this review, the following observations were apparent:

- While the lead agency has worked to bring constituents together, they currently do not have the resources to actively monitor the trauma system throughout each phase of care.
- There are limited resources fully dedicated to the cause of trauma system development.
- The SAC is advisory to DHSS and has a complex committee structure, the functionality and productivity of which is unclear. Moreover, by composition, there is only one trauma surgeon on the committee and no

clear linkage to the State Committee on Trauma or to the Office of Rural Health, two key constituency groups.

- While the pediatric patient subgroup appears dynamic and functional, system work for other populations such as traumatic brain injury, spinal cord injury, reimplantation, and burn appear to be in fledgling stages at best.
- The position of Medical Director of EMS is funded by the Missouri Foundation for Health (MFH) and is not a line item position in DHSS or the BEMS.
- While the current contracted Medical Director of EMS has appropriate knowledge and ability for her level of experience, the level of experience is not commensurate with the demands of the job. Moreover, there is no clear plan for in-state trauma system leadership development.
- Participation by the surgical leadership from the Missouri State Committee on Trauma, in the process of trauma system development, is limited.
- There appears to be no unified, empowered group beyond the advisory level to develop the trauma system. The work related to trauma system development is fragmented across a variety of entities. Each individual element appears to be managing day-to-day but without a clear overarching trauma system development plan.
- While efforts have been made through the TCD System to educate policy makers, elected officials, community groups, and others about the trauma system, it appears the message regarding the importance of injury care has been lost amongst the concerns over stroke care and myocardial infarction.
- The SAC has no active, centrally mediated, data driven method to evaluate the trauma system performance.

In short, there is a need for greater leadership focus on the trauma system through the formulation of a clear vision and plan for the trauma system development. However, the current organizational structure and available resource allocation does not adequately support this approach.

RECOMMENDATIONS

- **Create a Division of Emergency Care within the Department of Health and Senior Services which unifies the Time Critical Diagnosis System and Emergency Medical Services. The Division, composed of high level state leaders empowered by law, should delineate the vision for Missouri's trauma system as part of the TCDS.**
- Create an agency-funded leadership position for Medical Director of the Division of Emergency Care commensurate with appropriate experience in trauma and EMS.

- Increase resources in the form of both personnel and funding to develop a data driven monitoring capability to evaluate trauma system performance and development.
- Establish a clear advisory role for the State Chairman (or designee) of the Missouri Committee on Trauma to the newly created Division of Emergency Care.
- Re-examine the composition and capability of the SAC and the Trauma Subcommittee and develop clear time delimited goals for these groups related to the development of the trauma system plan and a vision for a Missouri trauma system.

Coalition Building and Community Support

Purpose and Rationale

Coalition building is a continuous process of cultivating and maintaining relationships with constituents (interested citizens) in a state or region who agree to collaborate on injury control and trauma system development. Key constituents include health professionals, trauma center administrators, prehospital care providers, health insurers and payers, data experts, consumers and advocates, policy makers, and media representatives. The coalition of key constituents comprises the trauma system's stakeholders. The involvement of these key constituents is important for the following:

- Trauma system plan development
- Regionalization: promoting collaboration rather than competition between trauma centers
- System integration
- State policy development: authorizing legislation and regulations
- Financing initiatives
- Disaster preparedness

The coalition should be effectively organized through the formation of multidisciplinary state and regional advisory groups to coordinate trauma system planning and implementation efforts. Constituents also communicate with elected officials and policy leaders regarding the development and sustainability of the trauma system. Information and education are needed by constituents to be effective partners in policy development for trauma system planning. Regular communication about the status of the trauma system helps these key partners to recognize needs and progress made with trauma system implementation.

One of the most effective ways to educate elected officials and the public is through an organized public information and education effort that may involve a media campaign about the burden of injury in the state and the need for trauma system development. Information and education are important to reduce the incidence of injury in all age groups and to demonstrate the value of an effective trauma system when a serious injury occurs.

OPTIMAL ELEMENT

- I. The lead agency informs and educates state, regional, and local constituencies and policy makers to foster collaboration and cooperation for system enhancement and injury control. **(B-207)**

CURRENT STATUS

There is a 16 member State Advisory Council on EMS (SAC) that meets approximately ten times a year. At the time of this review, the membership was not complete due to changes in State administration. The new Governor has not yet appointed all members. Within the SAC are 13 subcommittees, meeting as necessary, to resolve TCD and EMS system issues as they arise. There is a trauma subcommittee focused on discussing trauma related issues.

Other State initiated coalitions include the Injury and Violence Prevention Program that coordinates nine local *Safe Kids* coalitions; and *Show Me Falls Free Missouri* (newly formed). There is a suicide prevention coalition within Mental Health but no information was available on projects, priorities, or linkage to the trauma system. Many of the regions have formed injury coalitions and are engaged in communities to reduce the burden of injury in Missouri.

There are also examples of community engagement and coalition building within the local and regional areas. Many community activities are done by regional councils, EMS providers, air medical providers, hospitals, and others reaching out to communicate and educate the communities they serve. Monthly case reviews, Trauma Trends, and coordinating councils between regions and surrounding states (MARC) are examples of efforts to educate and inform constituents in respective areas.

Strong trauma leadership was not evident in the discussions of community coalition building, nor did there appear to be strong representation of trauma professionals on the SAC. Little effort has been made by the state lead agency to develop a uniform method of reaching out to constituents or engaging elected officials and others about the strengths, weaknesses, or needs of the trauma system.

A unifying and coordinated statewide communication strategy has not yet been realized. There are efforts at communication and coordination at the local and regional level, but a unifying approach for delivering critical information is absent. State leadership involvement is largely missing from regional or local efforts. The exception to this may be the work done by the EPI Division and IVPP. Both programs seem to have a greater emphasis on reaching out to the regions and engaging local health departments and other community partners in educating and informing the community. This remains an area that would benefit from a statewide approach to community partnering, strategic planning, and a broad based communication strategy.

RECOMMENDATIONS

- 1. Provide workshops on community engagement and coalition building, to further develop and enhance the State's ability to work effectively with constituency groups throughout the state.**
2. Develop a written unifying and cohesive strategic communication plan that includes;

- a. Establishing a mechanism and process for bi-directional sharing of information between the regions and the state.
 - b. Training in media communications.
 - c. Establishment of clear stakeholder/constituency communication mechanisms.
 - d. Defining roles and responsibilities of state and community partners.
 - e. Improve collaboration and communication among multidisciplinary constituency groups and stakeholders.
3. Develop and routinely update media messages that can be used by the state and local and regional entities to inform, promote, and educate consumers, elected officials, providers, and others about system services, strengths, and challenges.
 4. Strengthen and enhance (e.g. trauma plan, policy and protocol development and implementation statewide) the work of the SAC Trauma Subcommittee ensuring strong participation from trauma medical providers.
 5. Develop Multidisciplinary Trauma Coalitions/task groups in the Regions to review local and regional trauma service issues, develop regional plans, and provide for the communication, education, and oversight of trauma service delivery reporting up through the State trauma subcommittee to the SAC and Division.

Lead Agency and Human Resources within the Lead Agency

Purpose and Rationale

Each trauma system (state, regional, local, as defined in state statute) should have a lead agency with a strong program manager who is responsible for leading the trauma system. The lead agency, usually a government agency, should have the authority, responsibility, and resources to lead the planning, development, operations, and evaluation of the trauma system throughout the continuum of care. The lead agency, empowered through legislation, ensures system integrity and provides for program integration with other health care and community-based entities, namely, public health, EMS, disaster preparedness, emergency management, law enforcement, social services, and other community-based organizations.

The lead agency works through a variety of groups to accomplish the goals of trauma system planning, implementation, and evaluation. The ability to bring multidisciplinary, multiagency advisory groups together to accomplish trauma system goals is essential in developing and maintaining the trauma system and is part of providing leadership to evolving and mature systems.

The lead agency's trauma system program manager coordinates trauma system design, the adoption of minimum standards (prehospital and in-hospital), and provides for overall system evaluation through performance indicator assessment and assurance. In addition to a trauma program manager, the lead agency must be sufficiently staffed to actively participate in each phase of development and in maintaining the system through a clearly defined structure for decision making (policies and procedures) and through proactive surveillance and evaluation. *Minimum* staffing usually consists of a trauma system program manager, data entry and analysis personnel, and monitoring and compliance personnel. Additional staff resources include administrative support and a part-time commitment from the public health epidemiology service to provide system evaluation and research support.

Within the leadership and governance structure of the trauma system, there is a role for strong physician leadership. This role is usually fulfilled by a full- or part-time trauma medical director within the lead agency.

OPTIMAL ELEMENTS

- I. Comprehensive state statutory authority and administrative rules support trauma system leaders and maintain trauma system infrastructure, planning, oversight, and future development. **(B-201)**

- a. The legislative authority (statutes and regulations) plans, develops, implements, manages, and evaluates the trauma system and its component parts, including the identification of the lead agency and the designation of trauma facilities. **(I-201.1)**
 - b. The lead agency has adopted clearly defined trauma system standards (for example, facility standards, triage and transfer guidelines, and data collection standards) and has sufficient legal authority to ensure and enforce compliance. **(I-201.4).**
- II. Sufficient resources, including financial and infrastructure-related, support system planning, implementation, and maintenance. **(B-204)**

CURRENT STATUS

The lead agency for the Missouri EMS and Trauma Care System is the Bureau of Emergency Medical Services, Section for Health Standards and Licensure, Division of Regulation and Licensure, Department of Health and Senior Services.

The Bureau currently has 12 full time personnel, including the Bureau Chief. Lead personnel for the trauma care system are the Bureau Chief (.3 FTE), a trauma nurse (.5 FTE), and the trauma registry coordinator who also has other duties within the bureau. Other support personnel work part time on trauma issues, including five Emergency Medical Services Inspectors (.2 FTEs each) who help with trauma center verification reviews. No staff currently work full time on trauma system issues.

The Bureau Chief and staff receive advice and consultation from a State EMS Medical Director who reports to the Deputy Director of the Department. The EMS Medical Director has no direct authority over the Bureau of EMS, and advises the Deputy Director on a variety of state EMS issues, including the time critical diagnosis system and disaster preparedness planning. Her contract position is funded by the Missouri Foundation for Health.

The Bureau has statutory and regulatory authority over licensing of EMS providers, ambulance services, air ambulances, EMS training programs, and designation of trauma centers. It also receives advice and assistance from the State Advisory Council for Emergency Medical Services (SAC-EMS) appointed by the Governor. With expanded legislation passed in 2008, the Department has authority to develop a Time Critical Diagnosis System (TCDS), focusing on trauma, stroke, and ST-elevated myocardial infarctions (STEMI). Implementation of this legislation is under the direction of the State EMS Medical Director in the Director's Office, and Bureau staff work with her on this initiative.

With funding from the Missouri Foundation for Health, the Department's Director's Office formed a Trauma Task Force to develop recommendations on

improving the statewide trauma care system. This task force's duties have been assumed by the SAC trauma subcommittee.

Most injury prevention activities are administered and coordinated by the Chief of the Bureau of Genetics and Healthy Childhood in the Division of Community and Public Health. Collaboration with the trauma system is limited.

Although the EMS Bureau Chief has been in his current position less than one year, he has worked in the Bureau for over 24 years. Therefore, he has historical knowledge of EMS and trauma care system issues in Missouri. Other staff working on trauma system issues are relatively new, including the State EMS Medical Director.

The Department and EMS Bureau have shown a commitment to improving the statewide EMS and trauma care system by: creating the state Trauma Steering Committee (Task Force); requesting a National Highway Traffic Safety Administration Technical Assistance Team (NHTSA-TAT) review of the EMS system; and requesting this ACS-COT Trauma System Consultation.

There also appears to be strong support for the program from the Director and Deputy Director of the Department. Both of these key leaders were in attendance for portions of the review.

The State Epidemiologist, who also is relatively new, has expressed a desire to help analyze injury data, including data from the state trauma registry. She appears to have both the experience and resources to accomplish this goal.

Six EMS Regions were created by state statute, but they currently have no authority and no legal mechanisms to receive funding. Due to limited staffing, the major emphasis of the Bureau is on regulation and licensing of the EMS system and designation of trauma centers. Less time and resources are directed toward system planning and development. There has been little, if any, effort in system evaluation or oversight for the trauma system.

RECOMMENDATIONS

- **Create and fund a full time dedicated trauma nurse manager position within the lead agency.**
 - **The successful candidate should have a strong background in trauma system management and emergency care.**
- **Create a DHSS funded leadership position for an EMS/Trauma Medical Director (qualified by emergency medicine and trauma experience) within the lead agency.**

- Assign the trauma registry coordinator to work full time on the trauma registry and related trauma databases.
- Establish a formal working relationship with the State Epidemiologist to utilize the resources of her section to analyze trauma registry and other injury data and to develop useable and timely reports for trauma care stakeholders, EMS providers, and for the general public.
- Replace the existing trauma task force with a smaller trauma system advisory committee representing key trauma system stakeholders.
- Assist the EMS regions to form non-profit corporations so they can receive public or private funding.
- Provide training, education, and incentives for EMS providers to become more involved in injury prevention activities.

Trauma System Plan

Purpose and Rationale

Each trauma system, as defined in statute, should have a clearly articulated trauma system planning process resulting in a written trauma system plan. The plan should be built on a completed inventory of trauma system resources identifying gaps in services or resources and the location of assets. It should also include an assessment of population demographics, topography, or other access enhancements (location of hospital and prehospital resources) or barriers to access. It is important that the plan identify special populations (for example, pediatric, elderly, in need of burn care, ethnic groups, rural) within the geographic area served and address the needs of those populations within the planning process. A needs assessment (or other method of identifying injury patterns, patient care review/preventable death study) should also be completed for initial trauma system planning and updated periodically as needed to assess system changes over time.

The trauma system plan is developed by the lead trauma agency based on the results of a needs assessment and other data resources available for review. It describes the system design, integrated and inclusive, with adopted standards of care for prehospital and hospital personnel and a process to regularly review the plan over time. The plan is built on input from trauma advisory committees (or stakeholder groups) that assist in analyzing data, identifying resources, and developing system standards of care, including system policies and procedures and overall system design. Ideally, although every stakeholder group may not be satisfied with the plan or system design, the plan, to the extent possible, should be based on consensus of the advisory committees and stakeholder groups. These advisory groups should be able to review the plan before final adoption and approve the plan before it is submitted to the lead agency with authority for plan approval.

The trauma system plan is used to guide system development, implementation, and management. Each component of the trauma system (for example, prehospital, hospital, communications, and transportation) is clearly defined and an established service level identified (baseline) with goals for enhancement (benchmark). Within the plan are incorporated other planning documents used to ensure integration of similar services and build collaboration and cooperation with those services. Service plans for emergency preparedness, EMS, injury prevention and control, public health, social services, and mental health are examples of services for which the trauma system plan should include an interface between agencies and services.

OPTIMAL ELEMENT

I. The state lead agency has a comprehensive written trauma system plan based on national guidelines. The plan integrates the trauma system with EMS, public health, emergency preparedness, and incident management. The written trauma system plan is developed in collaboration with community partners and stakeholders. **(B-203)**

- a. The trauma system plan clearly describes the system design (including the components necessary to have an integrated and inclusive trauma system) and is used to guide system implementation and management. For example, the plan includes references to regulatory standards and documents and includes methods of and data collection and analysis. **(I-203.4)**

CURRENT STATUS

The State Lead Agency has not yet developed a comprehensive statewide trauma system plan. For over twenty years (as early as 1984), there have been numerous attempts to develop a statewide trauma system. Some efforts, such as verifying trauma centers, have been implemented but the framework and supporting infrastructure for a comprehensive trauma system has eluded the state. The foundation for such a comprehensive trauma system was resurrected in 2005 by Dr. Huckfeldt and others in presentations to government health officials and elected representatives. At that time, the trauma system design and implementation initiative began again. However, there was a loss of personnel and infrastructure with BEMS and a change in priorities within BEMS. DHSS shifted emphasis to the development of the Time Critical Diagnosis (TCD) System. This initiative provides an opportunity to renew statewide attention on the trauma system as the foundation for the TCD System. The TCD task force report includes components that are specific to stroke and STEMI. State leaders believe that the TCD system will be an opportunity for trauma system planning and development.

Advisory bodies and steering groups with a trauma focus have identified trauma system needs and have worked, over time, to resolve those needs (e.g. trauma center Level IVs), but comprehensive trauma system planning has not occurred.

There is no current gap analysis or needs assessment of trauma resources to aid efforts in trauma system planning. No trauma system document exists, in an organized manner, to address priorities, action plans, timelines, or to hold individuals/agencies accountable for accomplishing priorities and completing planning efforts and system design implementation.

Regions, relatively new in the trauma system development arena, do not yet have trauma plans or a mechanism by which to create them. The roles and

responsibilities of regions in developing trauma system plans have not been clearly articulated in policy or regulation.

