AMERICAN COLLEGE OF SURGEONS COMMITTEE ON TRAUMA
Trauma Systems Evaluation and Planning Committee

Trauma System Consultation Report

State of California

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AMERICAN COLLEGE OF SURGEONS
Inspiring Quality: Highest Standards, Better Outcomes

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EXECUTIVE SUMMARY

Current Status

California is a large and very diverse state with regard to topography and demography. Ocean, beaches, fertile growing fields, desert, expansive forests, alpine tundra, and high peaks can all be found within the state. Population density and the availability of health care facilities are also widely variable, ranging from highly urban regions to frontier areas. These factors represent a substantial challenge to the development of a comprehensive statewide approach to injury care.

In addition to the wide variability in geography and population between regions, California has a long historical tradition of local autonomy and control with limited central governance. For the emergency medical services (EMS) and trauma systems, this decentralized model of leadership and control has resulted in 33 highly autonomous local emergency medical service agencies (LEMSAs) that hold primary administrative and operational responsibility for the provision of injury care. For example the authority for trauma center designation is at the LEMSA level versus the state level. In practice, California is served by 33 individual trauma systems. The American College of Surgeon's (ACS) trauma system consultation team found a high degree of variability in the degree of trauma system development between the LEMSAs, reflecting their differing geography, population density, and healthcare resources, as well as political and economic climate. Further, hospital participation in the trauma system is voluntary, and as a result fewer than 25% of the state's acute care hospitals have a formal role, despite the intended design for an inclusive system at the state level. The LEMSAs operate in functional isolation with minimal guidance and limited integration within an overarching state trauma system. In support of the EMS Authority and the LEMSAs a voluntary regional infrastructure is evolving, consisting of five Regional Trauma Coordinating Councils, each comprised of several LEMSAs that form a functional or geographic group. The role and structure of these councils is not well defined or regulated, and significant variability in the composition, focus, and function was noted.

California has a long history of commitment to trauma system development, and several individual LEMSAs have been at the forefront of progress at a national level. Consistent with the tradition of local governance, the state's EMS Authority has limited authority and very limited resources (monetary and personnel) for trauma system development, integration, and oversight. As a result, the significant progress made over time is largely the result of the high level of cooperation and volunteer effort between individual stakeholders and individual institutions. The longstanding State Trauma Advisory Council (STAC) has enjoyed a stable composition and stable leadership, enabling it to be a major factor in this cooperation, and it is instrumental in the continued progress of the California trauma system.

The STAC recently led a lengthy process of assessing the trauma system components and creating a well-written trauma system plan, based on an inclusive trauma system model. The plan envisions a state-wide trauma system with greater uniformity and integration of care across the LEMSA's. However, limited central authority and very limited resources at the state level will challenge the trauma system stakeholders to fully implement the plan on its intended scale.

Although California has numerous state data resources, the very limited personnel and monetary resources hinder the state's ability to use these data to monitor trauma system performance and to drive improvement. The prehospital registry system is incompletely developed and not yet fully implemented. In addition, the linkage of prehospital data to the state

trauma registry data is not yet functional. The available population-based data from various sources (e.g., hospital discharge data) are not being used to their best advantage, in large part due to lack of central resources for database maintenance and data analysis. The leadership of the California trauma system functionally lacks the data necessary to measure the efficiency, effectiveness, and impact of the trauma system on an ongoing basis.

Advantages and Assets

- The state has a long history of leadership in trauma systems development
- The long history of dedicated volunteerism across the broad stakeholder group has been a key to past progress
- Stakeholders are engaged and energetic
- The EMS Authority is engaged and supportive
- A group of strong historical trauma centers has supported trauma system development
- Overall, the state's population has fairly good coverage by the Level I and II trauma centers
- A decentralized local governance model addresses local needs
    - The county, or a small group of counties, may well be the best geopolitical unit for an operational trauma system
    - Several LEMSAs have exemplary systems in place
- A well-written trauma plan was recently updated
- Broad enabling legislation with regulatory authority exists
- Funding sources are established in current statute
- The state hospital association is active and engaged
- The prehospital data collection system is evolving
- The statewide trauma registry is evolving
- Stakeholders have good access to epidemiologic data
- A wide range of injury prevention activities are conducted statewide
- The state resourcefully uses grant funding

Challenges and Vulnerabilities

- California is a large and heterogeneous state
- A high degree of variability in injury care exists across the state
- Minimal resources are available to support the trauma system at level of the EMS Authority
- Regulations are dated and do not set specific standards and requirements in key areas
- Limited active guidance is provided to LEMSAs by the EMS Authority
- A lack of functional trauma system integration exists
- The LEMSAs are functionally isolated from one another
- The trauma system has heavy dependence on volunteer effort at both the local, regional, and state level
    - Volunteer resources appear to be stretched to their limit
- The current trauma system is an incomplete embodiment of an inclusive model
    - Limited interaction exists with non-designated facilities
    - Data collection from non-designated facilities does not occur
- Variability in the trauma center designation process exists
    - Designation is not consistently based on need
- The utilization of available data is limited

- No standing process exists for statewide monitoring of trauma system performance
- Minimal system level process improvement is performed
- The public has little awareness of the trauma system at the state level
- Dependence on grant funding threatens continuity of key functions

Themes

- California is a microcosm of the nation
    - A broad spectrum of geography, demographics, development exist
    - Unity needs to be created from diversity
- Federalism is the recommended model
    - Central governance needs to be strengthened to create a better balance between state and LEMSA control
- Sometimes you need rules
- Volunteer effort alone is insufficient for continued progress
    - You have reached the limit
- Sometimes you have to re-allocate resources
    - Think catalyst - A small investment will reap large benefits
- Inclusive means inclusive, nobody can opt out
- You have created a vision, share it
    - Engage the public and the legislature
- You have the authority, use it
- Use the data you have while collecting better data
- Succession planning is essential – No one lives/works forever
- Do not be held back by *perceived* barriers
- Starting is the hardest part

PRIORITY RECOMMENDATIONS

Injury Epidemiology

- Create an injury report template for Local Emergency Medical Services Agencies (LEMSAs), and provide a list of EpiCenter queries to use to complete the injury report.

Statutory Authority

- **Update regulations to set specific standards and requirements for trauma system implementation, and to address changes to be consistent with the proposed *California State Trauma Plan, 2015*.**

- Establish in regulation scalable minimum operational standards based on the size and resource capabilities of the urban, suburban, and rural LEMSAs.

System Leadership

- Establish basic quality and activity reporting standards and report templates for the LEMSAs to ensure that the California Emergency Medical Services (EMS) Authority, State Trauma Advisory Committee (STAC) and Performance Improvement and Patient Safety (PIPS) subcommittee receive sufficient data to assess state trauma system performance.

- Formalize the structure and charge of the Regional Trauma Coordinating Committees (RTCCs) and continue to develop their function, especially in domains of clinical practice guidelines and quality assurance programs

Coalition Building and Community Support

- Collaborate with the Trauma Managers Association of California in their efforts to roll out a state-wide media campaign to educate the public about the trauma system.

Trauma System Plan

- Obtain approval for the *California State Trauma Plan, 2015* in as expeditious a manner as possible, while gaining broad stakeholder feedback.

- Establish a timeline and begin implementation of the key elements of the trauma system plan.

- Identify sufficient funding for the timely implementation of the trauma system plan.

Financing

- Identify and seek a stable and sustainable funding source to support California trauma system planning, oversight, and evaluation at the state level.

- Produce a report of the costs, value of the trauma system and trauma care, and the importance of maintaining trauma center readiness to treat persons with severe injuries in California.

Definitive Care Facilities

- Establish EMS Authority guidelines to standardize the trauma center designation process across LEMSAs.

- Exercise the authority of the LEMSAs to designate trauma centers based upon needs of the population served.

    - Provide EMS Authority guidelines for needs-assessment methodology.

    - Provide EMS Authority guidelines for metrics of trauma center need that are additional to the 350,000-population rule.

- Exercise the authority of the LEMSAs to collect data from all acute care facilities in their region.

System-Wide Evaluation and Quality Assurance

- Expedite the adoption of the state *Performance Improvement and Patient Safety* (PIPS) *Plan* in collaboration with appropriate state advisory committees, LEMSAs, RTCCs and other trauma system stakeholders.

- Monitor the performance measures, especially timeliness of secondary transfers and under- and over-triage, and address trends in deviation of care through the PIPS plan process.

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

The California Department of Public Health (CDPH) Safe and Active Communities (SAC) Branch has multiple epidemiologists, one of whom prepared the overview of injuries in California for the pre-review questionnaire (PRQ). The provided report was based predominantly on vital records, the hospital discharge dataset, and the emergency department dataset, but some data from the state trauma registry were also included. The report described injuries by mortality, morbidity, age group, intent, traumatic brain injury, and payer for 2013. Information was not provided about comparisons of injury incidence, mortality, and morbidity between counties or regions of the state, or changes over time. A special fact sheet on motor vehicle-related injury data was produced in 2013.

It was reported that the CDPH has not prepared a comprehensive injury report since about 2005 when the state last had funding for this effort. Current SAC Branch epidemiology efforts are tied to health issues for which grant funding has been awarded. It is not known if any of the state epidemiologists have specific training in injury epidemiology. Such specialization is important when preparing a comprehensive description of injury. This involves the integration of population-based and clinical datasets that illustrate the larger focus of injury control, including the association between severe injuries and the importance for trauma center care. It would be beneficial for the epidemiologist working with the state trauma system to learn injury epidemiology skills, such as International Classification of Diseases, 9th edition (ICD-9, or future version with ICD-10) injury severity score (ISS) mapping using hospital discharge data, the application of geographical information system (GIS) mapping that might help regions to target injury prevention efforts, and identifying patients who should have been taken to a trauma center.