RECOMMENDATIONS

- **Develop a comprehensive strategic plan for the further design, development, implementation, and ongoing improvement of a statewide, integrated, regional based/driven trauma system plan for Missouri within the next six months.**
 - Enlist a multidisciplinary group (not more than 30 participants) to include representation from BEMS, the State COT chair, emergency physicians, trauma surgeons, EMS, trauma program managers, non-designated acute care facilities, injury prevention, disaster preparedness, and EMS communications.
 - Charge this newly created committee with the task of writing the trauma plan including a new trauma system design, establishing trauma policies and procedures related to the trauma system, and setting standards of performance (utilization, response etc) for the entire statewide system.
- Within the written trauma plan consider;
 - The geographic and logistical diversity of the rural and urban areas within the state and regions.
 - The needs of special populations including pediatrics and the elderly.
 - Patient volume criteria by level of center particularly in urban areas.
 - A mechanism to ensure compliance with state standards and to measure system success including patient outcomes.
- Use the State Trauma Plan to drive efforts in developing new trauma regulations or changes to current regulations that;
 - Identify roles and responsibilities for the regions in trauma system operations.
 - Rely on leadership from the Level I's, II's and III's in conducting needs assessments, performance improvement activities, research, and policy development.
- Establish a process for the periodic (annual or biennial) review and update of the Trauma System Plan.

System Integration

Purpose and Rationale

Trauma system integration is essential for the daily care of injured people and includes such services as mental health, social services, child protective services, and public safety. The trauma system should use the public health approach to injury prevention to contribute to reducing the entire burden of injury in a state or region. This approach enables the trauma system to address primary, secondary, and tertiary injury prevention through closer integration with community health programs and mobilizing community partnerships. The partnerships also include mental health, social services, child protection, and public safety services. Collaboration with the public health community also provides access to health data that can be used for system assessment, development of public policy, and informing and educating the community.

Integration with EMS is essential because this system is linked with the emergency response and communication infrastructure and transports severely injured patients to trauma centers. Triage protocols should exist for treatment and patient delivery decisions. Regulations and procedures should exist for online and off -line medical direction. In the event of a disaster affecting local trauma centers, EMS would have a major role in evacuating patients from trauma centers to safety or to other facilities or to make beds available for patients in greater need.

The trauma system is a significant state and regional resource for the response to mass casualty incidents (MCIs). The trauma system and its trauma centers are essential for the rapid mobilization of resources during MCIs. Preplanning and integration of the trauma system with related systems (public health, EMS, and emergency preparedness) are critical for rapid mobilization when a disaster or MCI occurs. The extensive impact of disasters and MCIs on the functioning of trauma centers and the EMS and public health systems within the affected region or state must be considered, and joint planning for optimal use of all resources must occur to enable a coordinated response to an MCI. Trauma system leaders need to be actively involved in emergency management planning to ensure that trauma centers are integrated into the local, regional, and state disaster response plans.

OPTIMAL ELEMENTS

I. The state lead agency has a comprehensive written trauma system plan based on national guidelines. The plan integrates the trauma system with EMS, public health, emergency preparedness, and incident management. The written trauma system plan is developed in collaboration with community partners and stakeholders. **(B-203)**

- a. The trauma system plan has established clearly defined methods of integrating the trauma system plan with the EMS, emergency, and public health preparedness plans. **(I-203.7)**

II. The trauma, public health, and emergency preparedness systems are closely linked. **(B-208)**

CURRENT STATUS

Organization

The Department of Health and Senior Services is one of fifteen Administrative Departments answering to the Governor. Under the DHSS is the Division of Regulation and Licensure with a Section for Health Standards and Licensure. Within the latter is the Bureau of EMS (BEMS), which is the lead agency responsible for the trauma system.

DHSS

- Division of Regulation and Licensure
 - Section for Health Standards and Licensure
 - Bureau of EMS (Lead Agency)

Multiple other Departments, Divisions, Sections, and Bureaus provide services related to the trauma system.

Other Departments impacting the trauma system include:

- Department of Mental Health;
- Department of Public Safety;
- Department of Social Services; and
- Department of Insurance, Financial Institutions, and Professional Registration

Other DHSS Divisions and subdivisions impacting the trauma system include:

- Division of Senior and Disability Services;
- Division of Public Health
 - Center for Emergency Response and Terrorism;
 - Center for Health Policy Integration;
 - Section for Disease Control and Environmental Epidemiology;
 - Office of Epidemiology and Health Informatics;
 - Section of Maternal, Child, and Family Health; and
 - State Public Health Laboratory

Other sections within the Division of Regulation and Licensure impacting on trauma care include:

- Long Term Care Regulation; and
- Board of Nursing Home Administrators

Other Bureaus housed within the Division of Regulation and Licensure impacting the trauma system are:

- Health Services Regulation;
- Home Care and Rehabilitative Standards;
- Narcotics & Dangerous Drugs

Answering directly to the Deputy Director of DHSS are:

- State EMS Medical Director (Dr. Muzaffar) who is actually funded by the Missouri Foundation for Health, a contract employee within the state,
- an economist, and
- an Aging Coordinator.

Trauma Plan

System integration suffers from lack of a well-defined Trauma System Plan for the state. The current organizational structure does not account for the broad scope of issues impacting the trauma system and the care of trauma patients. There is a lack of understanding within the Bureau and perhaps even DHSS of what a trauma system is, its mission, vision, and the importance of integrating services for improved patient outcomes. The Site Visit Team (SVT) found that the various components of the trauma system function in isolation from one another. Both planning and operations of the various components of EMS and Trauma are poorly integrated. Without a clear mission, vision, and integrated plan, the system will continue to struggle in developing new pathways.

Integration

While some components are quite active and effective, there is no integration of their work products into the trauma system. Communication is also an issue. While there is cross-representation of individuals on multiple committees and task forces, there are no formal linkages with the trauma system, per se. The State Advisory Council for Emergency Medical Services (SAC-EMS) is not functionally integrated into the state organizational structure. Due to the nature of the SAC-EMS being a politically appointed body with turn-over every four years, the lack of a defined Trauma Medical Director, and the voluntary nature of a very large SAC Trauma Subcommittee, there is little institutional memory to assist in the integration of the various components impacting the trauma system, and little capacity for completing work products relative to improving trauma care and developing a functional trauma system.

The SVT did note evidence of integration of trauma system components at the regional level but these activities have been driven by interested parties in the local trauma centers or EMS systems rather than being state-wide policy or leadership-driven initiatives. Little or no data sharing occurs among state stakeholder agencies that would drive action plans based upon community assessments.

There are no existing mechanisms of integrating trauma data analysis into planning for prevention efforts, system performance improvement, assessment of funding mechanisms, or future resource allocation and planning.

Mental Health

There is little integration of the trauma system and mental health services, despite a recognized problem of higher than average suicide rates, particularly among youth, in the state. Missouri has a well-developed Department of Mental Health with a wide variety of mental health resources available throughout the state. Also, the DHSS itself coordinates a very focused suicide prevention program via the Missouri Injury and Violence Prevention Advisory Committee (MIVPAC). However, according to information in the PRQ and obtained at the site review, there is little or no communication or coordination of these activities with the trauma system lead agency (BEMS) or the trauma system as a whole.

It was reported that widespread perception that mental health emergencies do not qualify as true emergencies exists, resulting in some ambulance services refusing to transport these patients. Transport to mental health facilities often takes several hours because of lack of access due to reductions in the number of inpatient psychiatric beds. Educational programs on mental health emergencies as well as possible protocols for EMS providers may be indicated. Policies need to be developed and enforced regarding transport of patients with psychiatric emergencies.

There is a lack of knowledge within the trauma system regarding resources that are already available to aid in integration of mental health and social services within the trauma system. For example, an EMT report form for suspected abuse and mental health emergencies is available from the Department of Mental Health, but at the time of review, it was stated by EMS that they were not aware that there was one, so it isn't being utilized.

Handling of acute alcohol and drug intoxication and chronic abuse, which frequently co-occur with trauma, is not systematically integrated into the trauma care system with respect to policy development. No system-wide analysis has been done regarding utilization of brief interventions for substance abuse, and per report at the site visit, these aren't routinely done. Trauma centers need to be educated on utilization of brief interventions for substance abuse. Additional education for trauma center personnel should be provided regarding existing state social services for trauma patients. Local public health agency resources, a strength of the public health system in Missouri, could be utilized in this regard.

Prevention

The MIVPAC is a multidisciplinary committee with representation from several bureaus within the Department of Health and Senior Services (DHSS) and multiple other stakeholder groups from around the state. Dr. Sharmini Rogers,

Chief of the Bureau of Genetics and Healthy Childhood in the DHSS, is active on this committee and participates in a variety of other community health and prevention projects related to trauma. She is an asset within the system. Some of the activities with which her Bureau is involved relate to traumatic brain injury, suicide prevention, and other injury prevention.

Social Services and Child Protective Services

Awareness of social services programs related to trauma needs to be elevated. For example, there is an Adult Head Injury Program in DHSS, which was never mentioned in the PRQ or at the site visit. Programs such as this are a vital part of the trauma system.

One member of the BEMS team does participate in the Child Fatality Review teams as part of her role in EMS-C. However, the results of those reviews are not formally brought back into the trauma system to inform providers or formulate policy decisions, prevention efforts, or resource re-allocation. Given that all injury related child deaths are preventable, there ought to be a tremendous opportunity to share learning opportunities with a broad spectrum of agencies and trauma care providers.

There is a wealth of opportunities for improvement in integrating social service activities with EMS and trauma system services.

Law Enforcement and Public Safety

There is integration with law enforcement and the Department of Public Safety to some degree. Police first responder training systems were developed several years ago (Police Officer Secondary Training or POST). Training was initially done by the BEMS and as the program evolved, law enforcement assumed the responsibilities of these educational activities, which are still overseen by the BEMS.

There is a variety of Emergency Response and Disaster Planning activities ongoing, both at the state and regional level. It is unclear how these activities are integrated in the day-to-day activities of trauma care delivery.

Integration of the 9-1-1 system has not been achieved; the responsibility for the system lies within three different administrative departments.

RECOMMENDATIONS

- Incorporate, within the Trauma System Plan, the integration of goals and activities of other state agencies handling issues related to trauma, e.g. TBI, suicide prevention, etc.

- Charge the lead agency with integrating Trauma System Policy Development with other related departments and agencies.
- Provide education to all trauma centers and prehospital personnel on the appropriate use of screening and brief intervention for substance abuse issues including how to integrate social service resources into the trauma system when appropriate.
- Charge the lead agency with Coordinating
 - Trauma Community Assessments (MICA) and feeding the results back to the appropriate departments.
 - State-wide Trauma Educational Programs on system integration and public health.
 - A workshop on system integration. CDC has a model program, ***Emergency Medical Services and Public Health: Forging a More Powerful Relationship***.
 - Communications and projects with other departments to ensure that community needs vis-à-vis trauma care are being met.
 - Routine working committees to further the understanding between mental health, social services, law enforcement, and BEMS
 - Report learning objectives as appropriate for EMS and trauma care providers (i.e. Child Fatality Review)

Financing

Purpose and Rationale

Trauma systems need sufficient funding to plan, implement, and evaluate a statewide or regional system of care. All components of the trauma system need funding, including prehospital, acute care facilities, rehabilitation, and prevention programs. Lead agency trauma system management requires adequate funding for daily operations and other important activities such as advisory committee meetings, development of regulations, data collection, performance improvement, and public awareness and education. Adequate funding to support the operation of trauma centers and their state of readiness to care for seriously injured patients within the state or region is essential. The financial health of the trauma system is essential for ensuring its integrity and its improvement over time.

The trauma system lead agency needs a process for assessing its own financial health, as well as that of the trauma system. A trauma system budget should be prepared, and costs should be reported by each component, if possible. Routine collection of financial data from all participating health care facilities is encouraged to fully identify the costs and revenues of the trauma system, including costs and revenues pertaining to patient care, administrative, and trauma center operations. When possible, the lead agency financial planning should integrate with the budgets and costs of the EMS system and disaster, rehabilitation, and prevention programs to enable development of a comprehensive financial health report.

Trauma system financial planning should be related to the trauma plan outcome measures (for example, patient outcome measures such as mortality rates, length of stay, and quality-of-life indicators). Such information may demonstrate the value added by having a trauma system in place.

OPTIMAL ELEMENTS

- I. Sufficient resources, including financial and infrastructure-related, support system planning, implementation, and maintenance. **(B-204)**
 - a. Financial resources exist that support the planning, implementation, and ongoing management of the administrative and clinical care components of the trauma system. **(I 204.2)**
 - b. Designated funding for trauma system infrastructure support (lead agency) is legislatively appropriated. **(I-204.3)**

- c. Operational budgets (system administration and operations, facilities administration and operations, and EMS administration and operations) are aligned with the trauma system plan and priorities. **(I-204.4)**

II. The financial aspects of the trauma systems are integrated into the overall performance improvement system to ensure ongoing fine tuning and cost-effectiveness. **(B-309)**

- a. Collection and reimbursement data are submitted by each agency or institution on at least an annual basis. Common definitions exist for collection and reimbursement data and are submitted by each agency. **(I-309.2)**

CURRENT STATUS

The Bureau of EMS reports a budget of slightly over one million dollars annually. It is unclear how much of those resources go specifically and directly to the development, improvement, and oversight of the trauma system. The person primarily responsible for trauma system issues, Paula Adkison, has dual responsibilities for the EMS for Children program making it difficult to determine the amount of financial commitment being made to trauma within the Bureau of EMS.

When asked about the total burden of trauma for the State of Missouri including costs of readiness, uncompensated care, and system infrastructure, no one was able estimate those costs. One individual recalled a study completed by Dr. Huckfeldt in 2005 that estimated the total system costs to be \$77.5 million annually. A copy of the slide show produced by Dr. Huckfeldt was provided and, with update, could serve as the basis for a formal estimation of the cost concerning injury care in the State of Missouri.

Institutional memory concerning the use of the HRSA trauma funds was absent. When asked specifically about what the \$40,000 annual allocation from this grant program was historically used for, no one from either within or outside of the government structure could answer the question.

Participants noted that, recently, a Federal Reimbursement Allocation (FRA) had been enacted that brings Missouri Medicaid payments for EMS transports in-line with Federal Medicare reimbursement policies. These funds will help stabilize some EMS agencies, particularly those operating in rural areas. Little information was available on the impact of the Centers for Medicare/Medicaid Services (CMS) designation of super-rural bonus payments although it was anecdotally reported that of the eight areas initially eligible, 3 had dropped out of the program for unknown causes.

When asked if Rural Hospital Flexibility (FLEX) grant funds were being used to support the conversion of Critical Access Hospitals (CAH), it was noted by one

participant that she had been told that there were no funds for that activity. At a federal level, the Office of Rural Health Policy has specifically included the support of these developmental activities as being eligible for funding.

While the Time Critical Diagnosis concept is a crown jewel in Missouri's emergency care system, it is unclear that each of the current TCD branches (Trauma, Stroke, STEMI) are receiving the specific financial support necessary to create effective response systems for each. It appeared to the SVT that the financial commitment to trauma is woefully inadequate to ensure the protection of the injured citizens of Missouri.

A physician legislator, Dr. Cooper, made it clear that in the current financial climate it will be challenging to garner additional financial support through the legislative process. He did note that the broad trauma constituency needs to speak in a unified voice to affect such financial support.

RECOMMENDATIONS

- **Develop a specific budget within DHSS to support trauma system development and oversight.**
- Develop and routinely update a "total system cost" report based on the preliminary work completed by Dr. Huckfeldt.
 - These costs should include the administrative costs of the State and local/regional agencies as well as operational system costs (prehospital and hospital) to garner a full picture of the cost of trauma care in Missouri.
- Prioritize funding needs and develop a strategy to obtain legislative support for trauma system development including reimbursement for system development, maintenance, and uncompensated care.
- Make direct contact with the director of the Office of Primary Care and Rural Health to jointly develop priority funding support for the upgrading of CAH to Level IV trauma centers.

Trauma System Assurance

Prevention and Outreach

Purpose and Rationale

Trauma systems must develop prevention strategies that help control injury as part of an integrated, coordinated, and inclusive trauma system. The lead agency and providers throughout the system should be working with business organizations, community groups, and the public to enact prevention programs and prevention strategies that are based on epidemiologic data gleaned from the system.

Efforts at prevention must be targeted for the intended audience, well defined, and structured, so that the impact of prevention efforts is system-wide. The implementation of injury control and prevention requires the same priority as other aspects of the trauma system, including adequate staffing, partnering with the community, and taking advantage of outreach opportunities. Many systems focus information, education, and prevention efforts directly to the general public (for example, restraint use, driving while intoxicated). However, a portion of these efforts should be directed toward emergency medical services (EMS) and trauma care personnel safety (for example, securing the scene, infection control). Collaboration with public service agencies, such as the department of health is essential to successful prevention program implementation. Such partnerships can serve to synergize and increase the efficiency of individual efforts. Alliances with multiple agencies within the system, hospitals, and professional associations, working toward the formation of an injury control network, are beneficial.

Activities that are essential to the development and implementation of injury control and prevention programs include the following:

- A needs assessment focusing on the public information needed for media relations, public officials, general public, and third-party payers, thus ensuring a better understanding of injury control and prevention
- Needs assessment for the general medical community, including physicians, nurses, prehospital care providers, and others concerning trauma system and injury control information
- Preparation of annual reports on the status of injury prevention and trauma care in the system
- Trauma system databases that are available and usable for routine public health surveillance.

OPTIMAL ELEMENTS

I. The lead agency informs and educates state, regional, and local constituencies and policy makers to foster collaboration and cooperation for system enhancement and injury control. **(B-207)**

- a. The trauma system leaders (lead agency, advisory committees, and others) inform and educate constituencies and policy makers through community development activities, targeted media messaging, and active collaborations aimed at injury prevention and trauma system development. **(I-207.2)**

II. The jurisdictional lead agency, in cooperation with other agencies and organizations, uses analytic tools to monitor the performance of population based prevention and trauma care services. **(B-304)**

- a. The lead agency, along with partner organizations, prepares annual reports on the status of injury prevention and trauma care in state, regional, or local areas. **(I-304.1)**

III. The lead agency ensures that the trauma system demonstrates prevention and medical outreach activities within its defined service area. **(B-306)**

- a. The trauma system is active within its jurisdiction in the evaluation of community based activities and injury prevention and response programs. **(I-306.2)**
- b. The effect or impact of outreach programs (medical and community training and support and prevention activities) is evaluated as part of a system performance improvement process. **(I-306.3)**

CURRENT STATUS

Within the State of Missouri, there are multiple organizations and community groups engaged in injury prevention and outreach. Within State government, most injury prevention activities occur within DHSS, Community and Public Health Office of Injury Prevention. This office is actively working with a coalition of community stakeholders on the development of an injury prevention plan due to be released in August of 2009. Further, the office coordinates nine local Safe Kids coalitions. The Injury and Violence Prevention Program completed a program assessment conducted by the State and Territorial Injury Prevention Directors Association in 2005. Since that time, the office has been working to implement the key strategies and recommendations suggested by that review.

Recently, the state has begun to mobilize efforts around fall prevention including hiring a fall prevention coordinator and plans for 4 additional personnel at the local level. The fall prevention efforts, to date, include 80 partners working with the state towards a statewide fall prevention day of activities.

Missouri has an unexpectedly high rate of suicides, especially among youth ages 15-19 years old. Recently, the mental health office began forming a coalition to

study youth suicides in Missouri. No further information was provided to the team on the functionality of this group or the inclusion of the trauma program in establishing or enacting suicide prevention strategies.

Data collection and surveillance activities are completed by the Office of Epidemiology and Health Informatics. A robust data system exists, and reports are published identifying the leading causes of injury morbidity and mortality. Access to the Missouri Information for Community Assessment (MICA) is available on the website, and community organizations and trauma centers can access the data regularly. The trauma system participants were unaware of their ability to access the MICA data.

The state Epidemiologist has a strong interest in injury and identified four local health departments working on injury projects. State epidemiology grand rounds are conducted with the most recent one on poisonings. The state Epidemiologist expressed interest in providing additional grand rounds at trauma centers and within the regions.

At the regional level, trauma centers and EMS providers participate in injury prevention. Seat belt and helmet projects are common. Universally, the trauma centers indicated that they tend to use their own data collected from internal trauma registries as their primary source of information regarding injury trends that drive injury prevention programs.

The Children's trauma centers are also active in prevention efforts throughout the state. Southeast and East regions are working on ATV crashes, including those involving alcohol. An ATV coalition has been formed in the Southeast area. The Central region reported an increase in MVC in the elderly, and they are working on a strategy to address elder driving. Washington University has recently implemented a fall prevention screening tool for EMS personnel to use in the field to identify patients at risk for falls. The program, in its infancy, hopes to provide outreach to patients identified at risk for falling and to assist them in creating a safer environment.

RECOMMENDATIONS

- Develop and implement an overarching statewide strategic injury prevention and outreach plan. The plan should;
 - I. Track local, regional, and state injury projects (e.g. MoDOT, IVPP, Safe Kids, Mental Health).
 - II. Evaluate and report on project outcome measures.
 - III. Prioritize and align injury epidemiology with injury prevention projects.
 - IV. Disseminate ongoing projects, goals, outcomes, best practices, and trends.

- Seek active participation from the Office of EHI in designing strategies and in evaluating the effectiveness of injury and violence prevention programs.
- Link prevention program planning and outreach (within the state and regions) to identified trends in surveillance data.
- Ensure stakeholder groups and constituents include the BEMS, EMS providers, trauma program managers, and medical directors.
- Continue efforts to implement recommendations from the 2005 STIPDA Injury and Violence Prevention Assessment.

Emergency Medical Services

Purpose and Rationale

The trauma system includes, and/or interacts with, many different agencies, institutions, and systems. The EMS system is one of the most important of these relationships. EMS is often the critical link between the injury-producing event and definitive care at a trauma center. Even though at its inception the EMS system was a very broad system concept, over time, EMS has come to be recognized as the prehospital care component of the larger emergency health care system. It is a complex system that not only transports patients, but also includes public access, communications, personnel, triage, data collection, and quality improvement activities.

The EMS system medical director must have statutory authority to develop protocols, oversee practice, and establish a means of ongoing quality assessment to ensure the optimal provision of prehospital care. If not the same individual, the EMS system medical director must work closely with the trauma system medical director to ensure that protocols and goals are mutually aligned. The EMS system medical director must also have ongoing interaction with EMS agency medical directors at local levels, as well as the state EMS for Children program, to ensure that there is understanding of and compliance with trauma triage and destination protocols.

Ideally, a system should have some means of ensuring whether resources meet the needs of the population. To achieve this end, a resource and needs assessment evaluating the availability and geographic distribution of EMS personnel and physical resources is important to ensure a rapid and appropriate response. This assessment includes a detailed description of the distribution of ground ambulance and aeromedical locations across the region. Resource allocations must be assessed on a periodic basis as needs dictate a redistribution of resources. In communities with full-time paid EMS agencies, ambulances should be positioned according to predictable geographic or temporal demands to optimize response efficiencies. Such positioning schemes require strong prehospital data collection systems that can track the location of occurrences over time. Periodic assessment of dispatch and transport times will also provide insight into whether resources are consistent with needs. Each region should have objective criteria dictating the level of response (advanced life support [ALS], basic life support [BLS]), the mode of transport, and the disposition of the patient based on the location of the incident and the severity of injury. A mechanism for case-based review of trauma patients that involves prehospital and hospital providers allows bidirectional information sharing and continuing education, ensuring that expectations are met at both ends. Ongoing review of triage and treatment decisions allows for continuing quality improvement of the triage and prehospital care protocols. A more detailed

discussion of in-field (primary) triage criteria is provided in the section titled: System Coordination and Patient Flow (p 20) (White Book).

Human Resources

Periodic workforce assessments of EMS should be conducted to ensure adequate numbers and distribution of personnel. EMS, not unlike other health care professions, experiences shortages and maldistribution of personnel. Some means of addressing recruitment, retention, and engagement of qualified personnel should be a priority. It is critical that trauma system leaders work to ensure that prehospital care providers at all levels attain and maintain competence in trauma care. Maintenance of competence should be ensured by requiring standards for credentialing and certification and specifying continuing educational requirements for all prehospital personnel involved in trauma care. The core curricula for First Responder, Emergency Medical Technician (EMT) Basic, EMT-Intermediate, EMT Paramedic, and other levels of prehospital personnel have an essential orientation to trauma care for all ages. However, trauma care knowledge and skills need to be continuously updated, refined, and expanded through targeted trauma care training such as Prehospital Trauma Life Support®, Basic Trauma Life Support®, and age-specific courses. Mechanisms for the periodic assessment of competence, educational needs, and education availability within the system should be incorporated into the trauma system plan.

Systems of excellence also encourage EMS providers to go beyond meeting state standards for agency licensure and to seek national accreditation. National accreditation standards exist for ground-based and air medical agencies, as well as for EMS educational programs. In some states, agency licensure requirements are waived or substantially simplified if the EMS agency maintains national accreditation.

EMS is the only component of the emergency health care and trauma system that depends on a large cadre of volunteers. In some states, substantially more than half of all EMS agencies are staffed by volunteers. These agencies typically serve rural areas and are essential to the provision of immediate care to trauma patients, in addition to provision of efficient transportation to the appropriate facility. In some smaller facilities, EMS personnel also become part of the emergency resuscitation team, augmenting hospital personnel. The trauma care system program should reach out to these volunteer agencies to help them achieve their vital role in the outcome of care of trauma patients. However, it must be noted that there is a delicate balance between expecting quality performance in these agencies and placing unrealistic demands on their response capacity. In many cases, it is better to ensure that there is an optimal BLS response available at all times rather than a sporadic or less timely response involving ALS personnel. Support to volunteer EMS systems may be in the form of quality improvement activities, training, clinical opportunities, and support to the system medical director.

Owing to the multidisciplinary nature of trauma system response to injury, conferences that include all levels of providers (for example, prehospital personnel, nurses, and physicians) need to occur regularly with each level of personnel respected for its role in the care and outcome of trauma patients. Communication with and respect for prehospital providers is particularly important, especially in rural areas where exposure to major trauma patients might be relatively rare.

Integration of EMS Within the Trauma System

In addition to its critical role in the prehospital treatment and transportation of injured patients, EMS must also be engaged in assessment and integration functions that include the trauma system and also public health and other public safety agencies. EMS agencies should have a critical role in ensuring that communication systems are available and have sufficient redundancy so that trauma system stakeholders will be able to assess and act to limit death and disability at the single patient level and at the population level in the case of mass casualty incidents (MCIs). Enhanced 911 services and a central communication system for the EMS/trauma system to ensure field-to-facility bidirectional communications, interfacility dialogue, and all-hazards response communications among all system participants are important for integrating a system's response. Wireless communications capabilities, including automatic crash notification, hold great promise for quickly identifying trauma-producing events, thereby reducing delays in discovery and decreasing prehospital response intervals.

Further integration might be accomplished through the use of EMS data to help define high-risk geographic and demographic characteristics of injuries within a response area. EMS should assist with the identification of injury prevention program needs and in the delivery of prevention messages. EMS also serves a critical role in the development of all-hazards response plans and in the implementation of those plans during a crisis. This integration should be provided by the state and regional trauma plan and overseen by the lead agency. EMS should participate through its leadership in all aspects of trauma system design, evaluation, and operation, including policy development, public education, and strategic planning.

OPTIMAL ELEMENTS

I. The trauma system is supported by an EMS system that includes communications, medical oversight, prehospital triage, and transportation; the trauma system, EMS system, and public health agency are well integrated.

(B-302)

- a. There is well-defined trauma system medical oversight integrating the specialty needs of the trauma system with the medical oversight for the overall EMS system. **(I-302.1)**

- b. There is a clearly defined, cooperative, and ongoing relationship between the trauma specialty physician leaders (for example, trauma medical director within each trauma center) and the EMS system medical director. **(I-302.2)**
- c. There is clear-cut legal authority and responsibility for the EMS system medical director, including the authority to adopt protocols, to implement a performance improvement system, to restrict the practice of prehospital care providers, and to generally ensure medical appropriateness of the EMS system. **(I-302.3)**
- d. The trauma system medical director is actively involved with the development, implementation, and ongoing evaluation of system dispatch protocols to ensure they are congruent with the trauma system design. These protocols include, but are not limited to, which resources to dispatch, for example, ALS versus BLS, airground coordination, early notification of the trauma care facility, prearrival instructions, and other procedures necessary to ensure that resources dispatched are consistent with the needs of injured patients. **(I-302.4)**
- e. The retrospective medical oversight of the EMS system for trauma triage, communications, treatment, and transport is closely coordinated with the established performance improvement processes of the trauma system. **(I-302.5)**
- f. There is a universal access number for citizens to access the EMS/trauma system, with dispatch of appropriate medical resources. There is a central communication system for the EMS/trauma system to ensure field- to-facility bidirectional communications, interfacility dialogue, and all-hazards response communications among all system participants. **(I-302.7)**
- g. There are sufficient and well-coordinated transportation resources to ensure that EMS providers arrive at the scene promptly and expeditiously transport the patient to the correct hospital by the correct transportation mode. **(I-302.8)**

II. The lead trauma authority ensures a competent workforce. **(B-310)**

- a. In cooperation with the prehospital certification and licensure authority, set guidelines for prehospital personnel for initial and ongoing trauma training, including trauma-specific courses and courses that are readily available throughout the state. **(I-310.1)**
- b. In cooperation with the prehospital certification and licensure authority, ensure that prehospital personnel who routinely provide care to trauma patients have a current trauma training certificate, for example, Prehospital Trauma Life Support or Basic Trauma Life Support and others, or that trauma training needs are driven by the performance improvement process. **(I-310.2)**

- c. Conduct at least 1 multidisciplinary trauma conference annually that encourages system and team approaches to trauma care. **(I-310.9)**

III. The lead agency acts to protect the public welfare by enforcing various laws, rules, and regulations as they pertain to the trauma system. **(B-311)**

- a. Incentives are provided to individual agencies and institutions to seek state or nationally recognized accreditation in areas that will contribute to overall improvement across the trauma system, for example, Commission on Accreditation of Ambulance Services for prehospital agencies, Council on Allied Health Education Accreditation for training programs, and American College of Surgeons (ACS) verification for trauma facilities. **(I-311.6)**

CURRENT STATUS

The Department of Health and Senior Services (DHSS) Bureau of EMS is responsible for EMS and trauma services in the State of Missouri. The Missouri Rules of the Department of Health and Senior Services Chapters 30 and 40 (19 CSR 30-40) describe the role and responsibility of EMS physician medical directors; EMS provider scope of practice, EMS training, and EMS licensure; and trauma center designation.

State regulations provide guidance regarding the qualifications of physicians responsible for EMS and require physician oversight for ground ambulances, air medical services, EMS training programs, and 911 dispatch centers that provide EMD-PAI (emergency medical dispatch-pre arrival instructions). EMS physicians are required to obtain education in medical direction. During inspection of EMS agencies, training programs, or dispatch entities, the state checks physician credentials. In addition, during the investigation of complaints or quality assurance issues, state officials also examine EMS training materials and protocols. There are no standardized, statewide EMS protocols, and physician directors are free to develop treatment protocols consistent with EMS scope of practice as defined by state regulation and the peculiarities of the practice environment.

The State of Missouri embraces the concept of national accreditation for most aspects of emergency medical services, and incentives exist for those who attain accreditation status. State regulations reference the Commission on Accreditation of Ambulance Services (CAAS) for EMS ground ambulances, the Commission on Accreditation of Medical Transportation Services (CAMTS) for air medical providers, the Commission on Accreditation of Allied Health Education Programs (CAAHEP) for EMS training programs, the National Registry of EMT's (NREMT) for EMS providers initial education, the Continuing Education Coordinating Board for Emergency Medical Services (CECBEMS) for EMS

continuing education, and the National Academy of Emergency Medical Dispatch (NAEMD) for dispatchers.

State EMS transport assets (2008 data) consist of 215 ground ambulance providers, 16 air ambulance agencies, and 37 Emergency Medical Response Agencies (EMRA). EMS workforce assets (2008 data) include 14,536 EMS providers (9,801 EMT-Basic, 4,735 EMT-Paramedic). The percentages of these providers who are unpaid volunteers are not reported by DHSS; therefore, it is unclear if issues relative to volunteer accessibility to training and competency are present in the rural areas of Missouri.

Within the State of Missouri (comprised of 114 counties and the City of St. Louis), a universal emergency services number (9-1-1) is available in 91 counties (80%) with 6 additional counties (5%) planning or implementing these services. The remaining 17 counties (15%) utilize a 7-digit phone number to access essential services. State officials report the decision to attain 9-1-1 rests with individual county authorities to determine the need for and a funding source for this universal number. Of the approximately 170 PSAP's within Missouri, there are no data relative to the existence of "enhanced" service for hardwire phones (address of calling party is displayed at the dispatch center) nor is there data regarding 9-1-1 capabilities for cell phones (Phase I-display of call back number; Phase II-display of X, Y coordinates of the phone). It is also not known how many dispatch entities are performing EMD (emergency medical dispatch) functions. The Missouri Ambulance Association is surveying all ambulance providers to describe the variety of dispatch services being offered. These data will be instructive to DHSS officials and EMS medical directors who are responsible for oversight functions and to explore potential funding streams to provide 9-1-1 throughout the state.

Currently, the authority and responsibility for PSAP's (public safety answering points) are divided between three state agencies (Department of Public Safety, Department of Health and Senior Services, Office of Administration). This fragmentation complicates oversight, problem solving, and quality assurance activities for this aspect of emergency response.

While state regulations mandate the collection of demographic and patient care data on all emergency runs, the EMS agencies are not required to report these data to the state. The current MARS platform is insufficient including only EMS patients designated as "life threatening". Comprehensive national guidance regarding optimal EMS data elements is found in NEMSIS. DHSS should require the submission of data on all EMS runs to include subcomponents of the NEMSIS database. These essential data would inform the system and provide opportunities for oversight, education, and process improvement.

The EMSsystem is a web-based resource accounting system for each hospital in the state. This system is maintained and monitored by the Missouri Hospital

Association (MHA) through a contract with DHSS with funding from federal disaster preparedness grants. In Missouri, the EMSsystem is utilized for daily tracking of hospital diversion and service availability (beds, telemetry, CT, subspecialty care). Real-time EMSsystem data is reportedly accessible by DHSS, emergency managers, hospitals, EMS agencies, and PSAP's to inform decision-makers regarding daily system operations and disaster resource availability. The MHA reports they are unaware of any PSAP's utilizing EMSsystem and only a few EMS agencies (5 in Kansas City, 8 in St Louis, 17 in the rest of the state) access the system. Officials report that a state query for hospital bed capacity would yield a comprehensive accounting within "one hour".