California has a web-based epidemiologic resource, EpiCenter, for individuals to obtain injury and other public health data for their county or region. This resource has a tutorial to help novice users. Some technical assistance is available when needed. It is not known how aware the injury control community is about this resource, but it is likely that individuals without injury data expertise have little knowledge of this resource. The larger Local Emergency Medical Services Agencies (LEMSAs) are more likely to have epidemiologist support to use EpiCenter effectively. However, many LEMSAs have no epidemiologist support to help them compare their county or regional injury data with the state data. It would be helpful to the LEMSAs to have a template for an injury report that could be obtained from EpiCenter, and identification of the individual queries that could be used to fill the template. While epidemiology resources are limited at the SAC, the state has several Schools of Public Health with epidemiology programs. The SAC Branch or the EMSA trauma system program could potentially seek an epidemiology graduate student to assist with creating a comprehensive report on injuries in California or a report template using EpiCenter data.

Recommendations

- Develop a comprehensive report of injuries for the state of California, with comparisons of the injury problem in rural, suburban, and urban counties.
    - Obtain a template for a comprehensive state injury report from a state with a CDC Core Injury Grant.
    - Prepare an executive summary of the injury report including key information and graphics for use in educating elected officials and the public.

- Seek opportunities for the epidemiologist that collaborates with the trauma system program to obtain additional skills in injury epidemiology.

- **Create an injury report template for the Local Emergency Medical Services Agencies, and provide a list of EpiCenter queries to use to complete the injury report.**

    - **Include a list of queries from the emergency medical services (EMS) and trauma registries when those are included in the set of databases used by EpiCenter.**

- Consider seeking an injury epidemiology graduate student from a School of Public Health to support development of additional injury data reports and report templates.

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 sub-state (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

The Benchmark, Indicator, and Scoring (BIS) tool has been used appropriately to assist in the development of two key documents pertaining to trauma system development in California. The first, titled *California Statewide Trauma Planning: Assessment and Future Development,* was published in 2006 by the Emergency Medical Services (EMS) Authority. It is notable that this document included very contemporary guidance from the Health Resources and Services Administration (HRSA) *Model Trauma System Planning and Evaluation* publication that contains the BIS and recommendations from the Institute of Medicine's *Future of Emergency Care* series, also published in 2006.

The BIS was completed by the 16-member State Trauma Advisory Committee (STAC), and the findings and recommendations were submitted in the *California Statewide Trauma Planning: Assessment and Future Development* document to the EMS Authority director for approval.

The BIS findings were informally monitored and updated periodically between 2006 and 2013. In 2013 the BIS was formally reviewed and scores were updated. Again this process relied on

the STAC, and the findings helped to frame priorities for the *California State Trauma Plan, 2015,* which is in the final state review and approval process.

Scoring for many of the BIS elements showed improvement between the two measurement periods. One example is assuring the public welfare by enforcing regulations pertaining to trauma care. Other indicators were resistant to change such as securing funding to continue the planning, development and evaluation of the trauma system in EMS Authority.

Recommendations

- Continue to use the Benchmarks, Indicators, and Scoring (BIS) tool to monitor ongoing trauma system performance improvement effort.
- Create a schedule for periodic BIS re-assessment.
- Expand the number of stakeholders involved in the future BIS re-assessment and consensus process, perhaps capitalizing on the annual trauma summit as a venue.
- Encourage utilization of the BIS by the LEMSAs.
    - Train facilitators to conduct the BIS for LEMSAs

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 pre-described 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 post-injury 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 State of California has enabling legislation that provides broad authority for the EMS Authority. In 1980 the Emergency Medical Services System and Prehospital Emergency Care Personnel Act (SB 125) was passed. The Act provided the foundation for EMS in California by creating the EMS Authority, effective January 1, 1981, and adding Division 2.5 to the Health and Safety Code (H&SC), Sections 1797-1799.

The statute established the Commission on EMS with 18 commissioners representing many California EMS constituent groups. The Governor appoints twelve commissioners, and the Senate Rules Committee and the Speaker of the Assembly each appoint three. The Act also includes language addressing the LEMSAs and EMS providers.
The statute requires the following eight functional areas of the state's EMS system development to be addressed:

- Manpower and training
- Communications
- Transportation
- Assessment of hospitals and critical care centers
- System organization and management
- Data collection and evaluation
- Public information and education
- Disaster response

The EMS Authority is charged with developing and implementing EMS systems throughout California (H&SC 1797.102-105). It also has the responsibility for developing a statewide trauma system. The state is to be commended for using a consensus approach involving its many stakeholders and the public in developing and regulating the statewide system.

The state currently has a two-tier structure for managing and regulating the statewide EMS and trauma system. The EMS Authority is the lead agency for establishing minimum statewide standards and overall monitoring of the statewide system. LEMSAs are the lead agency for the EMS system at the county, regional, or local level, and a LEMSA is mandated for any county or multi-county region that chooses to implement an EMS program. Each LEMSA has regulatory authority.

California is a large and diverse state with highly urbanized counties, suburban counties, and many rural and isolated counties. The state currently has 33 LEMSAs with local statutory authority to manage its EMS system. Each LEMSA has varying capabilities associated with factors such as the county population and local government capacity. Resources to meet the population's needs for trauma care and EMS differs depending on the LEMSA and county resources. Establishing a regulatory environment with one minimum standard is difficult and challenging with such diversity.

There are broad differences in the service needs and management resources required for the urban areas compared to suburban and rural. Given this diversity and uniqueness, consideration should be given to developing regulations with a more scalable approach while maintaining a standard that ensures the residents and visitors of the state have access to and receive appropriate emergency medical and trauma services. For example, regulations for

criteria for the Level III trauma center designation process could require strict adherence to ACS Level III trauma center criteria for all urbanized LEMSAs, but have more flexible criteria for Level III trauma centers in rural LEMSAs that lack higher level trauma center resources.

The state currently allows for exemptions in statute. While exemptions to minimum standards may be necessary in some cases, clearly written non-subjective criteria for regulatory exemptions should be codified in regulations.

California currently has a peer review law identified as §1157, Statute-Evidence Code. During this trauma system consultation (TSC) visit several hospitals and LEMSA's expressed concern that the current statute may not be broad enough or written with the specificity to provide all the necessary protection for an effective peer review process. In addition, five RTCCs have been established since this statute was enacted. While peer review conducted by the RTCCs may be protected, it is suggested that the statute be reviewed and amended as needed to address all areas of concern.

California has three funding sources specifically for EMS and trauma currently in statute. In 2001 the legislature enacted AB 430 (Cardenas), which created the Trauma Care Fund subject to legislature appropriation from the State's General Fund. While this law has not been repealed, the state legislature has not appropriated funds since 2005/06. The state experienced good progress for the 3 years funding was appropriated, including the establishment of 20 new trauma centers, predominantly in the rural areas.

The Maddy Fund, §1797.98a-g (derived from surcharge on traffic fines), is available for uncompensated care, but is not specific to trauma patient claims. However, the Richie Fund component of the Maddy Fund is dedicated to the improvement of pediatric trauma care, which can also include reimbursement for uncompensated care. Unless re-enacted the Richie Fund section in statute will expire on January 1, 2017.

Although these statutes were enacted for a specific purpose, it is now critical that the state reassess these laws. With the federal Affordable Care Act, uncompensated care may no longer be the preferred method for trauma center reimbursement. A determination of all costs associated with sustaining the EMS and trauma system should be made, including operating expenses within the EMS Authority. Other allocation strategies for funding to support trauma care should be considered to continue to meet the needs of California's residents and visitors. Efforts to revise the statutes should be made.

Recommendations

- Assure that the performance improvement process is protected from discovery, when conducted at all levels of the trauma system, including the Regional Trauma Coordinating Committees.

- Review existing funding statutes, regulations, and processes, including the Maddy EMS Fund, State Trauma Fund, and the Richie Fund, to ensure adequate funding and the appropriate distribution of funds to provide sustainability of the statewide EMS and trauma system.

- **Update regulations to set specific standards and requirements for trauma system implementation, and to address changes to be consistent with the proposed *California State Trauma Plan, 2015*.**

- **Establish in regulation scalable minimum operational standards based on the size and resource capabilities of the urban, suburban, and rural Local Emergency Medical Services Agencies (LEMSAs).**

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 an integrated 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

The California trauma system organization has two separate tiers of system leadership, both very different in nature, authority, and visibility. This situation presents both advantages and significant challenges. At a functional level, California is comprised of 33 individual trauma systems, defined by the LEMSA. This includes 26 individual counties, and 7 multi-county groups, including two LEMSAs in which the counties are not all physically contiguous. The overarching state leadership in the EMS Authority has a broad integrative charge to collect data and to assess the needs in each trauma region, to develop guidelines, and to review the specific plans developed by each LEMSA. Within this structure, the drive to create and optimize a regional system, its design and implementation, day-to-day operations, and quality assurance are all the responsibility of leaders at the local level.