RECOMMENDATIONS

- **Ensure the availability of universal access number (e9-1-1) coverage to all citizens of Missouri.**
- Develop an electronic medical record for EMS and require submission of data to the state for EMS/trauma system monitoring and process improvement (NEMESIS reference).
- Eliminate the barriers and impediments regarding EMS data sharing for system performance improvement.
- Consolidate authority and responsibility for 9-1-1 services under a single entity at the state level to oversee all aspects of 9-1-1, including local PSAP, EMD, and PAI.
- Develop statewide treatment protocols to be used in the regions and local EMS agency service areas (modified as needed for rural providers).
- Provide EMS Medical Director courses throughout the year to ensure consistent application of treatment protocols and adherence to statewide policies.

Definitive Care Facilities

Purpose and Rationale

Inclusive trauma systems are the systems that include all acute health care facilities, to the extent that their resources and capabilities allow and in which the patient's needs are matched to hospital resources and capabilities. Thus, as the core of a regional trauma system, acute care facilities operating within an inclusive trauma system provide definitive care to the entire spectrum of patients with traumatic injuries. Acute care facilities must be well integrated into the continuum of care, including prevention and rehabilitation, and operate as part of a network of trauma-receiving hospitals within the public health framework. All acute care facilities should participate in the essential activities of a trauma system, including performance improvement, data submission to state or regional registries, representation on regional trauma advisory committees, and mutual operational agreements with other regional hospitals to address interfacility transfer, educational support, and outreach. The roles of all definitive care facilities, including specialty hospitals (for example, pediatric, burn, severe traumatic brain injury [TBI], spinal cord injury [SCI]) within the system should be clearly outlined in the regional trauma plan and monitored by the lead agency. Facilities providing the highest level of trauma care are expected to provide leadership in education, outreach, patient care, and research and to participate in the design, development, evaluation, and operation of the regional trauma system.

In an inclusive system, patients should be triaged to the appropriate facility based on their needs and facility resources. Patients with the least severe injuries might be cared for at appropriately designated facilities within their community, whereas the most severe should be triaged to a Level I or II trauma center. In rural and frontier systems, smaller facilities must be ready to resuscitate and initiate treatment of the major injuries and have a system in place that will allow for the fastest, safest transfer to a higher level of care.

Trauma receiving facilities providing definitive care to patients with other than minor injuries must be specifically designated by the state or regional lead agency and equipped and qualified to do so at a level commensurate with injury severity. To assess and ensure that injury type and severity are matched to the qualifications of the facilities and personnel providing definitive care, the lead agency should have a process in place that reviews and verifies the qualifications of a particular facility according to a specific set of resource and quality standards. This criteria-based process for review and verification should be consistent with national standards and be conducted on a periodic cycle as determined by the lead agency. When centers do not meet set standards, there should be a process for suspension, probation, revocation, or dedesignation.

Designation by the lead agency should be restricted to facilities meeting criteria or statewide resource and quality standards and based on patient care needs of the regional trauma system. There should be a well-defined regulatory relationship between the lead agency and designated trauma facilities in the form of a contract, guidelines, or memorandum of understanding. This legally binding document should define the relationships, roles, and responsibilities between the lead agency and the medical leadership from each designated trauma facility. The number of trauma centers by level of designation and location of acute care facilities must be periodically assessed by the lead agency with respect to patient care needs and timely access to definitive trauma care. There should be a process in place for augmenting and restricting, if necessary, the number and/or level of acute care facilities based on these periodic assessments. The trauma system plan should address means for improving acute care facility participation in the trauma system, particularly in systems in which there has been difficulty addressing needs.

Human Resources

The ability to deliver high-quality trauma care is highly dependent on the availability of skilled human resources. Therefore, it is critical to assess the availability and educational needs of providers on a periodic basis. Because availability, particularly of subspecialty resources, is often limited, some means of addressing recruitment, retention, and engagement of qualified personnel should be a priority. Periodic workforce assessments should be conducted. Maintenance of competence should be ensured by requiring standards for credentialing and certification and specifying continuing educational requirements for physicians and nurses providing care to trauma patients. Mechanisms for the periodic assessment of ancillary and subspecialty competence, educational needs, and availability within the system for all designated facilities should be incorporated into the trauma system plan. The lead trauma centers in rural areas will need to consider teleconferencing and telemedicine to assist smaller facilities in providing education on regionally identified needs. In addition, lead trauma centers within the region should assist in meeting educational needs while fostering a team approach to care through annual educational multidisciplinary trauma conferences. These activities will do much to foster a sense of teamwork and a functionally inclusive system.

Integration of Designated Trauma Facilities Within the Trauma System

Designated trauma facilities must be well integrated into all other facets of an organized system of trauma care, including public health systems and injury surveillance, prevention, EMS and prehospital care, disaster preparedness, rehabilitation, and system performance improvement. This integration should be provided by the state and/or regional trauma plan and overseen by the lead agency.

Each designated acute care facility should participate, through its trauma program leadership, in all aspects of trauma system design, evaluation, and

operation. This participation should include policy and legislative development, legislative and public education, and strategic planning. In addition, the trauma program and subspecialty leaders should provide direction and oversight to the development, implementation, and monitoring of integrated protocols for patient care used throughout the system (for example, TBI guidelines used by prehospital providers and nondesignated transferring centers), including region specific primary (field) and secondary (early transfer) triage protocols. The highest level trauma facilities should provide leadership of the regional trauma committees through their trauma program medical leadership. These medical leaders, through their activities on these committees, can assist the lead agency and help ensure that deficiencies in the quality of care within the system, relative to national standards, are recognized and corrected. Educational outreach by these higher levels centers should be used when appropriate to help achieve this goal.

OPTIMAL ELEMENTS

I. Acute care facilities are integrated into a resource efficient, inclusive network that meets required standards and that provides optimal care for all injured patients. **(B-303)**

- a. The trauma system plan has clearly defined the roles and responsibilities of all acute care facilities treating trauma and of facilities that provide care to specialty populations (for example, burn, pediatric, SCI, and others). **(I-303.1)**

II. To maintain its state, regional, or local designation, each hospital will continually work to improve the trauma care as measured by patient outcomes. **(B-307)**

- a. The trauma system engages in regular evaluation of all licensed acute care facilities that provide trauma care to trauma patients and of designated trauma hospitals. Such evaluation involves independent external reviews. **(I-307.1)**

III. The lead trauma authority ensures a competent workforce. **(B-310)**

- a. As part of the established standards, set appropriate levels of trauma training for nursing personnel who routinely care for trauma patients in acute care facilities. **(I-310.3)**
- b. Ensure that appropriate, approved trauma training courses are provided for nursing personnel on a regular basis. **(I-310.4)**
- c. In cooperation with the nursing licensure authority, ensure that all nursing personnel who routinely provide care to trauma patients have a trauma training certificate (for example, Advanced Trauma Care for Nurses, Trauma Nursing Core Course, or any national or state trauma nurse verification course). As an alternative after initial trauma course

completion, training can be driven by the performance improvement process. **(I-310.5)**

- d. In cooperation with the physician licensure authority, ensure that physicians who routinely provide care to trauma patients have a current trauma training certificate of completion, for example, Advanced Trauma Life Support® (ATLS®) and others. As an alternative, physicians may maintain trauma competence through continuing medical education programs after initial ATLS completion. **(I-310.8)**
- e. Conduct at least 1 multidisciplinary trauma conference annually that encourages system and team approaches to trauma care. **(I-310.9)**
- f. As new protocols and treatment approaches are instituted within the system, structured mechanisms are in place to inform all personnel about the changes in a timely manner. **(I-310-10)**

CURRENT STATUS

Currently, there are 29 designated trauma centers in the state of Missouri. These include: Level I (10), Level II (11), and Level III (8), three of which are designated Pediatric Trauma Centers (Level I). BEMS has the authority to designate, as well as de-designate trauma centers. Trauma centers voluntarily apply and are designated by level loosely aligned with the classifications outlined by the ACS Committee on Trauma's *Resources for the Optimal Care of the Injured Patient*. However; there is some variance in the rules and regulations from the ACS Standards. Where there is variance, the Missouri rules and regulations for trauma center designation are less rigorous than the ACS verification standards. Two Level I centers, the University of Missouri Hospitals and Clinics and Barnes Jewish Hospital, are both designated by the state and verified by the ACS. The verification period by the state is five years; again a less rigorous standard than the ACS which requires a review every three years. Once a review is completed, a final report is prepared by the BEMS. This report is created by the Trauma Systems Manager/EMSC Manager in conjunction with the Chief of BEMS. These two individuals make the final decision relative to designation. As agents of BEMS, they have the authority to approve, suspend, revoke, or deny trauma center designation. The decision becomes part of the public record, and the standards at variance are included. Moreover, on occasions when lack of compliance with the rules and regulations for designation occurs, these agents of the Bureau issue verbal waivers to extend verification status. It is unclear what standards are used for these decisions, and we were unable to discover any written policy which governs this practice. In essence, the standards used for designation are not aligned with the *ACS Optimal Resource Guide*, and arbitrary waivers are granted at the discretion of the responsible agents of the BEMS. This practice, combined with the five year designation period, makes it difficult at best to draw the conclusion that national benchmarks

for care of the injured are consistently being achieved at designated centers. To our knowledge, no center has been de-designated or suspended by the BEMS.

There are specific strengths in some of the trauma centers with evidence of strong commitment by providers across the state. Clearly, the center representatives that we encountered at the time of the review were committed to their centers and the patients in their EMS Region. However, other salient observations were evident:

- The distribution and number of designated centers are NOT aligned with the distribution of patients. While the three major urban centers across the state are well covered by Level I and Level II centers, several more rural areas of the state appear underserved. However, no time driven accessibility analysis was available from the state. This concern is substantiated by the Trauma Information Exchange Program of the American Trauma Society (<http://tramah.cml.upenn.edu/CML.TraumaCenters.Web/statepage.aspx?state=29&responseTime=60&transportMethod=DOF&year=2008>)

This demonstrates a number of areas in the state which are not accessible to either Level I or Level II trauma centers within 60 minutes by either ground or air. However, if the Level III centers are considered, this accessibility improves considerably.

- The system is totally voluntary and not need driven.
- There is no apparent mechanism for tracking flow between centers.
- The trauma centers are challenged by the large number of out of state patients by virtue of the fact that the state is bordered by 8 other states.
- No unified assessment of workforce and manpower needs for delivering trauma care has been performed at the state level. Any cursory assessment takes place on a limited basis at the time of designation review.
- The educational and credentialing standards for all providers are at variance with the ACS Standards and are less rigorous; however, the state has used the RTTDC and CALS as a resource to rural providers.
- The responsibility for multidisciplinary educational conferences takes place at the regional and individual center level.
- No formal or consistent evaluation of trauma care practices and performance provided by non-trauma acute care hospitals is conducted by BEMS.
- Trauma center compliance with rules and regulations is not monitored by BEMS during the intervals between ACS verification visits. Moreover,

BEMS does not request, nor do trauma centers voluntarily submit, any reports containing performance information based on indicators and benchmarks or compliance data.

- The current trauma system is an exclusive system that does not include all acute care hospitals at some level of participation with defined roles and responsibilities for trauma care.
- Considerable efforts have been undertaken to develop criteria for Level IV Trauma Centers. This is an important move towards a more inclusive system.

In essence, there are individual strengths in trauma centers across the state with considerable variability region by region. As such, the level of response and treatment for injured Missourians is a function of where they are injured. Optimal response and treatment is not assumed.

RECOMMENDATIONS

- **Define roles, responsibilities, and accountabilities for all acute care facilities in an inclusive system related to trauma care.**
- **Establish uniform, clearly defined designation criteria, including critical and non-critical criteria deficiencies for each trauma center level, aligned with the current American College of Surgeons' guidelines.**
 - **Apply criteria consistently to all centers.**
 - **Utilize a broader confidential multidisciplinary group (SAC) to review and act upon designation recommendations.**
 - **Eliminate all waivers.**
 - **Move to a three year verification schedule in line with national standards.**
- Perform time driven trauma center accessibility analysis.
- Perform a workforce needs assessment for adequate delivery of trauma care.

System Coordination and Patient Flow

Purpose and Rationale

To achieve the best possible outcomes, the system must be designed so that the right patient is transported to the right facility at the right time. Although on the surface this objective seems relatively straightforward, patients, geography, and transportation systems often conspire to present significant challenges. The most critically injured trauma patient is often easy to identify at the scene by virtue of the presence of coma or hypotension. However, in some circumstances, the patients requiring the resources of a Level I or II center may not be immediately apparent to prehospital providers. Primary or field triage criteria aid providers in identifying which patients have the greatest likelihood of adverse outcomes and might benefit from the resources of a designated trauma center. Even if the need is identified, regional geography or limited air medical (or land) transport services might not allow for direct transport to an appropriate facility.

Primary triage of a patient from the field to a center capable of providing definitive care is the goal of the trauma system. However, there are circumstances (for example, airway management, rural environments, inclement weather) when triaging a patient to a closer facility for stabilization and transfer is the best option for accessing definitive care. Patients sustaining severe injuries in rural environments might need immediate assessment and stabilization before a long-distance transport to a trauma center. In addition, evaluation of the patient might bring to light severe injuries for which needed care exceeds the resources of the initial receiving facility. Some patients might have specific needs that can be addressed at relatively few centers within a region (for example, pediatric trauma, burns, severe TBI, SCI, and reimplantation). Finally, temporary resource limitations might necessitate the transfer of patients between acute care facilities.

Secondary triage at the initial receiving facility has several advantages in systems with a large rural or suburban component. The ability to assess patients at nondesignated or Level III to V centers provides an opportunity to limit the transfer of only the most severely injured patients to Level I or II facilities, thus preserving a limited resource for patients most in need. It also provides patients with lesser injuries the possibility of being cared for within their community.

The decision to transfer a trauma patient should be based on objective, prospectively agreed-on criteria. Established transfer criteria and transfer agreements will minimize discussions about individual patient transfers, expedite the process, and ensure optimal patient care. Delays in transfer might increase mortality, complications, and length of stay. A system with an excess of transferred patients might tax the resources of the regional trauma facility. Conversely, inappropriate retention of patients at centers without adequate facilities or expertise might increase the risk of adverse outcomes. Given the

importance of timely, appropriate interfacility transfers, the time to transfer, as well as the rates of primary and secondary overtriage basis, and corrective actions should be instituted when problems are identified. Data derived from tracking and monitoring the timeliness of access to a level of trauma care commensurate with injury type and severity should be used to help define optimal system configuration.

A central communications center with real-time access to information on system resources greatly facilitates the transfer process. Ideally, this center identifies a receiving facility, facilitates dialogue between the transferring and receiving centers, and coordinates interfacility transport.

To ensure that the system operates at the greatest efficiency, it is important that patients are repatriated back to community hospitals once the acute phase of trauma care is complete. The process of repatriation opens up the limited resources available to care for severely injured patients. In addition, it provides an opportunity to bring patients back into their local environment where their social network might help reintegrate patients into their community.

OPTIMAL ELEMENTS

I. The trauma system is supported by an EMS system that includes communications, medical oversight, prehospital triage, and transportation; the trauma system, EMS system, and public health agency are well integrated.

(B-302)

- a. There are mandatory system-wide prehospital triage criteria to ensure that trauma patients are transported to an appropriate facility based on their injuries. These triage criteria are regularly evaluated and updated to ensure acceptable and system-defined rates of sensitivity and specificity for appropriately identifying a major trauma patient. **(I-302.6)**
- b. There is a universal access number for citizens to access the EMS/trauma system, with dispatch of appropriate medical resources. There is a central communications system for the EMS/trauma system to ensure field-to-facility bidirectional communications, interfacility dialogue, and all-hazards response communications among all system participants. **(I-302.7)**
- c. There is a procedure for communications among medical facilities when arranging for interfacility transfers, including contingencies for radio or telephone system failure. **(I-302.9)**

II. Acute care facilities are integrated into a resource-efficient, inclusive network that meets required standards and that provides optimal care for all injured patients. **(B-303)**

- a. When injured patients arrive at a medical facility that cannot provide the appropriate level of definitive care, there is an organized and regularly

monitored system to ensure that the patients are expeditiously transferred to the appropriate system-defined trauma facility. **(I-303.4)**

CURRENT STATUS

There is no consensus at this time on moving toward a truly inclusive statewide trauma system in Missouri. There does seem to be agreement, however, that in the current configuration, not all injured patients receive trauma center care, and trauma patients are being treated at non-trauma system hospitals. There is no readily available information on the volume, outcomes, length of stay, injury severity, morbidity, or mortality of the trauma patients seen at non-trauma system hospitals. The Trauma Task Force received a request from a Critical Access Hospital representative to consider adding Level IV trauma centers to the statewide trauma system, based on information obtained at a national conference. Discussion ensued, and the Task Force came to support the concept. At the current time, draft regulations for Level IV trauma centers have been developed and are scheduled to be filed in 2010. There is no information at this time about how many hospitals may be interested in joining the trauma system at the new level.