The size and the heterogeneity of the state, the very limited trauma-specific resources in the EMS Authority, as well as local tradition, have created a situation in which each LEMSA is essentially its own trauma system. In most cases this LEMSA is largely independent of other LEMSAs. Additionally, the LEMSAs function without substantial policy input, direction, or technical assistance from the EMS Authority. As a result, the LEMSAs vary dramatically in size, resources, and degree of development. Large urban counties are highly organized and functional systems, while rural LEMSAs have minimal resources, including several that do not have designated trauma centers at any level within their boundaries.

The leadership resources and stakeholder engagement in the individual LEMSA exhibit similar variability. It was difficult for the TSC team to assess the full spectrum of LEMSA leadership issues as the size of the state and limited resources for travel also worked against a full representation of the smaller and more rural LEMSAs during the TSC visit. The rural LEMSA constituencies were underrepresented compared to larger, well-established LEMSAs, essentially all of which had multiple stakeholders at the TSC visit. While the large and well-established LEMSA coincide with the population distribution of the state, further development and expansion of trauma care capability into less populated regions will require active engagement and nurturance of smaller and less well-resourced LEMSAs.

The EMS Authority is advised by the STAC, a well-established group that has been very active in the development of the state trauma plan and the development of state-level regulations. The STAC is largely composed of representatives and stakeholders from large and well-established LEMSAs, with relatively little representation from smaller and more rural LEMSAs. This may simply reflect the relative number of engaged stakeholders available for participation, but it works against increased involvement of smaller LEMSAs in the state-level system.

The EMS Authority and the STAC are tasked with monitoring the overall function of the trauma system, both in the aggregate and at the level of the individual LEMSA. Neither group has been able to effectively perform this function due to a lack of good data. The current statewide databases for hospital and prehospital care are not used on a regular basis to run statewide queries. The individual LEMSAs vary widely in their reporting ability and the frequency with

which such reports are generated and shared with the EMS Authority. As a result, the STAC and the EMS Authority are challenged to understand the day-to-day functioning of the trauma system on a statewide basis, and they are currently unable to measure trauma system-level performance. The EMS Authority is limited in its ability to gather data from the LEMSAs, both due to the permissive nature of current regulations, and the lack of dedicated EMS Authority staff to perform data collection and analysis.

The strong local structure of system leadership has worked well in several large urban LEMSAs that are fortunate to be associated with leading academic trauma centers and a large group of experienced and committed trauma system stakeholders. The placement of the lead agencies within county government, which is much more accessible and nimble than state government, has facilitated the establishment of strong county-level systems that have served as models of system development on a national scale. Yet this same local structure has made progress difficult in smaller and more rural areas, which lack such high-level facilities, resources, and experienced and motivated leadership. The limited staffing at the EMS Authority, along with permissive regulations makes it difficult to provide motivation and assistance to the rural LEMSAs. The implementation of five RTCCs has been effective to some degree in providing leadership training and technical assistance to smaller LEMSAs, and in improving cooperation between LEMSAs. However, the utility of the RTCCs has been limited by the lack of a clear mandate and resource support for their activities.

Recommendations

- **Establish basic quality and activity reporting standards and report templates for the Local EMS Agencies (LEMSAs) to ensure that the California Emergency Medical Services (EMS) Authority, State Trauma Advisory Committee (STAC) and Performance Improvement and Patient Safety (PIPS) subcommittee receive sufficient data to assess state trauma system performance**.
    - **Consider scalable reporting standards for LEMSAs based upon size, activity, available resources, and degree of system development.**
    - **Include information about the organizational structure, staffing, and financial resources of the individual LEMSAs.**
- Use LEMSA data and state registry data to create aggregate system-wide performance reports on regular ongoing basis
- Use LEMSA reports and system reports to educate the public and elected officials regarding trauma system accomplishments, as well as the need for future development.
- Increase representation from Level III and Level IV trauma centers, non-designated acute care facilities, and the smaller LEMSAs on the STAC.
- Use input from the RTCCs and system performance reports to identify LEMSAs in need of leadership support and technical assistance.
- **Formalize the structure and charge of the Regional Trauma Coordination Committees (RTCCs) and continue to develop their function, especially in domains of clinical practice guidelines and quality assurance programs.**

- **Seek resources to provide administrative and liaison support to the RTCCs in support of these goals.**

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

The EMS Authority utilized the STAC and other constituents in the process to update the state trauma system plan. They also included the STAC Project Subcommittee, RTCCs, EMS Administrators of California, and the EMS Medical Association of California. The STAC is both multidisciplinary and broad-based in its representation. However, the membership of the committee does not include representation from non-designated acute care facilities, elected officials, injury prevention, or rehabilitation. During preparation of the PRQ, the trauma system

manager identified the importance of developing a closer relationship with injury prevention and rehabilitation programs to support trauma system development.

At the regional level, California has established five trauma regions based on routine patient flow patterns. The RTCCs serve as regional coalitions for trauma system development and collaboration. Each region defines its own membership. Unfortunately, some of the regions do not have representation from non-designated acute care facilities, leaving a key aspect of local system development unrecognized and exclusive. Ultimately, this exclusion can greatly impact efforts to improve patient care through system evaluation.

The chairperson of each RTCC serves on the STAC, and this facilitates reporting about regional activities and issues. Various approaches are taken by the RTCCs to promote trauma system development. For example, the American College of Surgeons (ACS) Rural Trauma Team Development Course (RTTDC) has been promoted in rural areas to address the timeliness of transfers. In turn, urban members of the RTCCs help to review cases and provide resources to the LEMSAs within their neighboring counties.

The LEMSAs appear to have broad-based representation of stakeholders on their guidance committees, although non-designated acute care facilities may be less actively involved.

Some LEMSAs also provide information to the public regarding the EMS and trauma system; however, the efforts were reported to be sporadic and could be more aggressive in seeking media attention. Some of the LEMSA activities were listed in the annual trauma plan status reports. A best practice cited involved a LEMSA holding an EMS banquet. This forum served to inform community members of the EMS system and to recognize selected EMS personnel for their service. In turn, the EMS Authority also hosts an annual EMS recognition program; however, a trauma system award is not clearly specified or recognized.

The Monterey County LEMSA conducted a question and answer session for concerned citizens regarding trauma center designation. The session served to educate the public about the benefits of having a designated trauma center available to them. Trauma centers also educate the public about the trauma system and conduct injury prevention activities. For example, the University of California Davis Medical Center developed a child passenger safety education program for diverse populations, in partnership with local family resource centers. Other trauma centers reported conducting injury prevention programs, as well as trauma survivor recognition reunions.

Ultimately, the key to mobilizing the state trauma system coalition rests with the state trauma system manager who attends organizational meetings regularly and has integrated the trauma system plan into other strategic plans such as Highway Safety, PIPS, and the EMS Challenge Area. The state trauma system manager participates with regional meetings as time and travel funds permit, and shares state-of-the-state information. However, the trauma system program staff consists of only one person, limiting opportunities to expand the trauma system coalition and enhance integration with injury prevention, rehabilitation, emergency management, and public health. Not stifled by this limitation, the state trauma system manager has leveraged networking with other organizations to assist in educating the public and in coalition building.

The Trauma Managers Association of California (TMAC) is another well-established organization providing leadership in trauma system development. The membership is inclusive and open to anyone interested in trauma care. There are 46 Trauma program managers participating along with representation from 13 of the 33 LEMSAs. The state trauma system

manager is also a member of this organization. TMAC is active in strategic planning and in educating other LEMSAs and hospitals about the trauma system through their website. TMAC created a listserv where members can address trauma system issues or matters requiring immediate attention. This listserv can also be tapped to recruit stakeholders to support legislative action work. TMAC recently formed a subcommittee to develop and roll out a statewide campaign.

The California Hospital Association (CHA) has an EMS/Trauma Committee that serves in an advisory capacity to the CHA Board of Trustees. This committee provides an opportunity to educate and inform CHA members on trauma system development and to gather input and support for future goals and objectives. The state trauma system manager is also a member of this committee. The CHA also hosts an annual Symposium, Leadership Conference, and Health Policy Day with legislators, all in an effort to educate and inform.

Another well-established conference is the annual state trauma summit. This is an efficient forum for the EMS Authority to educate policymakers, key trauma stakeholders and system leadership. This conference serves as an opportunity for the EMS Authority to provide updates of the state and national trauma system. They have also developed a website to inform policymakers about various activities and regulations.

Most of the communication with various organizations occurs through meetings, list-serves, conferences, electronic documents available on websites, and by Facebook and Twitter pages. Though the public can access these sources for information, no state effort to implement an organized and targeted media campaign educating the public about the trauma system has occurred within the EMS Authority or by other trauma system stakeholder organizations.

Additional assistance would be beneficial to coordinate, develop, and mobilize a multidisciplinary statewide trauma system coalition to inform the public and elected officials about the challenges faced by the trauma system. It is likely that an experienced coalition coordinator exists in one of the larger LEMSAs who could help develop a strategic plan for this purpose.

Recommendations

- **Collaborate with the Trauma Managers Association of California in their efforts to roll out a statewide media campaign to educate the public about the trauma system.**
    - Consider engaging graduate student(s) from a communications or marketing program to support this effort.
    - Develop a one page fact sheet to summarize the updated goals in the *California State Trauma Plan, 2015* and publish it on the Emergency Medical Services (EMS) Authority website.
    - Integrate the executive summary from the comprehensive trauma injury report recommended in the Injury Epidemiology section.
- Expand representation on the State Trauma Advisory Committee (STAC) to include non-designated acute care facilities, public member(s) and elected officials.