A draft Field Triage document was developed by bringing together existing regional triage protocols and blending them with the newly released CDC's Field Triage Decision Scheme. The timeframe for implementation of this document is estimated to be the end of 2009. At this time, there is uncertainty as to whether the BEMS has the authority to require the Triage document through policy, and a general counsel opinion will be sought. Depending on that result, the Field Triage document will be moved forward as either a trauma system protocol or a guideline.

Hospital diversion is an ongoing issue, primarily in the large cities of Missouri. Trauma centers that serve as the only designated trauma facility in a region do not divert since there is no alternate destination available for high acuity patients. One region with two trauma centers discussed how the two facilities cooperatively work on the diversion issue so as to assure that one of them is always open. The St. Louis area trauma centers are planning to go to a no-diversion policy, while Kansas City trauma centers have many triggers and steps before they can go on divert. Diversion statistics are monitored closely on the hospital level and through the EMSsystem, which is maintained by the Missouri Hospital Association. Trauma center regulations stipulate only that each trauma center must have a diversion policy. There was no information available on the experience of urban EMS agencies related to hospital diversion.

Interfacility transfer is accomplished primarily on a case-by-case basis, with the physician in charge of the patient making calls, sometimes multiple, to locate an available bed. Interfacility transfer destination decisions are generally made based on existing referral patterns. The EMSsystem provides real time information on bed availability that can be accessed by hospitals, dispatch

centers, and EMS units. A survey from the Missouri Ambulance Association is currently being done and will help to determine the actual number of units that use this system. One Level III trauma center that is the sole trauma center in its region discussed a document they have distributed within their region explaining which types of patients are appropriate for transfer to them, and which patients need to be transferred directly to a higher level of care.

Level I trauma centers and some Level II trauma centers treat traumatic brain and spinal cord injured patients. There are two or three reimplantation sites in the state. There are three Level I Pediatric trauma centers, several Burn Centers, and three of the Level I trauma centers treat adult and pediatric patients. Pediatric Trauma Center leaders noted the lengthy transport times of children being brought to their facilities. No assessment of patient needs relating to adults or children has been completed. There is no information on whether the services provided by the Level I's, II's, or Pediatric Centers are being utilized to their fullest extent, especially related to care of the injured child.

Repatriation of patients back to the referring facilities is not routinely accomplished at this time, although the Trauma Taskforce has included this topic on its list of future projects. The Pediatric Trauma Centers are the exception and send children back to their home community hospitals whenever possible, as part of their family-centered care approach. Trauma centers reported their most difficult issues associated with this topic involve attempts to send out-of-state patients back to their home states. No outcome data was provided to demonstrate increases or decreases in morbidity or mortality because of these transfer practices.

RECOMMENDATIONS

- Develop a plan to incorporate all acute care facilities that receive trauma patients into the statewide trauma system.
- Obtain a definitive answer on whether the BEMS has the authority to mandate the use of the Trauma Field Triage protocol and put the Field Triage protocol forward statewide accordingly.
- Develop a mechanism to monitor appropriate utilization of the Trauma Field Triage protocol at the local and regional levels.
- Continue current efforts to manage hospital diversion.
- Address interstate repatriation issues as a state trauma system.
- Develop regional methods of coordinating inter-facility transfers.
- Ensure repatriation guidelines allow for reporting short/long term outcomes.
- Complete a patient flow study giving consideration to injury severity, time to definitive care, and patient outcome.

Rehabilitation

Purpose and Rationale

As an integral component of the trauma system, rehabilitation services in acute care and rehabilitation centers provide coordinated care for trauma patients who have sustained severe or catastrophic injuries, resulting in long-standing or permanent impairments. Patients with less severe injuries may also benefit from rehabilitative programs that enhance recovery and speed return to function and productivity. The goal of rehabilitative interventions is to allow the patient to return to the highest level of function, reducing disability and avoiding handicap whenever possible. The rehabilitation process should begin in the acute care facility as soon as possible, ideally within the first 24 hours. Inpatient and outpatient rehabilitation services should be available. Rehabilitation centers should have CARF (Commission of Accreditation of Rehabilitation Facilities) accreditation for comprehensive inpatient rehabilitation programs, and accreditation of specialty centers (SCI and TBI) should be strongly encouraged.

The trauma system should conduct a rehabilitation needs assessment (including specialized programs in SCI, TBI, and for children) to identify the number of beds needed and available for rehabilitation in the geographic region. Rehabilitation specialists should be integrated into the multidisciplinary advisory committee to ensure that rehabilitation issues are integrated into the trauma system plan. The trauma system should demonstrate strong linkages and transfer agreements between designated trauma centers and rehabilitation facilities located in its geographic region (in or out of state). Plans for repatriation of patients, especially when rehabilitation centers across state lines are used, should be part of rehabilitation system planning. Feedback on functional outcomes after rehabilitation should be made available to the trauma centers.

OPTIMAL ELEMENTS

- I. The lead agency ensures that adequate rehabilitation facilities have been integrated into the trauma system and that these resources are made available to all populations requiring them. **(B-308)**
 - a. The lead agency has incorporated, within the trauma system plan and the trauma center standards, requirements for rehabilitation services, including interfacility transfer of trauma patients to rehabilitation centers. **(I-308.1)**
 - b. Rehabilitation centers and outpatient rehabilitation services provide data on trauma patients to the central trauma system registry that include final disposition, functional outcome, and rehabilitation costs and also participate in performance improvement processes. **(I-308.2)**

II. A resource assessment for the trauma system has been completed and is regularly updated. **(B-103)**

- a. The trauma system has completed a comprehensive system status inventory that identifies the availability and distribution of current capabilities and resources. **(I-103.1)**

CURRENT STATUS

The state of Missouri is relatively rich as it relates to rehabilitation capacity with 112 acute care facilities possessing rehabilitation beds and 4 stand alone rehabilitation hospitals. Of these, 22 are accredited by the Commission on Accreditation of Rehabilitation Facilities (CARF), and DHSS estimates that there are approximately 900 rehab beds available statewide. Subspecialty care services as it relates to burns, pediatrics, SCI, and TBI are also available. The vast majority (84%) of accredited rehab centers are concentrated in the metropolitan centers (Kansas City, St. Louis, Joplin/Springfield, and Columbia).

The lead agency is unaware of the wait time for patient placement in rehabilitation facilities, but anecdotal reports from trauma centers indicate that rehabilitation planning begins on the day of admission to the acute care centers. For non-complex trauma cases, transfer and placement to rehabilitation facilities generally occurs within 2-3 days. Alternatively, more complex patients (ventilator-dependent, dialysis, MRSA) and those with social issues (unfunded, resident alien) may take months to be placed. One trauma stakeholder reports there are “no SCI ventilator-dependent beds available in Missouri”. The trauma system is unable to track and quantify this problem or others related to rehabilitation as DHSS does not track resources or availability of these services; therefore, placement issues and the costs of delayed placement are born by individual trauma centers.

An added layer of complexity regarding rehabilitation involves out-of-state residents who are injured within the state of Missouri; this is a significant issue since Missouri borders 8 other states. Some border states possess little or no capacity or capability for rehabilitation services. Others may not wish to pay for services rendered within Missouri. Ideally, DHSS would engage their counterparts in adjacent states to address issues of reciprocity, funding, and repatriation for the trauma patient requiring rehabilitation services.

Within individual trauma centers, rehabilitation specialists contribute to trauma care on a daily (work rounds), weekly (multidisciplinary plan of care committee), and monthly (morbidity and mortality conferences) basis. Unfortunately, there is little to no participation at any other level within the trauma system; at a minimum, incorporation of rehab specialists at the regional (6 EMS regions) and state (SAC-EMS, Trauma subcommittee) levels should be assured by DHSS.

Information systems and data collection tools utilized by the trauma system do not include elements specific to rehabilitation; as a result, initiatives for system assessment, process improvements, quality assurance, and research relative to rehabilitation are seriously hindered. Trauma centers report they are interested in receiving CARF and rehab outcomes data especially as it relates to functionality by injury and functional independence measures (FIM). Image Trends, a trauma data base vendor available to the trauma centers, has blank data fields which could incorporate these elements.

RECOMMENDATIONS

- Assure representation of rehabilitation on the SAC-EMS Advisory Committee, the SAC-Trauma Subcommittee, and the EMS Regional Committees.
- Conduct a needs assessment for rehabilitation (including specialized programs for SCI, TBI, and programs for children) to identify the available resources and existing gaps within the state.
- Incorporate rehabilitation data elements into the statewide trauma database and utilize these elements to make trauma system improvements.
- Engage state level counterparts (Medicaid, trauma leaders) in bordering states to facilitate discharge to rehab care for out-of-state residents.

Disaster Preparedness

Purpose and Rationale

As critically important resources for state, regional, and local responses to MCIs, the trauma system and its trauma centers are central to disaster preparedness. Trauma system leaders need to be actively involved in public health preparedness planning to ensure that trauma system resources are integrated into the state, regional, and local disaster response plans. Acute care facilities (sometimes including one or more trauma centers) within an affected community are the first line of response to an MCI. However, an MCI may result in more casualties than the local acute care facilities can handle, requiring the activation of a larger emergency response plan with support provided by state and regional assets.

For this reason, the trauma system and its trauma centers must conduct a resource assessment of its surge capacity to respond to MCIs. The resource assessment should build on and be coupled to a hazard vulnerability analysis. An assessment of the trauma system's response to simulated incident or tabletop drills must be conducted to determine the trauma system's ability to respond to MCIs. Following these assessments, a gap analysis should be conducted to develop statewide MCI response resource standards. This information is essential for the development of an emergency management plan that includes the trauma system.

Planning and integration of the trauma system with plans of related systems (public health, EMS, and emergency management) are important because of the extensive impact disasters have on the trauma system and the value of the trauma system in providing care. Relationships and working cooperation between the trauma system and public health, EMS, and emergency management agencies support the provision of assets that enable a more rapid and organized disaster response when an event occurs. For example, the EMS emergency preparedness plan needs to include the distribution of severely injured patients to trauma centers, when possible, to make optimal use of trauma center resources. This plan could optimize triage through directing less severely injured patients to lower level trauma centers or nondesignated facilities, thus allowing resources in trauma centers to be spared for patients with the most severe injuries. In addition, the trauma system and its trauma centers will be targeted to receive additional resources (personnel, equipment, and supplies) during major MCIs.

Mass casualty events and disasters are chaotic, and only with planning and drills will a more organized response be possible. Simulation or tabletop drills provide an opportunity to test the emergency preparedness response plans for the trauma system and other systems and to train the teams that will respond.

Exercises must be jointly conducted with other agencies to ensure that all aspects of the response plan have the trauma system integrated.

OPTIMAL ELEMENTS

I. An assessment of the trauma system's emergency preparedness has been completed, including coordination with the public health agency, EMS system, and the emergency management agency. **(B-104)**

- a. There is a resource assessment of the trauma system's ability to expand its capacity to respond to MCIs in an all-hazards approach. **(I-104.1)**
- b. There has been a consultation by external experts to assist in identifying current status and needs of the trauma system to be able to respond to MCIs. **(I-104.2)**
- c. The trauma system has completed a gap analysis based on the resource assessment for trauma emergency preparedness. **(I-104.3)**

II. The lead agency ensures that its trauma system plan is integrated with, and complementary to, the comprehensive mass casualty plan for natural and manmade incidents, including an all-hazards approach to planning and operations. **(B-305)**

- a. The EMS, the trauma system, and the all-hazards medical response system have operational trauma and all-hazards response plans and have established an ongoing cooperative working relationship to ensure trauma system readiness for all-hazards events. **(I-305.1)**
- b. All-hazards events routinely include situations involving natural (for example, earthquake), unintentional (for example, school bus crash), and intentional (for example, terrorist explosion) trauma-producing events that test the expanded response capabilities and surge capacity of the trauma system. **(I-305-2)**
- c. The trauma system, through the lead agency, has access to additional equipment, materials, and personnel for large-scale traumatic events. **(I-305.3)**

CURRENT STATUS

Missouri has a state Disaster Plan, and the lead trauma agency, DHSS-Bureau of EMS, is a liaison (resource advisor) to the ESF-8 (Health and Medical) function of the State Emergency Management Agency. Missouri, like many states, has a plethora of federal monies and response programs from DHHS, CDC, and Homeland Security; for example, the MMRS (Metropolitan Medical Response System), UASI (Urban Area Security Initiatives), ASPR (Assistant Secretary for Preparedness and Response), and DMAT (Disaster Medical Assistance Team). As a result, the state possesses equipment caches and

mobile surge facilities that are distributed across the state. The level of engagement for trauma centers in disaster planning, training, and response at the state or regional level is not clear.

As a part of JCAHO (Joint Commission on Accreditation of Healthcare Organizations) accreditation, each facility is required to have a disaster plan and must participate in annual drills. Trauma center drills of individual components of response (communications, personnel rostering, patient triage, etc.), and natural events (H1N1, bus crash) are used to exercise facility response plans. It is relatively rare for drills to cross jurisdictions or involve federal, state, or regional assets. The use of detailed after action reviews (AAR's) are extremely important to inform and improve response but there is no documentation that this avenue is utilized at any level of the trauma system.

State plans for the evacuation of non-affected populations and the use of rural facilities to "off-load" non-critical patients during a mass casualty are not known. These issues have significant impact on trauma system and trauma center operations during disaster events and should be addressed at the state level.

RECOMMENDATIONS

- Perform a system-wide disaster assessment and gap analysis for trauma emergency preparedness.
- Engage all hospitals (non-trauma centers, trauma centers) in regional and state disaster drills.
- Assure all aspects of the trauma system are engaged in disaster response planning, education, and performance improvement.
- Include the EMS/Trauma System in all emergency response and disaster plans.
- Educate emergency responders and hospital personnel on the trauma system so that the system is appropriately utilized during mass causality events.

System-wide Evaluation and Quality Assurance

Purpose and Rationale

The trauma lead agency has responsibility for instituting processes to evaluate the performance of all aspects of the trauma system. Key aspects of system-wide effectiveness include the outcomes of population based injury prevention initiatives, access to care, as well as the availability of services, the quality of services provided within the trauma care continuum from prehospital and acute care management phases through rehabilitation and community reintegration, and financial impact or cost. Intrinsic to this function is the delineation of valid, objective metrics for the ongoing quality audit of system performance and patient outcomes based on sound benchmarks and available clinical evidence. Trauma management information systems (MISs) must be available to support data collection and analysis.

The lead agency should establish forums that promote inclusive multidisciplinary and multiagency review of cases, events, concerns, regulatory issues, policies, procedures, and standards that pertain to the trauma system. The evaluation of system effectiveness must take into account the integration of these various components of the trauma care continuum and review how well personnel, agencies, and facilities perform together to achieve the desired goals and objectives. Results of customer satisfaction (patient, provider, and facility) appraisals and data indicative of community and population needs should be considered in strategic planning for system development. System improvements derived through evaluation and quality assurance activities may encompass enhancements in technology, legislative or regulatory infrastructure, clinical care, and critical resource availability.

To promote participation and sustainability, the lead agency should associate accountability for achieving defined goals and trauma system performance indicators with meaningful incentives that will act to cement the support of key constituents in the health care community and general population. For example, the costs and benefits of the trauma system as they relate to reducing mortality or decreasing years of productive life lost may make the value of promoting trauma system development more tangible. A facility that achieves trauma center verification/designation may be rewarded with monetary compensation (for example, ability to bill for trauma activation fees) and the ability to serve as a receiving center for trauma patients. The trauma lead agency should promote ongoing dialog with key stakeholders to ensure that incentives remain aligned with system needs.

OPTIMAL ELEMENTS

I. The trauma MIS is used to facilitate ongoing assessment and assurance of system performance and outcomes and provides a basis for continuously improving the trauma system, including a cost-benefit analysis. **(B-301)**

- a. The lead trauma authority ensures that each member hospital of the trauma system collects and uses patient data, as well as provider data, to assess system performance and to improve quality of care. Assessment data are routinely submitted to the lead trauma authority. **(I-301.1)**

II. The jurisdictional lead agency, in cooperation with other agencies and organizations, uses analytic tools to monitor the performance of population based prevention and trauma care services. **(B-304)**

III. The financial aspects of the trauma system are integrated into the overall performance improvement system to ensure ongoing fine tuning and cost-effectiveness. **(B-309)**

- a. Financial data are combined with other cost, outcome, or surrogate measures, for example, years of potential life lost, quality-adjusted life years, and disability adjusted life years; length of stay; length of intensive care unit stay; number of ventilator days; and others, to estimate and track true system costs and cost- benefits. **(I-309.4)**

CURRENT STATUS

Trauma performance improvement is conducted on an ongoing basis by the trauma centers, utilizing their trauma registry data. Reportedly, this includes analyses of preventable, potentially preventable, and non-preventable injury deaths, and review of the interfacility transfer process. PI work is reviewed at trauma center site visits by both the reviewers and the Trauma Systems Manager. MOSTORM includes various performance improvement reports, both standard and ad hoc. An example was provided from one trauma center on identification of need for a field amputation protocol through PI analysis of a sentinel event.

Many trauma centers provide case-based outreach education with both prehospital providers and referral hospital staff that includes discussion of opportunities for improvement in care. The pediatric trauma centers do extensive outreach education across their larger catchment areas, as well as a pediatric conference which includes case review presentations. Region-wide performance improvement, embracing all entities, is a vision for the future. Regions with only one trauma center have outreach activities that are more inclusive than are activities in regions with multiple trauma centers.

There is concern about peer review protection for EMS agencies and providers. Several attempts have been made to address this gap through legislation, to no avail. A new approach that has been identified is to work with the Patient Safety

Organization to obtain protection under their umbrella. Preliminary discussions are reported to be positive.

At this time, no trauma system evaluation is taking place. There is no information available on system-wide preventable and potentially preventable injury death rates, nor on trauma patients presenting to non-trauma centers and not subsequently transferred to the appropriate level of trauma care. It was stated that the last report on deaths at non-trauma centers was completed about 11 years ago. The Child Fatality Reviews do classify deaths as preventable or non-preventable, but the thoroughness of these reviews was not discussed. Aggregate MOSTORM data for the regions and state are not provided for PI use at those levels at this time.

- The target date for implementation of trauma system performance improvement was estimated to be spring or winter of 2010. Identification of the highest priority questions to be answered through system PI is included in the work of the Trauma Taskforce as a goal for 2010.

RECOMMENDATIONS

- **Create a consensus vision and plan for Trauma System Performance Improvement including:**
 - **which forum will be utilized**
 - **who will be responsible for it**
 - **who will participate in it**
 - **which filters/parameters will be utilized first**
 - **which data sources will be used**
- Develop human resources within the lead agency and execute the Trauma System Performance Improvement Plan.
- Conduct routine assessments of preventable and non-preventable deaths particularly in rural areas.
- Circulate internal reports on performance improvement initiatives and learning outcomes from selected case reviews to all trauma system participants.
- Translate findings from performance improvement processes into educational programs or public policy changes as necessary.

Trauma Management Information Systems

Purpose and Rationale

Hospital-based trauma registries developed from the idea that aggregating data from similar cases may reveal variations in care and ultimately result in a better understanding of the underlying injury and its treatment. Hospital-based registries have proven very effective in improving trauma care within an institution but provide limited information regarding how interactions with other phases of health care influence the outcome of an injured patient. To address this limitation, data from hospital-based registries should be collated into a regional registry and linked such that data from all phases of care (prehospital, hospital, and rehabilitation) are accessible in 1 data set. When possible, these data should be further linked to law enforcement, crash incident reports, ED records, administrative discharge data, medical examiner records, vital statistics data (death certificates), and financial data. The information system should be designed to provide system-wide data that allow and facilitate evaluation of the structure, process, and outcomes of the entire system; all phases of care; and their interactions. This information should be used to develop, implement, and influence public policy.

The lead agency should maintain oversight of the information system. In doing so, it must define the roles and responsibilities for agencies and institutions regarding data collection and outline processes to evaluate the quality, timeliness, and completeness of data. There must be some means to ensure patient and provider confidentiality is in keeping with federal regulations. The agency must also develop policies and procedures to facilitate and encourage injury surveillance and trauma care research using data derived from the trauma MIS. There are key features of regional trauma MISs that enhance their usefulness as a means to evaluate the quality of care provided within a system. Patient information collected within the management system must be standardized to ensure that noted variations in care can be characterized in a similar manner across differing geographic regions, facilities, and EMS agencies. The composition of patients and injuries included in local registries (inclusion criteria) should be consistent across centers, allowing for the evaluation of processes and outcomes among similar patient groups. Many regions limit their information systems to trauma centers. However, the optimal approach is to collect data from all acute care facilities within the region. Limiting required data submission to hospitals designated as trauma centers allows one to evaluate systems issues only among patients transported to appropriate facilities. It is also important to have protocols in place to ensure a uniform approach to data abstraction and collection. Research suggests that if the process of case abstraction is not routinely calibrated, practices used by abstractors begin to drift.

Finally, every effort should be made to conform to national standards defining processes for case acquisition, case definition (that is, inclusion criteria), and registry coding conventions. Two such national standards include the National Highway Traffic Safety Administration's National Emergency Medical Services Information System (NEMSIS), which standardizes EMS data collection, and the American College of Surgeons National Trauma Data Standard, which addresses the standardization of hospital registry data collection. Strictly adhering to national standards markedly increases the value of state trauma MISs by providing national benchmarks and allowing for the use of software solutions that link data sets to enable a review of the entire injury and health care event for an injured patient.

To derive value from the tremendous amount of effort that goes into data collection, it is important that a similar focus address the process of data reporting. Dedicated staff and resources should be available to ensure rapid and consistent reporting of information to vested parties with the authority and vision to prevent injuries and improve the care of patients with injuries. An optimal information reporting process will include standardized reporting tools that allow for the assessment of temporal and/or system changes and a dynamic reporting tool, permitting anyone to tailor specific "views" of the information.

OPTIMAL ELEMENTS

I. There is an established trauma MIS for ongoing injury surveillance and system performance assessment. **(B-102)**

- a. There is an established injury surveillance process that can, in part, be used as an MIS performance measure. **(I-102.1)**
- b. Injury surveillance is coordinated with statewide and local community health surveillance. **(I-102.2)**
- c. There is a process to evaluate the quality, timeliness, completeness, and confidentiality of data. **(I-102.4)**
- d. There is an established method of collecting trauma financial data from all health care facilities and trauma agencies, including patient charges and administrative and system costs. **(I-102.5)**

II. The trauma MIS is used to facilitate ongoing assessment and assurance of system performance and outcomes and provides a basis for continuously improving the trauma system, including a cost-benefit analysis. **(B-301)**

- a. The lead trauma authority ensures that each member hospital of the trauma system collects and uses patient data, as well as provider data, to assess system performance and to improve quality of care. Assessment data are routinely submitted to the lead trauma authority. **(I-301.1)**

- b. Prehospital care providers collect patient care and administrative data for each episode of care and not only provide these data to the hospital, but also have a mechanism to evaluate the data within their own agency, including monitoring trends and identifying outliers. **(I-301.2)**
- c. Trauma registry, ED, prehospital, rehabilitation, and other databases are linked or combined to create a trauma system registry. **(I-301.3)**
- d. The lead agency has available for use the latest in computer/technology advances and analytic tools for monitoring injury prevention and control components of the trauma system. There is reporting on the outcome of implemented strategies for injury prevention and control programs within the trauma system. **(I-301.4)**

CURRENT STATUS

Missouri has a plethora of data available through the Office of Epidemiology and Health Informatics. Some portions of these data can, and should be, used to help drive trauma system development and oversight. However, the key elements of a trauma management information system, specifically the presence of a statewide trauma registry coupled with a statewide prehospital data set are conspicuously absent.

The trauma managers who were in the audience relayed concerns about the current central trauma registry at the state level. Those concerns revolved, primarily, around the translation and import of data from Collector™ being used in the majority of the trauma centers, to Image Trend™ TCD Data System which is the platform selected by the Bureau of EMS. While both systems are reported to be consistent with National Trauma Data System definitions and standards, the translation between the two has been, to date, problematic. When pressed for when those issues could/would be finally resolved, no definitive time frame could be provided. Additionally, the manner by which Image Trend was identified to be the statewide trauma registry platform is a source of contention among the trauma managers who felt disenfranchised during the selection process. It was unclear if a formal Request for Proposal was developed and released by BEMS with input from trauma center managers and medical directors. Additionally, data fields for Stroke and STEMI have been added to TCD Data System prior to it achieving full functionality of its primary mission – trauma.

It is also unclear how operational the prehospital data system, titled Missouri Ambulance Reporting System (MARS), developed and supported by Image Trend is at the current time. The Bureau of EMS noted that they were able to garner information from MARS pertaining to the number of cardiac patients transported by EMT-Basic personnel to assist in developing policy decisions concerning the creation of a specific level of certification. The fundamental flaw in the MARS is not the platform but, rather, the lax nature of the required reporting by prehospital agencies. Agencies are required to report only “life-threatening”

events. As it relates to injury, national data would indicate that less than 10% of patients would meet true “life-threatening” criteria. This selection bias does not allow for a true understanding of the magnitude of the injury across the State of Missouri. Likewise, it severely limits the value of MARS for purposes of trauma system planning, monitoring, or performance improvement.

Variability in transmitting prehospital records to receiving trauma centers was also noted to be an issue by many trauma directors and managers. It was noted, that when such issues are reported to the Bureau of EMS, they are managed on a case-by-case basis. No system-wide performance improvement process exists to increase the delivery of prehospital records concurrent with the transfer of the patient to ensure continuity of care during the transition of prehospital to hospital phases of care.

The Bureau of EMS notes that it is possible to “link” records between the MOSTORM and MARS databases. However, this linkage is done manually by name and other variable matching between the data sets. Tracking individuals through secondary transfer, while possible, becomes increasingly more difficult.

RECOMMENDATIONS

- **Require all acute care hospitals to participate in the timely submission of injury data (limited subset) as part of both trauma center designation (participating hospitals) and hospital licensure (non-participating acute care facilities).**
- **Enforce all EMS agencies to complete and submit a MARS compatible record for all patient contacts. (add to regulatory authority as well)**
- **Ensure that TCD Data System and MARS data systems are managed in a manner that assures reliability and validity of data and is capable of producing reports that can be used to form trauma policy. This could occur by either substantially increasing the capacity of the newly formed Center to or by a collaborative relationship with the Office of Epidemiology and Health Informatics.**
- Transfer the day-to-day management of the TCD Data System and the MARS databases to the Office of Epidemiology and Health Informatics.
- Form a user’s committee comprised of trauma directors, trauma managers, and registrars, to help ensure that all translation problems between Collector and TCD Data System are corrected in a timely manner.

- Ensure that the TCD Data System web-based interface for smaller facility data submission and capture is fully operational.
- Produce standardized reports for all agencies, institutions, and regions using TCD Data System and MARS data on, at least, a semi-annual basis.
- Use standardized and special reports to guide policy development, oversight, and performance improvement processes for the trauma system.
- Require EMS agencies to leave the prehospital patient record at the emergency department once care for the patient has been transferred to emergency department staff.
- Implement appropriate government procurement guidelines and policies (RFP, RFQ) and stakeholder input when selecting vendors to provide data for the EMS trauma system.

Research

Purpose and Rationale

Overview of Research Activity

Trauma systems are remarkably diverse. This diversity is simply a reflection of authorities tailoring the system to meet the needs of the region based on the unique combination of geographic, economic, and population characteristics within their jurisdiction. In addition, trauma systems are not fixed in their organization or operation. The system evolves over years in response to lessons learned, critical review, and changes in population demographics. Given the diversity of organization and the dynamic nature of any particular system, it is valuable when research can be conducted that evaluates the effectiveness of the regional or statewide system. Research drives the system and will provide the foundation for system development and performance improvement. Research findings provide value in defining best practices and might alter system development. Thus, the system should facilitate and encourage trauma-related research through processes designed to make data available to investigators. Competitive grants or contracts made available through lead authorities or constituencies should provide funds to support research activities. All system components should contribute to the research agenda. The extent to which research activities are required should be clearly outlined in the trauma system plan and/or the criteria for trauma center designation.

The sources of data used for research might be institutional and regional trauma registries. As an alternative, population-based research might provide a broader view of trauma care within the region. Primary data collection, although desirable, is expensive but might provide insights into system performance that might not be otherwise available.

Trauma Registry–based Research

Investigators examining trauma systems can use the information recorded in trauma registries to great advantage to determine the prevalence and annual incidence rate of injuries, patterns of care that occur to injured patients in the system's region, and outcomes for the patients. These data can be compared with standards available from other trauma registries, such as the NTDB. Such comparisons can then enable investigators to determine if care within their region is within standards and can allow for benchmarking. Initiating and sustaining injury prevention initiatives is a vital goal in mature trauma systems. Investigators can take a leadership role in performing research using trauma registry data that identify emerging threats and instituting public health measures to mitigate the threats. For example, a recent surge in death and disability related to off-road vehicles can be identified and the scope of the problem defined in terms of who,

where, and how riders are injured, and then, through presentations and publications, the public can be informed of a new threat.

Trauma system administrators have a responsibility to control investigators' access to the registry. The integrity and reliability of data in a trauma systems registry are essential if accurate research and valid conclusions are to be reached using the data. Trauma system administrators should have a process that screens data entered into the system's composite registry from individual institutions. There should be a mechanism that ensures that the information is stored in a secure manner. Investigators who seek access to the trauma registry must follow a written policy and procedure that includes approval by an authorized institutional review board. Trauma registry data may include unique identifiers, and system administrators must ensure that patient confidentiality is respected, consistent with state and federal regulations.

Population-based Trauma System Research

A major disadvantage of using only trauma registry data to conduct research that evaluates injured patients in a region is the bias resulting from missing data on patients not treated at trauma centers. Specifically, most registry data are restricted to information from hospitals that participate in the trauma system. Although ideally all facilities participate in the form of an inclusive system, many systems do not attain this goal. Thus, a population-based data set provides investigators with the full spectrum of patients, irrespective of whether they have been treated in trauma centers or nondesignated centers or were never admitted to the hospital owing to death at the scene of incident or because their injuries were insufficiently severe to require admission. The state and national hospital discharge databases are examples of population-based data. These discharge databases contain information that was abstracted from medical records for billing purposes by hospital employees who enter these data into an electronic database. For investigators seeking a wider perspective on the care of injured patients in their region, these more inclusive data sets, compared with registries, are essential tools. Other population based data that may be of help include mortality vital statistics data recorded in death certificates. Selected regions might have outpatient data to capture patients who are assessed in the ED and then released.

Investigators can use these population-based data to study the influence of a regional trauma system on the entire spectrum of patients within its catchment area.

Participation in Research Projects and Primary Data Collection

Multi-institutional research projects are important mechanisms for learning new knowledge that can guide the care of injured patients. Investigators within trauma systems can participate as coinvestigators in these projects. Investigators can participate by recruiting patients into prospective studies, being leaders in the design and administration of grants, and preparing manuscripts and reports.

Evidence of this collaboration is that investigators within a trauma system are recognized in announcements of grants or awards. Lead agency personnel should identify and reach out to resources within the system with research expertise. These include academic centers and public health agencies.

Measures of Research Activity

Research can be broadly defined as hypothesis-driven data analysis. This analysis leads the investigators to a conclusion, which might become a recommendation for system change. Full manuscripts published in peer reviewed research journals are an exemplary form of research activity. Research reported in annual reviews or in public information formats intended to inform the trauma system's constituency can also be considered legitimate research activity.

OPTIMAL ELEMENTS

- I. The trauma MIS is used to facilitate ongoing assessment and assurance of system performance and outcomes and provides a basis for continuously improving the trauma system, including a cost-benefit analysis. **(B-301)**
 - a. The lead agency has available for use the latest in computer/technology advances and analytic tools for monitoring injury prevention and control components of the trauma system. There is reporting on the outcome of implemented strategies for injury prevention and control programs within the trauma system. **(I-301.4)**
- II. The lead agency ensures that the trauma system demonstrates prevention and medical outreach activities within its defined service area. **(B-306)**
 - a. The trauma system has developed mechanisms to engage the general medical community and other system participants in their research findings and performance improvement efforts. **(I-306.1)**
 - b. The effect or impact of outreach programs (medical community training/support and prevention activities) is evaluated as part of a system performance improvement process. **(I-306.3)**
- III. To maintain its state, regional, or local designation, each hospital will continually work to improve the trauma care as measured by patient outcomes. **(B-307)**
 - a. The trauma system implements and regularly reviews a standardized report on patient care outcomes as measured against national norms. **(I-307.2)**

CURRENT STATUS

There is no formalized program of systems-based trauma research. While there is a plethora of trauma data available through the Bureau of Health Informatics, a motivated and knowledgeable epidemiologist (Dr. Sarah Patrick) at the helm, and a large staff, none of the key stakeholders have taken advantage of the data availability to conduct research. The E-Code data for emergency department discharges, E-Code data for admitted/discharged trauma patients in non-designated trauma centers, and all deaths are reported. Using these available data, Dr. Patrick and Dr. Mark Van Tuinen have amassed a great deal of information delineating many of the priority diagnoses in the trauma system that could formulate the basis of systems-based research.

Lack of awareness of datasets available in the Office of Epidemiology has inhibited research by non-state employed stakeholders in the system. A wealth of information is available via the Missouri Information for Community Assessment System (MICA). None of the many key stakeholders present at the site review were familiar with the activities of Dr. Patrick's department, MICA, or services available from the Office of Epidemiology. Dr. Patrick is new in the position (less than one year) and has been working diligently to build her department by communicating their capabilities (e.g., through Epidemiology Grand Rounds programs), recruitment of an information systems manager, and building credibility and relationships with her staff and other departments. She has also fostered relationships with local academic departments to bring in students and fellows to work on epidemiology projects. She is to be highly commended for these efforts. Notably, her grants department personnel all have retired, and these positions need to be refilled.

No aggregate population-based data to conduct systems research is available. Due to the lack of mandatory reporting from all hospitals regarding trauma care, additional hospital clinical data are lacking in the system, and it isn't clear to what degree the above data points are underreported or missing. Certainly, prehospital data are lacking due to non-enforcement of statutes regarding data reporting of all ambulance runs. (Only "life threats" and deaths are currently being reported.)

The lead agency (BEMS) has the latest in computer/technology advances and analytic tools for monitoring injury prevention and control components of the trauma system. However, these technologies are not being utilized to their full potential. This appears to be at least somewhat related to the lead agency being under-resourced. Only three individuals (state employees) can access the MARS and TCD Data System databases, each of whom have multiple responsibilities.