- Develop subcommittees to the STAC around targeted issues to increase the number of engaged trauma stakeholders.

- Cultivate relationships with public health, injury prevention, rehabilitation, emergency management organizations, EMS providers, transport agencies, public safety, and academic institutions to expand the trauma system coalition.

    - Identify an individual in California with past leadership success in building a local or regional trauma coalition to guide the development of a state-based trauma coalition.

- Support regional collaboration to enhance system integration and performance improvement

- Compile the Local EMS Agency Trauma System Activity Reports recommended in the System Leadership section, and post the document to the EMS Authority website.

- Expand the state EMS annual recognition program to include a category specific to the trauma system.

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 state of California has a two-tier structure for administrative leadership. The lead agency for the state trauma system is the EMS Authority, a department of the Health and Human Services Agency. Each county or region designates a LEMSA that serves as the lead agency for the implementation and operation of its local trauma system. The EMS Authority has one full time equivalent (FTE) position dedicated to the trauma system program with some limited support from other administrative leadership positions within the agency. Some rural counties join together for administrative support to provide a multi-county LEMSA. The number LEMSA employees vary among the 33 local systems. Currently no statewide report or information is available to validate whether each LEMSA has sufficient staff to effectively manage their local system.

The EMS Authority state trauma system manager is the primary point of contact in the agency, having the responsibility for the overall coordination and management of the trauma system. The LEMSAs and trauma centers rely heavily on the state trauma system manager for assistance, particularly in the area of data support, including analysis and reporting. As reported by many participants during the TSC consultation, the workload and expectations of for the person in this position are overwhelming. No succession plan was reported to exist should this position become vacant. The TSC team concurred with the opinion of many in TSC participants that insufficient personnel resources exist in the EMS Authority dedicated to supporting the statewide trauma system.

A strength of the trauma system includes the number of stakeholders, many of whom volunteer their time to assist in the development of the statewide trauma system. One example of this is the creation of the five RTCCs. These committees function as a conduit between the LEMSAs and the EMS Authority and the STAC to aid in statewide trauma system development and standardization. The RTCC membership is currently drawn from trauma system partners within each region to include, but not be limited to, LEMSA trauma system coordinators, EMS directors and administrators, trauma center directors, trauma program managers (TPMs), non-designated acute care facility representatives, EMS providers, and other trauma partners. The state trauma system manager attends each region's Annual Summit and provides a state-of-the-state presentation. It is clear the RTCCs provide valuable and worthwhile support for the trauma system. In order to sustain this good work and structure, the EMS Authority should assess resources within its current structure and provide the necessary liaison support. Such support will enable the RTCCs to be more effective in promoting trauma system development in the rural and less developed LEMSAs.

Data management is a critical component of the trauma system. Currently, limited information technology (IT) support is provided by the EMS Authority. In addition, the EMS Authority borrows the services of an epidemiologist from the CDPH on a part-time basis. Thus the ability to respond to queries from trauma centers entering or uploading data to the state trauma registry, or to provide data analysis and reporting for the trauma system is very limited. At the LEMSA level, likewise, IT support is limited and varied. The EMS Authority should assess current staff resources and commit adequate personnel for data management support, data analysis, and reporting for the statewide EMS and trauma information systems.

Several state agencies, as well as, external resources provide services that can complement and assist in the development and management of the state trauma system. The CDPH SAC Branch, the location of the state injury prevention program, would be a good partner for data analysis. The California State Transportation Agency is currently engaged in addressing many

EMS issues, and it is collecting and analyzing data for the *California Strategic Highway Safety Plan 2015-2019.* Resources invested for this project by the EMS Authority may also inform data management needs and approaches for the EMS and trauma information systems. Rehabilitation specialists may also have valuable information to share regarding services provided to trauma survivors. The EMS Authority will need to assess its resources and dedicate sufficient staff to coordinate and support this effort.

The state trauma system is fortunate to have many stakeholders and individuals enthusiastically supporting it and volunteering their time to assist the EMS Authority and the LEMSAs in the continued development of California's trauma system. It is imperative that their support and participation is recognized and those sufficient personnel resources are dedicated to support and sustain their efforts.

Recommendations

- Review the current organization structure in Emergency Medical Services (EMS) Authority and dedicate adequate resources for agency trauma system functions.
    - Ensure adequate personnel for data management, data analysis, and reporting for the statewide EMS and trauma information systems.
    - Provide liaison support to the Regional Trauma Coordinating Committees.
- Develop a staff succession plan to ensure trauma system stability in the event of future personnel changes.
- Identify and collaborate with other state agencies and external resources to enhance trauma system development.

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 data collection and analysis. **(I-203.4)**

Current Status

State Trauma System Plan

California developed its first comprehensive trauma system plan (TSP) in 2015, defining three major goals:

- Timely access to trauma care,
- Delivery of optimal trauma care, and
- Community health and wellness.

Trauma system planning followed a robust process beginning in 2005 and culminated with the current TSP in 2015. Early in the process, the EMS Authority published an analysis entitled *California Statewide Trauma Planning: Assessment and Future Direction* in 2006, which was based upon completion of the HRSA *Model Trauma System Planning and Evaluation* (MTSPE) document BIS self-evaluation tool. The BIS evaluates the status of 113 key indicators of an inclusive mature trauma system. Between 2006 and 2015, statewide annual trauma summits were held to refine the goals of the trauma system and its plan. Data collection for the California Emergency Medical System Information System (CEMSIS), the state trauma registry, began in 2009 to further inform TSP development. The trauma system planning process continued in 2010 with direction from the EMS Authority to the STAC to produce the current TSP. The STAC again utilized the BIS self-evaluation tool, as well as the ACS *Regional Trauma Systems: Optimal Elements, Integration, and Assessment* document to assist with the identification and description of the key components of the trauma system in California. All of these resources are solid foundations for formulation of a trauma system plan.

While the STAC consists of stakeholders with multiple roles in the trauma system representing several organizations, these individuals are appointed, and by definition are already very engaged in trauma care. A potential concern is that the actual conceptual design input for the TSP came from the STAC, which is a relatively small group of stakeholders. However, elements of the plan's development were addressed at several well-attended annual trauma summit meetings. Furthermore, broad vetting of the TSP is being completed for overall stakeholder engagement and approval prior to final enactment and implementation. Additionally, the deployment of the five RTCCs to assist with the development of the written TSP, in collaboration with the STAC, was an excellent strategy for the engagement of stakeholders from all regions.

Overall, the initial implementation goals of the TSP are written somewhat conservatively to ensure success at the outset, which is likely to be a good strategy going forward. The TSP relies on a data structure that is not yet fully operational, which is a relative weakness. No statewide injury report has been prepared since 2010, due to lack of funding. Such a report, with specific comparisons to national and neighboring state injury rates, patterns, and outcomes, would help inform priorities for plan execution going forward, although this should not hinder approval of the TSP.

The TSP was distributed for public comment to all trauma partners throughout the state for review, comment, and suggested revisions. The TSP was also reviewed by the EMS Authority Director and Deputy Director for final review prior to seeking approval by the Department of Finance and the Health and Human Services Agency Secretary. Although the request for final approval signature was scheduled for March 2016 from the Department of Finance and the

Health and Human Services Agency, agency representatives recommended delay for final approval until the TSC report was provided. This would enable the integration of significant recommendations into the TSP.

Local Trauma System Plans

The local trauma systems have high variability in their maturity. LEMSA participation in the trauma system is voluntary, but currently all 33 LEMSAs have elected to participate. Participation dictates that the LEMSA complete a trauma plan and submit it to the EMS Authority. Local trauma plans are designed to meet *minimum* standards and to address both short- and long-term needs of the local trauma system, including the number and location of trauma centers. The EMS Authority process for reassessment of LEMSA trauma plans is to review a brief LEMSA update submitted annually. The EMS Authority has limited capacity to review more detailed trauma plan updates if this were to be required.

LEMSAs are not required to perform regular re-assessment of population needs for trauma services or trauma centers. Additionally, no formal engagement in the trauma system is required of non-designated acute care facilities. Each of these activities would be helpful in bringing all LEMSAs into alignment with the overall goals of uniform quality, performance improvement standards, and timeliness of care across the system. In summary, the heterogeneity and operational independence of the LEMSAs is a relative weakness that will be addressed by successful execution of the state TSP. This will not necessarily reduce their local authority or freedom to operate and meet local community needs. The EMS Authority and the LEMSAs need sufficient financial and human resources to accomplish this through data collection and analysis, reporting, and oversight mechanisms.

The *California State Trauma Plan, 2015* is an excellent, well-developed document providing direction for the future of trauma system development in the state. The plan appropriately focuses on regional and statewide leadership, coordination of systems performance improvement, and further integration of local trauma systems.

Recommendations

- **Obtain approval for the *California State Trauma Plan, 2015* in as expeditious a manner as possible, while gaining broad stakeholder feedback.**
- **Establish a timeline and begin implementation of the key elements of the trauma system plan.**
- **Identify sufficient funding for the timely implementation 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

The California Standardized Emergency Management System (SEMS), which is compatible with the National Incident Management System (NIMS), coordinates all of the state's emergency

management, based upon a hierarchical responsibility that begins locally. Locally, the Medical Health Operational Area Coordinators (MHOACs), Regional Disaster Medical Health Coordinators (RDMHCs), and Regional Disaster Medical Health Specialists (RDMHSs) are strengths of the system. The RDMHSs plan regional drills, request resources when needed for major events, coordinate prevention activities, and serve as subject matter experts for other coalitions. While the six-region system works well as evidenced by the well-coordinated responses to a number of mass casualty incidents, the trauma system is not well-integrated into the regional infrastructure for emergency management, and the disaster mutual aid regional borders are slightly different from the five-region structure of the RTCCs. The trauma centers are not as involved with emergency management planning as would ideally occur. Implementation of the *California State Trauma Plan* should focus on reducing siloes in this area.