There is also lack of confidence in data available from TCD Data System, the trauma registry data set managed by the BEMS, due to concerns about migration

of data from Collector to ImageTrend software systems. Also, since trauma centers are only allowed to access their own data in MOSTORM, they find it easier to access data directly from their own registries to conduct research. This limits the research subject matter to the institution level only. (Several institutions have published trauma-related research from their centers.) Also, most institutions utilize the National Trauma Data Bank for national benchmarking purposes. They did express a need to have access to state data for state benchmarking purposes.

Limited employment of trauma system data to inform potential legislative action (such as motorcycle and helmet seatbelt laws) has occurred. The potential for using data for these purposes is significant; however, the model is currently reactive (responding to requests) rather than proactive, although Deputy Director McAnough has proactively used data to some degree. Data have also been used to study prehospital protocols in a very limited fashion.

There is no reporting on the outcome of implemented strategies for injury prevention and control programs within the trauma system. There may be reporting done on prevention programs in multiple departments and agencies, but the process is not formally integrated into the trauma system, and the Site Visit Team was not provided with this information.

The Office of Epidemiology has developed some mechanisms to engage the general medical community and other system participants in their research findings, e.g., by conducting Epidemiology Grand Rounds and publication of a comprehensive report entitled "Injuries in Missouri."

The trauma system has not engaged in system-wide performance improvement efforts. The effects or impact of outreach programs (medical community training/support and prevention activities) have not been evaluated as part of a system performance improvement process.

The trauma system does not implement and regularly review a standardized report on patient care outcomes as measured against national norms. Statewide or regional analyses of outcomes are also not currently being performed. Should regional population-based reports be generated, cross-border populations (i.e., regional referral bases) will also need to be considered as the two largest metropolitan areas, St. Louis and Kansas City, serve multi-state populations for trauma care, as do several other trauma centers.

RECOMMENDATIONS

- Complete a Trauma Research Plan/Agenda that includes a strategy for population-based research.
- Publish a Trauma System Annual Report.
- Expand the Epidemiology Grand Rounds program to trauma region meetings with focus on MICA capabilities and training on its use.
- Conduct a statewide preventable mortality study for trauma, pursuing grant funding if necessary.

Focus Question 1

1. How does Missouri's trauma system funding compare to other states?

Missouri does not have a full accounting of the funds spent on trauma across the state. There is not a budget or report that summarizes the total cost of injury care at the state (infrastructure and system coordination), region, local, institutional, agency, or practitioner. While the work of Dr. Huckfeldt in 2005 provides a good start toward such an accounting, additional detail and updating is required.

Even the budget provided in the PRQ, as it pertains to the Bureau of EMS and its resources, is an incomplete picture of fiscal and human resources within the Bureau who focus primarily on trauma. The current personnel configuration of ½ FTE devoted to trauma management and a partial FTE in trauma data systems is woefully inadequate in terms of total FTE allocation to the time critical diagnosis that results in more years of potential life lost (YPLL) in injury than stroke and STEMI combined.

The burden of uncompensated care is not documented in an aggregate form. The general discussions originating from representatives of various trauma centers during the interrogatory indicated that of the total burden of uncompensated care for injured patients accounted for 25-35% of the total. This gross estimate is within the expected ratio based on surveys in other states.

- What types of financial review reports or processes are other states using with their advisory councils?
 - a. Some states collect hospital charges and source of payment information in their trauma registries. This information can help track percentages and costs of uncompensated care and it can help document the costs of hospitalized injuries (not including physician charges and other costs) by different payer sources (e.g. Workers' Compensation, Medicare, Medicaid, private insurance, etc.).
 - b. Once a budget is fixed for trauma system development and monitoring activities within the Lead Agency, the trauma stakeholders will be very interested in tracking both programmatic progress and fiscal expenditures associated with those funds.
 - c. Eventually, a cost benefit analysis of the system cost per life saved should be attainable and is important to inform the public and the legislature.

- What recommendations would ACS/COT provide Missouri to expand its infrastructure support for the trauma system, including lead agency and trauma centers and other agencies supporting the trauma system?
 - a. Ongoing, stable funding is necessary to expand and maintain the trauma system infrastructure. For the lead agency in state government, different states use a variety of funding sources, including: general fund revenues; fines or fees on motor vehicle moving violations (12 states); fines or fees on other criminal penalties (4 states); motor vehicle registration/license plates fees or drivers license renewal surcharges (8 states); cigarette excise taxes (5 states); gambling taxes (1 state); surcharge on 911 calls (1 state); and other sources (2 states).
 - b. Some states also fund some EMS and trauma care equipment with state capital improvement funds.
 - c. Other possible funding mechanisms include federal, state, and private funding partnerships (e.g. Alaska Code Blue Project).
 - d. In trauma systems such as Missouri which are, in reality, a loosely connected network of trauma centers, the trauma leadership from each of those centers, individually and collectively, often become myopically focused on reimbursement of uncompensated care. While this focus is important, it is not the only focus. Funds must be invested in system infrastructure, management, and oversight to best protect the health and welfare of the citizens of Missouri. Disproportionate share and uncompensated care should be linked to trauma system performance.
 - e. Federal grants. The absence of a specific grant program for trauma system development, such as those previously funded through the Title XII Trauma and EMS Program, make it more difficult to find sources of financial support from the federal level. However, other states have helped build infrastructure with ASPR, DHS, DOT/NHTSA 508, Rural Hospital FLEX, CDC Block Grants, MCH Block Grants, EMS for Children grants, among others.
- Source: “Summary of Trauma Systems and Funding Mechanisms by State”, American College of Surgeons State Affairs Office.

Focus Question 2

2. What 911, emergency medical dispatch and response coordination elements must be in place to fully support an integrated and inclusive trauma system?

An integral part of developing an effective trauma system is the essential role of communications systems. Coordination of the trauma and EMS communications systems begins with an effective, efficient system that allows for equal access to emergency services for public safety, EMS, and trauma services. The state should ensure that the needs of the EMS community are fully represented in these efforts to establish public safety and EMS communications interoperability. This can be accomplished by:

- Having one state, central coordinating agency responsible for public safety and EMS-trauma communications.
- Including BEMS as an active member and integral part of the agency overseeing public safety and EMS-trauma communications.
- Including a component for comprehensive EMS communications planning and implementable action plans in the state EMS and trauma plan

The National standard is E-911 availability throughout the state. The goal of statewide E-911 should be a major focus of a statewide communication and coordination initiative. The trauma system must be supported by a communication system that provides immediate citizen access and the dispatch of appropriate medical resources (ambulances and helicopters) with pre-arrival instructions to the calling party. This can be accomplished by looking to opportunities to merge and consolidate Public Service Answering Points (PSAP) where appropriate, and expanding 911 or E-911 to underserved areas. The central coordinating agency should establish statewide standards for dispatch to include:

- Standards for dispatcher training and certification
- Standards for pre-arrival instructions
- Standards for medical oversight of all EMD programs
- Standards for a performance improvement process for PSAP and EMD activities

Acronyms Used in the Report

AARs – after action reviews
ACS – American College of Surgeons
ALS – advanced life support
ASPR – Assistant Secretary for Preparedness and Response
ATLS – Advanced Trauma Life Support program
BEMS – Bureau of Emergency Medical Services
BIS – Benchmarks, Indicators, and Scoring
BLS – basic life support
CAAHEP – Commission on Accreditation of Allied Health Education Programs
CAAS – Commission on Accreditation of Ambulance Services
CAH – Critical Access Hospital
CAMTS – Commission on Accreditation of Medical Transport Services
CALs - Comprehensive Advance Life Support
CARF – Commission on the Accreditation of Rehabilitation Facilities
CDC – Centers for Disease Control and Prevention
CECBEMS- Continuing Education Coordinating Board of EMS
CME – continuing medical education
CMS – Centers for Medicare/Medicaid Services
CPS – Child Passenger Safety
CODES – Crash Outcome Data Evaluation System
COT – Committee on Trauma
DHS- Department of Homeland Security
DHSS – Department of Health and Human Services
DMAT – Disaster Medical Assistance Team
DOT- Department of Transportation
ED – Emergency Department
EMD – Emergency Medical Dispatch
EMS – emergency medical services
EMT – emergency medical technician
FIM – functional independence measures
FLEX – Rural Hospital Flexibility Grant
FRA – Federal Reimbursement Allocation
FTE – full time equivalent
HCFA – Health Care Finance Administration
HRSA – Health Resources and Services Administration
ICS – Incident Command System
ICU – intensive care unit
JCAHO – Joint Commission on Accreditation of Healthcare Organizations
MARS – Missouri Ambulance Reporting System
MCH – Maternal and Child Health
MFH – Missouri Foundation for Health
MHA – Missouri Hospital Association

MICA – Missouri Information for Community Assessment
MIS – Management Information System
MIVPAC – Missouri Injury and Violence Prevention Advisory Committee
MMRS – Metropolitan Medical Response System
MODOT – Missouri Department of Transportation
MOSTORM – Missouri State Trauma Outcome Registry Management
MTSPE – Model Trauma Systems Planning and Evaluation
NREMT – National Registry of Emergency Medical Technicians
MSCOT – Missouri State Committee of Trauma
NEMSIS – National EMS Information System
NHTSA – National Highway Traffic Safety Administration
ORH – Office of Rural Health
PAI – pre-arrival instructions
PI – performance improvement
POST – Police Officer Secondary Training
PRQ – pre-review questionnaire
PSAP – Public Safety Answering Point
QI – Quality Improvement
RTTDC – Rural Trauma Team Development Course
SAC – State Advisory Committee on EMS
SCI – Spinal Cord Injury
SYEMI – ST Elevated Myocardial Infarction
SVT – site visit team
TBI – Traumatic Brain Injury
TTF – Trauma Task Force
TCD – Time Critical Diagnosis
TCDS- Time Critical Diagnosis System
TCDDS – Time Critical Diagnosis Data System
TSC – Trauma System Consultation
UASI – Urban Area Security Initiatives
YPLL – Years of Potential Life Lost

Appendix A: Methodology

Methodology

The Missouri Department of Health and Senior Services (MDHSS) requested this trauma system consultation, which was conducted under the auspices of the American College of Surgeons (ACS), Trauma System Consultation program (TSC). The multi-disciplinary Site Visit Team (SVT) consisted of: two trauma/general surgeons, one emergency physician, a State EMS/trauma director, a trauma program manager, a rural trauma and prehospital specialist, and a public health and injury specialist. Biographical sketches for team members are included as Appendix B of this report.

The primary objective of this ACS trauma system consultation is to guide and help promote a sustainable effort in the graduated development of an inclusive system of trauma care for the State of Missouri. The format of this report correlates with the public health framework of assessment, policy development, and assurance outlined in the ACS *Regional Trauma Systems Optimal Elements, Integration, and Assessment: System Consultation Guide*. Prior to the visit, the SVT reviewed the ACS Pre-Review Questionnaire (PRQ) submitted by a Project Consultant to the Missouri Department of Health and Senior Services. The SVT also reviewed a number of related supporting documents provided by the MDHSS and information available on state government websites.

The SVT convened in Jefferson City, Missouri on June 22nd-25th, 2009, to review the state of Missouri trauma system. The meetings during the four-day visit consisted of plenary sessions during which the SVT engaged in interactive dialogue with a broad range of representative trauma system participants. There was also an opportunity for informal discussion with the participants and time devoted to questions and answers. During the survey, the SVT also met in sequestered sessions for more detailed reviews and discussion, and for the purpose of developing a team consensus on the various issues, preparing a report of their findings, and developing recommendations for future development of the trauma system in Missouri. This report was developed independently of any other trauma system consultations or assessments.

Appendix B: Site Visit Team Biographical Sketches

MICHAEL F. ROTONDO, MD, FACS- TEAM LEADER

Michael F. Rotondo, MD, Professor and Chairman of the Department of Surgery at The Brody School of Medicine at East Carolina University, is an innovator, educator and national leader in Trauma and Surgical Critical Care. He received his undergraduate degree, as well as a Masters in Cardiovascular Physiology, from Georgetown University. In 1984, after graduating from Georgetown University School of Medicine, he took his general surgical training at Thomas Jefferson University Hospital. This was followed by a fellowship in Traumatology and Surgical Critical Care at the University of Pennsylvania under the tutelage of Dr. C. William Schwab.

In 1990, he accepted a post on the faculty at the University of Pennsylvania as an assistant professor and was promoted to the rank of associate professor of surgery in 1997. His skills in both clinical surgery and administration led to important contributions in the development of the Trauma Center at PENN, a University Level I Trauma Center, and Brandywine Hospital, an affiliate Level II Trauma Center. In 1995, he was named Vice Chief of Traumatology and Surgical Critical Care in the Department of Surgery at the University of Pennsylvania and became the Trauma Program Director in 1997. In addition to holding these positions of leadership, he consistently demonstrated his commitment to mentorship of medical students, residents, and fellows, a facet of his practice that continues today.

In 1999, he became Professor and Vice Chairman of the Department of Surgery at The Brody School of Medicine and Chief of Trauma and Surgical Critical at University Health Systems of Eastern Carolina. He brought world-class trauma and critical care to eastern North Carolina and successfully recruited young, dynamic trauma/critical care surgeons who shared his vision and brought this center to national prominence. In May 2005, he was named Chairman of the Department of Surgery at The Brody School of Medicine at East Carolina University.

He has achieved national and international reputation through his work in damage control surgery and abdominal compartment syndrome and through leadership in the American College of Surgeons Committee on Trauma, the American Association for the Surgery of Trauma, and the Eastern Association for the Surgery of Trauma over which he currently presides as president. He has over 130 publications, abstracts, book chapters and monographs and has delivered over 125 national presentations and visiting professorships.

GAIL F. COOPER, PUBLIC HEALTH ADMINISTRATOR (RETIRED)

Ms. Cooper retired from the County of San Diego, Health and Human Services Agency in March 2003, and since that time has worked on special projects in EMS, Trauma, and Public Health Preparedness. Prior to retiring from the County of San Diego she served as the Public Health Administrator for the County of

San Diego and was responsible for over 500 employees and a budget of over \$71 million. For over 25 years Ms. Cooper has been assisting in the establishment of Emergency Medical Service Systems, Trauma Systems, Injury Control programs, Disaster medical response/Public Health Preparedness and Public Health policy at the local, state and national level. She has been involved in major trauma legislative agendas in numerous states while assisting states in implementing statewide and regional systems of trauma care. She has also assisted state and local communities in further development and refinement of their respective EMS systems, strengthened data collection and evaluation components of EMS and Trauma systems, and formulated policies allowing for the integration of EMS, Trauma, and Injury programs. As part of the EMS, Trauma and Injury agenda she has implemented programs to assess data/evaluation for injury mechanisms, triage criteria, car crash statistics, bicycle injuries, helmet use, pedestrian safety and bioterrorism.

Ms Cooper was a major contributor and principal author to the HRSA Model Trauma System Planning and Evaluation document released in 2005, and the corresponding Benchmarks Indicators and Scoring curriculum; ACS-COT Regional Trauma Systems: Optimal Elements, Integration, and Assessment, systems consultation guide, released in 2008; CDC Emergency Medical Services and Public Health: Forging a More Powerful Relationship course.

AMY EBERLE, RN, BSN, EMT

Amy Eberle has worked as the State Trauma Coordinator with the Division of Emergency Medical Services, North Dakota Department of Health for four years. She has also worked at the St. Alexius Medical Center in Bismarck, North Dakota on the Neuro/Surgical floor for the past 8 years.

Amy is the current Director for the State Trauma Manager North Central Region. She is a member of the ND COT, ND EMSC advisory committee, ND EMS advisory committee, Society of Trauma Nurses, and the ND ENA. She is also a part of the planning committee for the annual ND State Trauma Conferences.

Amy has been a strong advocate for an all inclusive trauma system within ND. She has been involved in many legislative activities in regards to enhancing the ND trauma system and as a result has been very successful in getting legislature to pass a bill that requires all hospitals in ND to be trauma designated at some level.

Amy is a Registered Nurse with a Bachelor in Science degree. She graduated from the University of Mary, Bismarck ND. She was certified as an EMT-Basic in 2006. She also obtained certification as a TNCC instructor and has attended numerous conferences, courses, and workshops on EMS, Trauma and disaster planning and response. Amy is also a part of the North Dakota Department of Health Emergency Response and Preparedness incident command team.

MARK JOHNSON, MPA

Mark S. Johnson has over 30 years experience in Emergency Medical Services (EMS) and Trauma Systems development at statewide and regional levels, including over 25 years as Chief of EMS, and later Community Health and EMS, for the State of Alaska. He also supervised development of Injury Surveillance and Prevention programs in Alaska (20+ years) and served as President of the State and Territorial Injury Prevention Directors Association (STIPDA) in 2000 and 2001. Mark has served on numerous state and national committees related to EMS, multiple casualty incident response, and injury prevention, and has published numerous articles on these issues.

In addition to his EMS, trauma care system, and injury prevention program experiences, Mark's other public health management experience includes supervision of Alaska's: Primary Care and Rural Health program (8 years); Health Promotion program (7 years); Tobacco Prevention and Control program (7 years); and the Behavioral Risk Factor Surveillance System (7 years).