While integration with a variety of other related services exists at the trauma center and LEMSA level, essentially no integration at the statewide level occurs with the following key aspects of the trauma system: injury prevention, mental health, social services, child protective services, public safety, and law enforcement. Minimal integration with other agencies in the CDPH was reported at the statewide level, despite the EMS Authority placement in the state agency organizational structure under the Department of Health and Human Services.

The coalition-based *California Strategic Highway Safety Plan* (SHSP) is a strong example of an integrated project within the system, involving interagency cooperation for the overall goal of reducing traffic-related injury, disability, and death.

The state has other specialty acute care facilities addressing time-sensitive conditions, such as stroke and ST elevation myocardial infarction (STEMI). Some of these acute care facilities are also designated trauma centers. No information was provided during the TSC regarding any current or anticipated state-level planning or policy development for these specialty care centers. Collaboration with stakeholders for these time-sensitive conditions may be beneficial when attempting to obtain adequate resources for trauma system development.

Recommendations

- Integrate the trauma centers and EMS in the development of *regional* emergency, disaster, surge capacity, and mass casualty planning based upon risk, population, and bed census assessments.

- Collaborate with the California Department of Public Health's Safe and Active Communities Branch to develop a needs-based, integrated, statewide injury prevention program.

- Devise mechanisms to disseminate best practices in integrated trauma care, mental health services, social services, child protective services, public safety, and law enforcement to all trauma stakeholders statewide.

- Develop a long-range plan of collaboration for specialized regional centers treating trauma and other time-sensitive conditions, such as stroke and ST elevation myocardial infarction (STEMI), capitalizing on shared resources.

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

California is fortunate to have some funding sources to support the state trauma system; however, these funds are extremely limited with regard to supporting the state trauma system operations. The federal Preventive Health and Human Services Block grant funds are used to support the salary of the state trauma system manager, office expenses, limited travel, and the annual trauma summit. For the current fiscal year, a portion of the ACS TSC was also funded by this block grant. Every year the EMS Authority collaborates with the CDPH to determine the distribution of federal block grant funds, but priorities of the U.S. Congress or the CDPH could change, making funding for the trauma system program vulnerable. The trauma system has no formal budget. No funding is available to support the RTCCs.

In 2001, the trauma system was successful in having the state legislature pass the Trauma Care Fund to support uncompensated care. Funds were appropriated from the State's General Fund for 3 years; but no additional appropriations were made after the 2005-2006 budget year. A small residual balance in this fund was identified recently, and it was used to help support costs associated with the TSC. This Trauma Care Fund statute has not been repealed and has no expiration. No effort was reported by TSC participants to seek restoration of funding through this statute in recent years, and no legislative champion for the California trauma system was reported.

The EMS Authority has successfully leveraged grant funding to support many of its programs. For example, National Highway Traffic Safety Administration (NHTSA) funds through the Highway Safety Program were obtained to establish the EMS and trauma registries. The federal Centers for Disease Control and Prevention (CDC) and Assistant Secretary for Preparedness and Response (ASPR) emergency preparedness grants support the EMS Authority's Disaster Medical Services Division. The EMS Authority has worked with the Office of Rural Health, potentially to support the RTCCs; however, funds available have been inadequate for that purpose. Some Office of Rural Health funds were used to offer the RTTDC to rural acute care facilities.

The Maddy Emergency Medical Services Fund was established by statute in 1998, and gives counties the option to establish a fund. Fees are added to fines for motor vehicle violations. The funding allocation formula specifies the distribution for hospitals providing disproportionate trauma and emergency medical services, physician payment for emergency care and stabilization of patients, uncompensated emergency care, discretionary funds for emergency medical services, and administration of the fund. It is reported that more than $100 million dollars are collected annually by the 47 counties that have established a fund. In 2014 the Legislature amended the Maddy Fund, requiring participating counties to submit to the EMS Authority an accounting of funds collected and how they were used. A compiled report will then be submitted to the Legislature. The EMS Authority was not provided any funding for this monitoring responsibility.

Significant concern was expressed by TSC participants that the Affordable Care Act will have a significant impact on distribution of the Maddy Fund, as it reduces the number of individuals without healthcare coverage and the amount of uncompensated care. The financial challenge now facing trauma centers is undercompensated care, especially for insured individuals covered by MediCal. The statute does not address payment for undercompensated care.

More recently the Legislature passed the "Richie Fund" portion of the Maddy Fund, which places additional fees on the motor vehicle violations. The allocation formula for this portion of

the Maddy Fund must be used to support pediatric trauma care in all trauma centers, to support pediatric trauma centers, or to improve access to and coordination of pediatric trauma care. The distribution of the Richie Fund portion of the Maddy Fund is not tied specifically to uncompensated care. Of important note, the Richie Fund has an expiration date of January 1, 2017, unless the Legislature extends the date.

The Kid's License Plate fund is associated with a fee for a vanity car license plate that is used to support injury prevention programs. It was reported that an estimated $45 million was collected through this program, which is managed by the CDPH SAC Branch.

Multicounty LEMSAs with 3 or more counties are eligible for additional state funding from the state general fund to support LEMSA operations. A local match is required.

Strategies for revision of funding statutes that specify uncompensated care as part of the allocation formula should be developed. Some states successfully persuaded elected officials to fund trauma center readiness costs, rather than uncompensated care. Such readiness costs may include on-call physician pay, equipment, and emergency department staffing to ensure that services are available 24 hours a day, every day. This funding strategy was illustrated in the statute language associated with the Richie Fund.

Rural Flexibility grant funding from the federal HRSA Office of Rural Health Policy is another potential funding source that could be leveraged to help support the development of trauma care capability in the state's 33 critical access hospitals.

Recommendations

- **Identify and seek a stable and sustainable funding source to support California trauma system planning, oversight, and evaluation at the state level.**

- **Produce a report of the costs, the value of the trauma system and trauma care, and the importance of maintaining trauma center readiness to treat persons with severe injuries in California.**

    - **Use information within the Cost and Value Trauma Report to inform elected officials and the public about the importance of the trauma system and the challenges in sustaining the existing trauma center resources.**

- Revise the Maddy Fund allocation formula to focus on readiness costs of emergency departments and trauma centers rather than uncompensated care.

    - Seek an extension of the Richie Fund portion of the Maddy Fund prior to its expiration on January 1, 2017.

- Seek other sources of funding to support development of trauma care capabilities in rural California acute care facilities, such as the Rural Flexibility grant program.

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

Prevention

It was reported that the CDPH has not prepared a comprehensive injury prevention plan with priorities for intervention since about 2006 when CDC funding was available. A final report of accomplishments associated with the last plan was published in 2010, and this report offered additional strategic directions for the following five priorities: older adult falls; older adult poisoning due to medication errors; motor vehicle driver and occupant injuries for ages 14 to 20 years; pedestrian safety, walkability, and universal liability; and child maltreatment. No statewide injury prevention coalition was reported to be currently active by the CDPH SAC injury program.

The *California Strategic Highway Safety Plan 2015-2019*, coordinated by the California State Transportation Agency, addresses many important injuries on state highways and public roads. The EMS Authority is an active participant in the plan and its focus areas are associated with trauma system priorities, including:

- Increase involvement by EMS leaders in the plan.
- Develop strategies to improve the time to definitive care
- Improve data regarding the time of the crash.
- Improve access to information to enable interoperability of communications systems between all responders to crash sites
- Develop guidance documents to share with EMS providers to increase crash scene safety.

Injury prevention activities are a significant focus at the Level I and Level II trauma centers, and the injury prevention coordinators in these centers often coordinate or participate in injury prevention activities within their LEMSA. Local injury prevention coalitions do exist for many focus areas such as: Safe Kids, Injury Free Coalition, Mothers Against Driving Drunk, and Students Against Destructive Decisions. The TMAC recently expanded its membership to include injury prevention coordinators. This membership category will potentially facilitate mentoring opportunities for new injury prevention coordinators. The statewide communication made possible by the TMAC has the potential to promote wider use of evidence-based injury prevention and evaluation strategies.

Selection of prevention priorities by the trauma centers is often informed by review of injury mechanisms for patients in the trauma center's registry. A wide range of injury prevention strategies have been implemented by the LEMSAs and trauma centers, including specific attention to older adult falls, child pedestrian safety, car safety seats, minority youth violence, water safety, equestrian safety, and preventing alcohol-related crash injuries in teen drivers. A few counties have used evidence-based strategies and then evaluated outcomes associated with their injury prevention efforts.

Injury prevention is not a significant focus of all LEMSAs, particularly those in more rural counties. However, it is likely that fire and EMS agencies, acute care facilities, trauma program managers, and injury prevention coalitions actively participate in sponsoring injury prevention efforts. Both the CDPH SAC Branch and the EMS Authority websites have links to injury prevention resources for interested advocates.

Outreach

Trauma centers have assumed a large role in education outreach to acute care facilities that do not have trauma center designation. The TMAC assumed the role of mentoring new TPMs, to help them establish policies and procedures, learn about the PIPS process, and assist with trauma registry issues.

Funding was obtained from the Office of Rural Health to offer the RTTDC to rural facilities since 2012. To date 7 courses have been offered, and 2 more courses are scheduled in 2016. The majority of these courses have been offered in critical access hospitals. Some pediatric trauma centers collaborate with air medical providers to take pediatric trauma education out to the rural facilities. Other trauma centers sponsor continuing medical education conferences within their region.

Efforts have been made to provide the annual trauma summit in a location that is more accessible to the rural health providers.

No funding is available to support outreach to the non-designated rural acute care facilities, including the state's 33 critical access hospitals. These facilities are important for an inclusive trauma system, as they are often the initial hospital destination for injured patients. These facilities need guidance and technical assistance to ensure that they are integrated into the trauma system. Technical assistance should focus on initial resuscitation and stabilization, re-triage criteria for transfer, appropriate facility to receive the injured patient, inter-facility transport options, who to call for inter-facility transfer, submission of data elements to the trauma registry, and inclusion in the performance improvement (PI) process. A dedicated outreach coordinator to support this process would be beneficial, especially if travel funds to visit the facilities exist.

Recommendations

- Create an injury prevention plan in collaboration with the California Department of Public Health that identifies priorities for intervention.

- Share the injury prevention plan and its priorities with Local EMS Agencies (LEMSAs) and trauma centers.

    - Encourage LEMSAs and trauma centers to develop strategies to address state priority injury prevention issues.

- Collaborate with the California Hospital Association to identify a strategy and potential funding mechanisms for technical assistance and outreach to non-designated acute care facilities in rural communities to assist them to become a trauma-participating hospital.

    - Develop a special recognition program for non-designated acute care facilities that submit trauma data as trauma participating hospitals.

- Seek funding for continued provision of the Rural Trauma Team Development Course to rural acute care facilities to assist them become a trauma participating facility.

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, inter-facility 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, air ground coordination, early notification of the trauma care facility, pre-arrival 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, inter-facility 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 EMS Authority completed a system inventory of the EMS providers (emergency medical technician [EMT]–basic, Advanced EMT, Paramedic), EMS transport services (ground ambulances, air medical services, specialty transport service) and Public Safety Answering Points (PSAPs) in California.

The EMS regulations clearly articulate the Scope of Practice, Local Optional Scope of Practice, and Trial Scope of Practice for EMS providers. This establishes a level of standardized practice throughout out the state while allowing for latitude by the local medical directors, as well as allowing the flexibility to conduct research trials. These practice scopes should be revised on a periodic basis to ensure that they remain current with modern practice. Regulations also set forth the requirements for initial certification/licensure, continuing education, and recurrent certification/licensure of prehospital providers. California utilizes the National Registry of Emergency Medical Technicians (NREMT) for written and skills examinations at all levels (EMT-Basic, Advanced-EMT, and Paramedic) for initial certification/licensure. Once initial certification is attained hourly requirements are specified for continuing medical education (CME), which are robust and match national benchmarks. However, no specific trauma or pediatric trauma requirements for CME or recertification are specified. Re-certification/re-licensure (performed every two years) is accomplished at the local level as determined by the LEMSA medical director who oversees their practice. Further assurance of competence for paramedics occurs at the local level (overseen by the EMS medical director) wherein providers must be “accredited” to practice in that jurisdiction.

Training programs for EMS providers must adhere to the curriculum as established by the U. S. Department of Transportation (US DOT) National Standard Curriculum for EMT-Basic, Advanced EMT, and Paramedic. Paramedic training programs must be accredited by the Commission on Accreditation of Allied Health Education Professions (CAAHEP). This provides assurance of a comprehensive and robust educational program for EMS professionals.

Transporting agencies (ground ambulances, air medical services, and critical care transport services) must be registered with the state. They are encouraged to utilize national accrediting

organizations, such as the Commission on Accreditation of Ambulance Services (CAAS) or the Commission on Accreditation of Medical Transport Systems (CAMTS), as a means to optimize operations and clinical care.

Emergency transport vehicle inspection and licensure are not uniformly performed by personnel with medical expertise. This has implications for adherence to the requirements regarding medical equipment, as well as the tracking of emergency medical resources available for trauma systems planning and improvement.

Public Safety Communications provides the state with emergency communications via the universal 911 access number. This access portal is provided to 452 individual PSAPs across the state. The PSAPs answer calls to 911 and dispatch medical resources (ambulances), in addition to providing pre-arrival instructions to callers. Some urban, high volume PSAPs use robust, national dispatch protocols and pre-arrival instructions, such as Emergency Medical Dispatch (EMD), and a quality performance program (e.g., ProQA) to monitor, assess, and optimize dispatch operations. Smaller PSAPs and those in rural areas do not utilize these tools and are a source of variance in this aspect of emergency care. LEMSA's are not uniformly monitoring or assessing this point of entry into the emergency care system. Plans to upgrade the current 911 system to Next Generation 911 were reported by TSC participants. Next Generation 911 will route emergency calls to the closest PSAP and more accurately triangulate caller location. The new system will improve the efficiency of operations and speed of emergency response; however the timeframe for upgrade was not reported.

Medical oversight of EMS occurs at two levels. Oversight at the county or LEMSA level occurs by offline medical control. This encompasses physician oversight of triage, treatment protocols, performance improvement (PI), and credentialing. This aspect of medical oversight needs to clearly delineate trauma system improvement initiatives to the LEMSA, which may in turn submit data reports to the EMS Authority for overall trauma system assessment. The second level of medical oversight occurs at base hospitals by way of radio or cell phone communications between the EMS provider and a physician or nurse in the Emergency Department. The LEMSAs encourage EMS providers to utilize the CDC *Guidelines for Field Triage of Injured Patients*. This assists EMS providers to determine the appropriate destination hospital for trauma patients. LEMSAs have the latitude to modify the field triage guidelines based upon local resource availability, topography, and weather conditions. The levels of over- and under-triage for trauma patients are not readily available to the EMS Authority or the RTCCs. Even at the local level, these data are not uniformly available to each LEMSA or trauma center. These data are collected and analyzed to a greater degree in the urban areas than in rural areas.

EMS providers transporting patients to hospitals (either trauma centers or non-trauma centers) are required to leave a patient care record at the facility. No uniform, electronic platform exists for these reports, and some agencies, especially those in rural environments, utilize hand written records. This lack of uniformity leads to data loss and hampers system improvement and planning, especially as it relates to over- and under-triage. Some trauma centers and non-trauma centers reported difficulty in obtaining prehospital data. This has negative effects for the required trauma center data reporting to the National Trauma Data Bank (NTDB), and it also impedes patient tracking along the continuum of trauma care.

The noncontiguous distribution of counties in the rural LEMSAs (North Coast EMS, North California EMS,) may not be ideal for trauma system oversight, monitoring, and PI.

Recommendations

- Establish benchmarks for over- and under-triage of trauma patients.
- Assess the over- and under-triage rate for each Local EMS Agency (LEMSA), and identify and close gaps with established benchmarks.
- Collaborate with the California Highway Patrol to incorporate medical equipment standards for transport vehicle licensure.
- Assure all EMS patient data are included in hospital medical records (trauma centers and non-trauma centers), as well as trauma registries.
- Ensure that all LEMSA medical directors report their clinical performance improvement initiatives to the EMS Authority.

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 inter-facility 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 de-designation.

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 non-designated 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

California is a large and heterogeneous state in terms of geography, population distribution, and resource availability. The state has approximately 435 acute care facilities, including 33 critical access hospitals. California currently recognizes six levels of trauma centers, adult Levels I, II, III, and IV, and pediatric Levels I and II. The EMS Authority reports a total of 76 designated trauma facilities:

- 13 Level I adult centers,
- 37 Level II adult centers,
- 13 Level III adult centers,
- 9 Level IV adult centers,
- 6 Level I pediatric centers, and
- 10 Level II pediatric centers.

Twelve facilities have dual pediatric and adult designations. The Level I and Level II trauma center locations coincide with the major population distribution. None are located in the northern third of the state or and along the eastern state border. As a result, according to 2010 data, the trauma system provides Level I or Level II trauma center coverage to about 98% of the

population and 55% of the land area, compared to a national average of Level I and II trauma centers covering 90% of population and 35% of land area.

The EMS Authority does not designate trauma centers; instead, the 33 LEMSAs have this authority and responsibility. Each LEMSA submits a policy to the EMS Authority that outlines the designation and de-designation process in their trauma plan, which is reviewed by the EMS Authority to ensure that the process adheres to statutory and regulatory language. Acute care facilities submit an application to the LEMSA, and if requirements are complete, an internal or external site visit is performed to verify the application.

Some variability exists among the LEMSAs relative to the designation process. Some LEMSAs require trauma center verification by the ACS for Level I and II trauma centers as part of the designation process. Most LEMSAs require an ACS visit even if ACS verification is not obtained. In some cases the LEMSA performs a simultaneous visit with the ACS team as part of the designation process. The designation process site visit for Level III and IV trauma facilities may be more commonly performed by local or in-state reviewers. In remote and rural areas interested acute care facilities should be offered technical assistance to encourage their participation in the trauma system. However, in more urban areas that are within reasonable time and distance access to Level I and II trauma centers, Level III trauma centers should also be held to ACS verification standard.