Mark retired from State of Alaska in August 2004. Since then, he has done part time consulting and volunteer work with a variety of national and state EMS and Injury Prevention organizations.

He currently serves as a voting representative on the Alaska Trauma System Review Committee and is Chairman of the Alaska EMS for Children Advisory Committee.

Mark has a Masters in Public Administration degree from the University of Alaska.

He has received several state and national awards for his work on EMS and injury prevention programs, as well as the Alaska Public Health Association's "Alaska Meritorious Health Service Award" (2005).

MARY SUE JONES, RN, MS

Mary Sue Jones has been Delaware's State Trauma Coordinator since 1996 and was the Associate Trauma System Coordinator for 2 years prior. Delaware has had an inclusive Trauma System since 2000. Mary Sue was Trauma Coordinator at a Pennsylvania Level II Trauma Center for 4 years, during the implementation period of the Pennsylvania Trauma System. Prior to that, she spent 5 years in the Admitting Area of Maryland's R. Adams Cowley Shock Trauma Center, and later taught for 3 years in a paramedic educational program. Previous clinical experience includes positions in Surgical Intensive Care as Emergency Department nurse manager and as hospital shift supervisor in hospitals in Baltimore and suburban Washington, D.C. She has served on

American College of Surgeons consultation teams since 2004, and represented the State Trauma System Managers on the National Trauma-EMS stakeholders group.

KATHY J. RINNERT, MD, MPH

Kathy J. Rinnert, MD, M.P.H., began her career in emergency medicine and emergency medical services (EMS) in the early 1980's as a Nationally Registered Paramedic in a five-county, rural EMS agency in the Allegheny Mountains of Southeast Ohio. She completed medical school at the Ohio State University, followed by internship in Internal Medicine at Loyola University, and residency training in Emergency Medicine at the University of Chicago. Following residency, Dr. Rinnert completed a two-year fellowship in EMS at the University of Pittsburgh. She simultaneously obtained a Master's in Public Health at the Graduate School during her tenure in Pittsburgh.

Dr. Rinnert currently serves as Associate Professor in Emergency Medicine at the University of Texas Southwestern Medical Center at Dallas (UTSWMC). In addition, she is the Associate Medical Director for the UTSW/BioTel EMS system, encompassing sixteen municipalities and their fire-based EMS and Public Safety agencies. In this capacity she oversees the out-of-hospital practice of over 1700 paramedics operating in urban, suburban, and rural environments. Dr. Rinnert directs the Center for Government Emergency Medical Security Services (GEMSS) at the UTSWMC, which provides academic and clinical tactical support to government agencies. At the Center she directs both the EMS and GEMSS fellowship programs, which provide post-doctoral training in these subspecialty areas of emergency medicine.

Dr. Rinnert has special interest and expertise in trauma, injury prevention and control, air medical transport, tactical EMS, urban search and rescue, and domestic preparedness for weapons of mass effect (WME) and counterterrorism. She serves as the physician representative on the Panel of Commissioners (POC) for the Commission on Accreditation of Ambulance Services (CAAS), the national body for accreditation of EMS agencies in the United States and Canada. In addition, Dr Rinnert is an active site reviewer for the Committee on Accreditation of Educational Programs for the EMS Professions (CoAEMSP) and trauma systems consultant to the American College of Surgeons Committee on Trauma (ACS-COT). Dr. Rinnert was recently elected to the Board of Directors of the National Association of EMS Physicians, the premier organization for physician practice in EMS.

NELS D. SANDDAL, MS, REMT-B

Mr. Sanddal is currently the president of the Critical Illness and Trauma Foundation (CIT), in Bozeman, Montana. CIT is a non-profit organization dedicated to improving the outcomes of people who are injured in rural America through programs of prevention, training, and research. He recently completed a

detachment as the Director of the Rural EMS and Trauma Technical Assistance Center which was funded by the Department of Health and Human Services, Health Resources and Services Administration. Mr. Sanddal worked as the training coordinator for the EMS and Injury Prevention Section of the Montana Department of Public Health and Human Services in the late 1970's. He has served as the Chairperson of the National Council of State EMS Training Coordinators and as the lead staff member for that organization, as well as the National Association of EMT.

Mr. Sanddal has been a co-investigator for six state or regional rural preventable trauma mortality studies and has conducted research in the area of training for prehospital and nursing personnel as well as in rural injury prevention and control. He is a core faculty member for the NHTSA Development of Trauma Systems course and has conducted several statewide EMS assessments for NHTSA. Mr. Sanddal served on the IOM Committee on the Future of Emergency Care in the U.S.

He received his EMT training in Boulder, Montana in 1973 and has been an active EMT with numerous volunteer ambulance services since that time. He currently responds with the Gallatin River Ranch Volunteer Fire Department where he serves as the Medical Officer and Assistant Chief.

He completed his undergraduate work at Carroll College, received his Master's degree in psychology from Montana State University and is currently completing his doctorate in Health and Human Behavior from Walden University.

SHELLY D. TIMMONS, MD, PHD, FACS

Shelly D. Timmons, M.D., Ph.D., is a neurological surgeon with Semmes-Murphey Clinic in Memphis, Tennessee. She is Associate Professor of Neurosurgery and has been Chief of the Neurotrauma Division of the University of Tennessee Health Science Center Department of Neurosurgery and Chief of Neurosurgery at the Regional Medical Center at Memphis/Elvis Presley Memorial Trauma Center in Memphis since 1997. She is Assistant Dean of Graduate Medical Education at UTHSC and Assistant Clinical Dean for the Regional Medical Center at Memphis for UTHSC.

Dr. Timmons earned her medical degree at the University of Illinois College of Medicine at Peoria in 1991, completed her residency training in neurological surgery in 1997 and her Ph.D. in 2002, both at the University of Tennessee Health Science Center-Memphis. She has been active in clinical research in traumatic brain injury and traumatic vascular injury, undergraduate and graduate medical teaching, development of evidence-based guidelines, and in several professional organizational activities, including those of the Executive Committee of the Joint Section of Neurotrauma and Critical Care of the American Association of Neurological Surgeons and Congress of Neurological Surgeons.

Appendix C: List of Participants

TraumaSystems evaluation & planning committee



American College of Surgeons
Trauma Systems Consultation
June 22nd-25th, 2009

Representative Category		Title	First Name	Last Name	Agency
State Health Commissioner	Director	Ms.	Margaret	Donnelly	Department of Health and Senior Services
Health Department Leadership	Deputy Director	Ms.	Nancie	McAnaugh	Department of Health and Senior Services
Health Standards and Licensure	Administrator	Mr.	Dean	Linneman	Department of Health and Senior Services
State EMS Medical Director	EMS Medical Director	Dr.	Samar	Muzaffar	Department of Health and Senior Services
State EMS Director	Chief	Mr.	Greg	Natsch	Department of Health and Senior Services
Trauma Advisory Committee and Subcommittee Member		Mr.	Wally	Patrick	Heartland Regional Medical Center
EMS Advisory Committee Member		Dr.	Lynthia	Andrews	Heartland Regional Medical Center
State Trauma Registrar	Inspector	Ms.	Shirley	Gastler	Department of Health and Senior Services
Trauma Program Epidemiology and Statistics Representative	State Epidemiologist	Dr.	Sarah	Patrick	Department of Health and Senior Services

Committee on Trauma, Retired		Dr.	Frank	Mitchell	
General Counsel	Legal Counsel	Ms.	Brenda	Arndt	Department of Health and Senior Services
Bureau of Geneticis and halth Childhood	Chief	Ms.	Sharmini	Rogers	Department of Health and Senior Services
Office of Pubic Information	Chief	Mr.	Kit	Wager	Department of Health and Senior Services
Governmental Policy and Legislation	Chief	Mr.	Patrick	Lynn	Department of Health and Senior Services
Office of Primary Care and Rural Health	Chief	Ms.	Marie	Peoples	Department of Health and Senior Services
	Director CERT				Department of Health and Senior Services
Governor's Highway Traffic Safety Representative	Highway Safety Division	Mr.	Scott	Turner	Missouri Department of Transportation
Department of Public Safety Director	Director	Mr.	John	Britt	Department of Public Safety
MEMSA	President	Mr.	Nathan	Williams	Missouri Emergency Medical Services Association
MSMA	President	Dr.	Tom	Sparkman	Missouri State Medical Association
MAOPS	President	Dr.	Rex	Lee	Missouri Association of Osteopathic Physicians and Surgeons

MONENA	President	Mr.	Mike	Kindle	Missouri National Emergency Numbers Association
		Mr.	Mark	Alexander	CoxHealth
Legislature		Rep.	Wayne	Cooper	House of Representatives
		Rep.	Mark	Bruns	House of Representatives
		Rep.	Jeff	Roorda	House of Representatives
Emergency Medical Services for Children, State Program Director/Coordinator		Ms.	Paula	Adkison	Department of Health and Senior Services
Missouri Hospital Association	Director of Licensure and Regulations	Mr.	Bryant	McNally	Missouri Hospital Association
American College of Emergency Physicians, Missouri Chapter		Dr.	Robert	Poirer	Washinton University
Emergency Nurses Association, State Chapter		Ms.	Helen	Sandkuhl	St. Louis University Hospital
Emergency Nurses Association, State Chapter		Ms.	Joan	Eberhardt	Missouri Emergency Nurses Association

Committee on Trauma, State Chapter	Director of Trauma Services, ACS Missouri Committee on Trauma	Dr.	Bryan	Troop	St. John's Mercy Medical Center
Rehabilitation Representatives	Rusk Rehabilitation Center	Mr.	Gary	Payne	Rusk Rehabilitation Center
	Injury Prevention Program Leaders and advocates	Ms.	Michelle Gibler		Missouri University-School of Medicine
Trauma Center Medical Directors	Medical Director	Dr.	Dennis	Vane	Cardinal Glennon Children's Medical Center
Level 1	Medical Director	Dr.	Ronald	Sharp	Children's Mercy Hospitals and Clinics
	Medical Director	Dr.	Martin	Keller	St. Louis Children's Hospital
	Medical Director	Dr.	Douglas	Schuerer	Barnes-Jewish Hospital
	Medical Director	Dr.	Bryan	Troop	St. John's Mercy
	Medical Director	Dr.	Aaron	Scifres	St. Louis University
	Medical Director	Dr.	Harry	Wilkins	St. Lukes Hospital
	Medical Director	Dr.	Douglas	Geehan	Truman Medical Center
	Medical Director	Dr.	James	Kessel	University Missouri Medical Center
	Medical Director	Dr.	Robert	Johnson	St. John's Regional Health Center
Level II	Medical Director	Dr.	Andrew	Karanas	DePaul Health Center
	Medical Director	Dr.	Kelly	James	Centerpoint Hospital

	Medical Director	Dr.	Charles	Beggs	Liberty Hospital
	Medical Director	Dr.	Robert	Beckman	St. Anthony Medical Center
	Medical Director	Dr.	Edward	Andres	Heartland Hospital East
	Medical Director	Dr.	David	McCollister	St. Joseph Health Center
	Medical Director	Dr.	Patrick	McGregor	North Kansas City Hospital
	Medical Director	Dr.	Robert	Wilcoxon	Freeman Hospital
	Medical Director	Dr.	Robert	Dodson	St. John's Regional Medical Center
	Medical Director	Dr.	Tim	Woods	Cox Medical Center
	Medical Director	Dr.	John	Webb	Research Medical Center
Level III	Medical Director	Dr.	Brent	Bartgis	Citizen's Memorial Hospital
	Medical Director	Dr.	Dana	Voight	Phelps County
	Medical Director	Dr.	Xavier	Jenkins	Freeman-Neosho Hospital
	Medical Director	Dr.	Charles	Zeman	Northeast Regional Medical Center
	Medical Director	Dr.	Michael	Duff	Lake Regional Health System
	Medical Director	Dr.	James	Cassat	St. John's Mercy
	Medical Director	Dr.	Kathleen	James	St. Joseph Hospital West
	Medical Director	Dr.	Michael	Heid	Saint Francis Medical Center
	Medical Director	Dr.	Michael	Nagle	Skaggs Community Health Center
Trauma Program Managers	Trauma Program Manager	Ms.	Chris	Green	Cardinal Glennon Children's Hospital

	Trauma Program Manager	Ms.	Noreen	Felich	Children's Mercy
	Trauma Program Manager	Ms.	Diana	Kraus	St. Louis Children's Hospital
	Trauma Program Manager	Ms.	Julie	Nash	Barnes-Jewish
	Trauma Program Manager	Ms.	Toni	Kanne	St. John's Mercy
	Trauma Program Manager	Ms.	Pamela	Golden	St. Louis University
	Trauma Program Manager	Ms.	Jennifer	Busby	St. Lukes Hospital
	Trauma Program Manager	Ms.	Teresa	Lienhop	Truman Medical Center
	Trauma Program Manager	Ms.	Carol	Nierling	University Missouri Medical Center
	Trauma Program Manager	Mr.	Ted	Shockley	St. John's Regional Health Center
	Trauma Program Manager	Ms.	Kathe	Russo	DePaul Health Center
	Trauma Program Manager	Ms.	Carolyn	Wells	Centerpoint Hospital
	Trauma Program Manager				Liberty Hospital
	Trauma Program Manager	Ms.	Dawn	Wotawa-Bennett	St. Anthony Medical Center
	Trauma Program Manager	Mr.	David	McKnight	Heartland Hospital East

	Trauma Program Manager	Ms.	Karen	Kemper	St. Joseph Health Center
	Trauma Program Manager	Ms.	Lori	Davis	North Kansas City Hospital
	Trauma Program Manager	Ms.	Chris	Hoag-Apel	Freeman Health System
		Mr.	Robert	Denton	Freeman Health System
	Trauma Program Manager	Ms.	Sandy	Woods	St. John's Regional Medical Center
	Trauma Program Manager	Ms.	Patty	Parish	Cox Medical Center
	Trauma Program Manager	Mr.	Eric	Roberts	Reasearch Medical Center
	Trauma Program Manager	Ms.	Diana	Oxford	Citizen's Memorial Hospital
	Trauma Program Manager	Ms.	Wrenae	Shabel	Phelps County Regional Medical Center
	Trauma Program Manager	Ms.	Shannnon	Hobson	Freeman-Neosho Health Center
	Trauma Program Manager	Mr.	Dan	Holte	Northeast Regional Medical Center
	Trauma Program Manager	Ms.	Amy	Knoernschild	Lake Regional Health System
	Trauma Program Manager	Mr.	Timothy	Norton	St. John's Mercy Hospital
	Trauma Program Manager	Mr.	Jason	Cullom	St. Joseph Hospital West
	Trauma Program Manager	Mr.	Rob	Grayhek	Saint Francis Medical Center

	Trauma Program Manager	Ms.	Angeline	Hein	Skaggs Community Health Center
Trauma Registrars		Mr.	Gerry	Keene	Saint Francis Medical Center
		Mr.	Bob	Brown	Heartland Regional Medical Center, Trauma Services
		Mr.	Paul	Bell	University Missouri Hospital and Clinics
		Ms.	Becky	Cheek	Research Medical Center
		Ms.	Sandy	Metze	St. Louis Children's Hospital, Trauma Services 5S-40
		Ms.	Carol	Weiss	St. Louis Children's Hospital, Trauma Services 5S-40
		Ms.	Kerri	Bogle	Freeman Health System
Representatives from Rural and Critical Access Hospitals		Ms.	Linda	Black	Pike Memorial County Hospital
Representatives from Rural and Critical Access Hospitals			Marsha	Dial	Scotland County Memorial Hospital
Representatives from Rural and Critical Access Hospitals		Ms.	Dolly	Giles	Pike Memorial County Hospital

Prehospital Provider		Mr.	Ken	Koch	St. Charles County Ambulance District
EMS Agency Managers		Mr.	Bob	Patterson	St. John's Emergency Medical Services
911 Communications		Ms.	Vicki	Groce	Andrew County Ambulance District
EMS Medical Directors, Regional and Local	KC Region	Dr.	Joseph	Salomone	Kansas City, MO EMS/SAC
	East Central Region	Dr.	David	Tan	Barnes-Jewish Hospital at Washington University School of Medicine
	East Central Region	Dr.	Brian	Froelke	Washington Univeristy
	Southwest Region	Dr.	Janet	Jordan	St. John's EMS
	Central Region	Dr.	Jeff	Coughenour	University Hospital and Clinics
	Southeast Region	Dr.	Jeffrey	Umfleet	Southeast Missouri Hospital
Helicopter Early Launch Provider or Air Ambulance		Ms.	Ruby	Mehrer	Lifeflight Eagle
Missouri Foundation for Health		Dr.	James	KimmeY	Missouri Foundation for Health
		Ms.	Michelle	Miller	Missouri Foundation for Health

Department of Health and Senior Services	Project Specialist	Ms.	Deborah	Markenson	Department of Health and Senior Services
Department of Health and Senior Services	Time Critical Diagnosis Representative	Ms.	Karen	Connell	Department of Health and Senior Services
Department of Health and Senior Services	Administrative Office Assistant	Ms.	Beverly	Smith	Department of Health and Senior Services
Department of Health and Senior Services		Ms.	Mary	Kleffner	Department of Health and Senior Services
Department of Health and Senior Services	Inspector I	Ms.	Jody	Hyman	Department of Health and Senior Services