California has not yet experienced wide spread proliferation of trauma centers where they are potentially not needed. The criterion, established in statute, used to determine need for a Level I or II trauma center is one per 350,000 population. It was reported by TSC participants that this criterion alone is not always adequate. Expanded criteria should be developed and applied to help with future determinations of need for additional Level I and II trauma centers. Potential metrics could include time and distance from existing trauma centers, the need for increased surge capacity, anticipated volume, and the protection of Level I trauma centers to be able to meet their training and research obligations.

While data submission is required from both, designated trauma centers and all acute care facilities, it was reported that the receipt of data from some Level III and Level IV trauma centers and the non-designated acute care facilities is not consistently provided. Trauma system performance measures vary by LEMSA. In more populous counties the PI process is robust, but it is less robust in more rural environments. Simple measures such as over- and under-triage, adherence to destination guidelines, delays in transfer, and multi-institution transfers should be measured consistently across LEMSAs.

Recommendations

- **Establish Emergency Medical Services (EMS) Authority guidelines to ensure uniformity of the trauma center designation process across Local EMS Agencies (LEMSAs).**
    - **Use the American College of Surgeons' (ACS) verification process for all Level I and Level II trauma centers**
    - **Use the ACS verification process for Level III trauma centers operating in proximity to higher-level trauma centers within a LEMSA.**

- **Modify the designation process for Level III and Level IV trauma centers operating in a LEMSA without a higher level trauma center, or in areas of a LEMSA not served by other trauma centers, to focus on resource enhancement and to encourage participation in the trauma system.**

- **Exercise the authority of the LEMSAs to designate trauma centers based upon the needs of the population served.**

  - **Provide EMS Authority guidelines for needs-assessment methodology.**

  - **Provide EMS Authority guidelines for metrics of trauma center need that are additional to the 350,000 population rule.**

- **Exercise the authority of the LEMSAs to collect data from all acute care facilities in their region.**

- Regularly analyze the interaction between definitive care facilities, within and across the LEMSAs, including the following metrics:

  - Primary (field to initial hospital) transport and secondary (inter-facility transfer) over-triage and under-triage

  - Delays in transfer

  - Multi-step transfers

  - Mortalities occurring outside of Level I and Level II trauma centers.

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 non-designated 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 inter-facility transfers, the time to transfer, as well as the rates of primary and secondary over-triage 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 inter-facility 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, inter-facility 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 inter-facility 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

The universal 911 number for citizens to access the EMS system is present, but migration to a more robust emergency communications system (Next Generation 911) is on hold due to legacy issues and funding. Even then, the widespread adoption of this technology into the rural areas will be slow. Until this transition is completed, gaps and shortfalls in locating cell phone callers and routing calls to the closest PSAP may impede access to the emergency care system.

For emergency dispatch, the use of EMD, pre-arrival instructions, and dispatch PI tends to be employed only in urban areas with high trauma volumes. Rural areas and regions with low trauma volumes not using these operational approaches and tools experience less efficient patient flow, and they are unable to execute PI activities. Dispatch is the point at which basic and advanced life support or air medical services are operationalized, thus this is an important determinant in the use of transport assets for the trauma patient.

Most LEMSA's encourage EMS providers to utilize the CDC field triage guidelines for injured patients. This assists EMS providers in determining the appropriate destination hospital for trauma patients. Individual LEMSA's have the latitude to modify these guidelines based upon local resource availability, topography, and weather conditions.

When triage guidelines are tightly followed, as in urban LEMSAs with larger populations, the trauma system is able to report their rates of over- and under-triage. Rural LEMSA's with smaller volumes may have difficulty in determining these rates, thus limiting the appropriate tracking of patients within the trauma system.

Trauma centers and other acute care facilities are required to have transfer agreements with specialty facilities able to provide care for spinal cord injury (SCI), reimplantation, burns, pediatric trauma patients, and repatriation. Of note, no similar transfer agreement requirement exists for the patient with traumatic brain injury (TBI). Re-triage guidelines exist to identify critically ill patients who may benefit from expedited transfer from a non-designated hospital to a trauma center. It is not clear if transfers between facilities or expediting transfers of critical patients are tracked, thus making it difficult to determine the re-triage rate (movement of trauma patients between hospitals).

No statewide or central communication system exists to assist in the transfer of trauma patients between facilities. This may best be facilitated at the level of the LEMSA who could develop a streamlined communications network and assure timely acceptance of patient transfers. Such a process would limit the need for health professionals to make multiple calls to effect a patient transfer.

Recommendations

- Utilize Local EMS Agency (LEMSA) data to develop benchmarks for the state and regional over- and under-triage rates, analyze data, and develop process improvement strategies to address gaps.

- Collaborate with the epidemiologist to use administrative data (hospital discharge dataset) to obtain death rates and the frequency of emergency department treatment and hospital admission for any patients with trauma diagnoses in non-designated facilities.

- Develop a process to track the movement of patients through the continuum of trauma care.

- Consider using a patient tracking system that could be implemented on a regular basis as well as in the event of a disaster.

- Utilize LEMSA level data to develop benchmarks for system and regional level secondary transfer rates, analyze data, and develop process improvement strategies to address gaps.

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 inter-facility 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 EMS Authority completed a system status inventory of rehabilitation resources within California. An estimated 2,470 inpatient rehabilitation beds are provided by 80 facilities, licensed as general acute care, physical rehabilitation, or pediatric beds. These facilities are distributed across the state with 15 facilities in the northern region, 11 in the central region, and 54 facilities in the southern region. Pediatric facilities have a total of 92 licensed rehabilitation beds. Rehabilitation resources in the adjoining states of Oregon, Nevada, and Arizona, especially those in nearby urban centers were not reported. Inpatient rehabilitation beds provide specialized care for SCI and TBI. Rehabilitation capacity for ventilator-dependent patients is available, but data limitations preclude an accurate assessment of resource gaps.

The California Code requires all designated Level I, II, III, and Pediatric Level I and II trauma centers to provide rehabilitation services. These services may be provided at the individual trauma centers or through written transfer agreements. State regulations require physical therapy, occupational therapy, and speech-language therapies; however, no guidance exists regarding the early integration of these modalities into the acute treatment plans for trauma patients. The LEMSA's are responsible for monitoring trauma center compliance with state regulations. The degree to which this is overseen at the local level is unknown.

The trauma registry, which is compliant with the NDTB, contains data fields for rehabilitation. However, the level of compliance with reporting these elements is not known. The use of variable rehabilitation measures for patient functional outcomes contributes to difficulties in reporting and standardizing assessments to compare outcomes across regions or the overall trauma system. Stakeholders (trauma centers) reported difficulty in obtaining rehabilitation data, even from rehabilitation units within their own facilities. Disparate reporting lines for rehabilitation data as it relates to functional outcomes and disposition (reported to the California Hospital Association) and cost data (reported to the Centers for Medicare and Medicaid Services) make it difficult to gain a full understanding of this component of trauma care from a system wide perspective.

Access to rehabilitation services is highly variable and dependent upon the needs of the patient, their insurance status, and the availability of rehabilitation resources within the region. Most large, urban trauma centers integrate rehabilitation early in the treatment care plan (typically beginning on the first day of hospitalization) while small, non-urban centers find this more problematic. All trauma centers reported difficulty with obtaining access to the rehabilitation services for the uninsured, underinsured, and undocumented population.

The average wait for a rehabilitation bed for patients with TBI, SCI, or multiple trauma are 17 days, 25 days, and 18 days respectively. Some patients with protracted waits are transferred to skilled nursing facilities or long-term care facilities to free up acute care beds and to simultaneously obtain some level of rehabilitation services.

Rehabilitation is not well integrated into the state trauma system planning, and rehabilitation specialists currently do not participate at any level (state, region, local) within the trauma system. These specialists are not represented in the stakeholder groups participating in the day-to-day operations of the trauma system (LEMSA, EMSA, etc.), nor does rehabilitation have representation in the work groups and committees who advise the State EMS Authority (RTCC, STAC, TMAC, etc.). A local rehabilitation champion (Director of Physical Medicine and Rehabilitation, Cedars-Sinai Medical Center) with experience in professional rehabilitation

organizations at both the state and national levels may serve as a resource in fully integrating this important component of trauma care.

Recommendations

- Perform a comprehensive inventory of trauma rehabilitation resources within California and neighboring states on a regular basis.
- Perform a gap analysis to identify shortfalls in trauma rehabilitative services.
- Identify special populations that may be disproportionally impacted by unavailable rehabilitation services.
- Utilize trauma rehabilitation data, such as functional outcomes and costs, to inform injury prevention programs across the state.
- Integrate rehabilitation specialists at all levels of the trauma system.
    - Assure active participation at the state, regional, and local level trauma system planning and evaluation.
    - Encourage trauma centers to partner with rehabilitation services internal and external to their centers.

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 non-designated 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

The EMS Authority has clear statutory authority to plan and implement guidelines for EMS disaster response. The agency is required to coordinate through LEMSAs and hospitals, and to assist in the development of the EMS component of the State Emergency Plan. The Health and Medical Emergency Operations Manual includes an assessment of immediate medical needs and coordination of resources, personnel, in-patient and emergency care, patient distribution, and integration with fire and EMS.

The EMS Authority along with the CDPH utilizes the 6 mutual aid regions, established by Cal OES, which are closely aligned with the 5 trauma regions. For purposes of administering the funds from the Hospital Preparedness Program (HPP) in California each of the 58 counties represent a healthcare coalition. This may make coordination between healthcare coalitions, mutual aid regions and trauma regions very challenging. Most states have developed regional (multi-county) healthcare coalitions. It was also unclear to the TSC team if the HPP funds provided to the healthcare coalitions were being well distributed to the hospitals and EMS agencies.

The state and regions follow the Standardized Emergency Management System (SEMS) and the NIMS. The hospitals utilize the Hospital Incident Command System (HICS) for command and control of a disaster response. Disasters are recognized at the lowest level beginning with the field, local government, operational area, region, and then the state. Each operational area has a MHOAC and each region has an RDMHC. It was stated that the RDMHC program works with the operational areas within the region to ensure that EMS public health and injury prevention, special populations, and emergency management are integrated into the disaster planning process.

No formal assessment of the hospitals, trauma centers, EMS provider resources and capabilities occur at the state level because the infrastructure for the state is decentralized. Though the capabilities of trauma centers have been determined through the trauma center designation process with the LEMSAs, this information is not shared with the EMSA. The LEMSAs submit their trauma plan to the EMS Authority, but inclusion of a disaster preparedness component for the local trauma system, is not required. The local disaster plans required by the Public Health Preparedness Program and the Hospital Preparedness Program are submitted to the CDPH.

Hospitals, public health, and LEMSAs participate in an annual Statewide Medical and Health exercise that is sponsored by the CDPH and the EMS Authority. These exercises have numerous partners involved including the CHA, long-term care facilities, emergency management, public safety and healthcare facilities. After action reports are generated from these exercises and generally shared at the local level.

The CDPH developed the California Department of Public Health Standards and Guidelines for Healthcare Surge During Emergencies. An all hazards approach has been taken for planning purposes, and the plan can address requests for personnel, equipment and supplies. Though the trauma system is not specifically addressed in the plan, the emergency healthcare providers (hospital and EMS) are included. Likewise, hospitals and EMS providers are integrated into the overall Public Health and Medical Emergency Operations Manual, but again, the trauma centers are not specifically addressed. It was reported that bed capacity has been tested, but managing patients needing immediate surgical intervention is a very limited capability.

The state has developed several medical assets that have either been strategically located or can be readily deployed when needed. Examples of the medical assets include 42 Disaster Medical Support Units which serve as command vehicles for Ambulance Strike Teams; California Medical Assistance Teams, consisting of approximately 200 members and three support caches; and Mission Support Teams. In addition, EMSA manages the Disaster Healthcare Volunteer Program, consisting of over 21,000 volunteers, which includes 44 Medical Reserve Corps teams. EMSA's Mobile Field Hospital (MFH) Program is unfunded and the MFHs can no longer be deployed as general acute care facilities. However, the MFH structures (tents only) remain viable and may be deployed to support shelter operations and other low acuity patient care needs.

Various resource management systems are utilized in the state. Some LEMSAs use EM Systems/ Resources for real-time communications and resource management. Others LESMAs utilize the ReddiNet, which provides them with the capability to manage ambulance and patient destinations. Users can view current emergency department status within the region and use the system for routine patient care decisions regarding diversion and transfers. This system can be used in the event of a mass casualty incident to query bed availability, as well as, the availability of additional resources such as ventilators, medications, and supplies. The communications system is linked with emergency management and public health officials as well.

With regard to patient triage and tracking during a disaster, the START triage system is the most predominant. As with many states, various patient tracking methods are used, but issues continue to plague this vital function. The Los Angeles LEMSA reported that they have a policy in place to send the most severely injured patients to the highest level trauma centers, leaving the moderate and minor patients being transported to other hospitals. Proliferation and

standardized use of this type of policy for determining patient destination in a time of disaster was not clear.

A joint Advisory Committee provides advice regarding disaster planning and response to both the EMS Authority and the CDPH. However, little integration of disaster planning and response appears to occur with the STAC. It was not clear to the TSC team that the STAC receives formal reporting of disaster planning activities, information about the status of available medical assets, or lessons learned from exercises and responses to real disasters.

Recommendations

- Require incorporation of local EMS agency (LEMSA) disaster plans with the LEMSA trauma plans for submission to the EMS Authority, along with annual disaster updates.

- Encourage LEMSA disaster medical response plans to include guidelines that direct less severely injured patients to non-designated acute care facilities when possible, allowing trauma centers to receive the most severely injured patients.

- Provide updated information to the State Trauma Advisory Committee and the Regional Trauma Coordinating Committees annually on the state disaster activities and the status of medical assets available to the trauma system.

- Utilize disaster management systems to assess hospital capacity and capability for specialized care.

- Integrate aspects of the *California State Trauma Plan, 2015* into the state medical response plan.

- Recognize appropriate aspects of the trauma system within all state medical response plans.

- Utilize Hospital Preparedness Program funding to assist the trauma system with disaster planning and exercises.

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

The California EMS Authority is mandated, by statute, to draft regulations that include the requirements for the care of trauma patients to ensure the integration of the trauma care system with the existing EMS system. These regulations address patient care guidelines, flow patterns, trauma center resources, a data collection system to assess operations and outcomes, and the periodic performance evaluation of the trauma system and its components. Performance improvement activities are required by Trauma Centers, LEMSAs, EMS providers and the EMS Authority.

Authority for quality assurance activities is well established for the LEMSAs. They are required to develop quality assurance plans for review and approval by the EMS Authority. The plan must include clinical care and patient outcomes. In addition, designated trauma centers are required to perform PI and demonstrate their capability through the verification process. The trauma centers also participate in local and regional PI review processes.

The EMS Authority and the STAC utilized the HRSA *Model Trauma System Planning and Evaluation* document to evaluate the status of the various system components. This public health approach to trauma system assessment laid the foundation for trauma system evaluation. The BIS process identified priorities and opportunities for improvement within the trauma system evaluation. These priorities were integrated into the *California State Trauma Plan, 2015* and the proposed *State Performance Improvement and Patient Safety Plan*.

The trauma stakeholders and staff are to be commended for their efforts in developing a draft PIPS plan and identifying performance measures, even though they are vaguely defined. The plan suggests that the EMS Authority and the STAC would provide leadership in implementing the PI process at the state level. This effort would include the establishment of a PIPS Subcommittee that would report to the STAC. Membership of the subcommittee has been outlined in the PIPS plan, and it appears to be multi-disciplinary in nature. The plan also proposes specific structure, process and outcome measures; a vision, mission and purpose; structure and operating procedures; documentation; authority; and confidentiality.

The draft PIPS plan lists the current trauma system evaluation goals and objectives that are prioritized in the state's trauma system plan. The PIPS plan also includes the two trauma core measures listed in the State Core Measures Project. These two measures are identified as scene time for severely injured trauma patients and direct transport to designated trauma centers for severely injured trauma patients meeting criteria.

Because trauma system development is decentralized in California, 33 LEMSAs have clear statutory authority for trauma system development, including system evaluation. LEMSA's must develop a trauma system plan and submit the plan to the EMS Authority for review and approval. The LEMSA plan must address quality improvement and system evaluation, including the responsibilities of the multi-disciplinary trauma peer review committee.

Evidence was provided that PI processes are being conducted. The larger LEMSAs have more resources, and the PI reviews are more robust. For example, the Los Angeles LEMSA conducts PI with 14 trauma centers and EMS providers. This LEMSA collected prospective data and looks at variability. PI efforts focused on TBI, splenic injury, and gunshot wounds. This LEMSA is evolving into a consortium and seeking the opportunity to create an ACS Trauma Quality Improvement Program (TQIP) Collaborative to obtain risk-adjusted data. Another example was Ventura County where the LEMSA developed a trauma audit committee, which has expanded to include other counties. The Ventura County LEMSA targeted reviews on pelvic fractures and the rate of drug testing with trauma patients.

In conducting a review of the 33 LEMSA trauma plans and status reports, significant variability was noted in the trauma system evaluation process, including committee review structures, terminology used in the process, as well as, the measures, indicators or filters used for patient care review. Though decentralization provides local flexibility, it can create greater variability in practice. Without some standardization in processes and common terminology, it is difficult to make comparisons and assess care across LEMSAs and regions. However, several LEMSA status reports demonstrated an integration of the EMS Authority and identified core quality measures into their plans and activities. Many of the trauma plans indicated that local PI review was conducted on trauma deaths and activations to help identify issues. This led to the development of best practices where policies regarding immediate transfers were established.

Of particular note is the involvement of several trauma centers and the EMS Authority in a Highway Safety project/study to improve the timeliness of care for victims of traffic-related incidents. This project appears to be promising in identifying ways to improve timeliness of transfers for injured patients.

Though trauma centers and EMS provider agencies are involved with PI activities, involvement by non-designated acute care facilities, dispatch centers, and rehabilitation centers is sporadic.

To further assess trauma care across jurisdictional lines, the EMS Authority has established five RTCCs. However, the RTCCs do not have statutory or regulatory authority for this role. They serve to conduct system case reviews that may cross LEMSA jurisdictional boundaries and provide some outreach education. Since the RTCCs have no authority to implement resolutions to patient care issues identified within a region or LEMSA, they submit cases that may have statewide implications to the EMS Authority for review. In turn, the Director of EMS Authority may refer the case to the STAC.

Stakeholder participants at the TSC expressed concerns regarding the PI process and confidentiality associated with sharing information, both with the Health Insurance Portability and Privacy Act requirements and protection for the PI process explicitly provided in statute. This is of greatest concern for the RTCC PI processes since the five regions are not formally recognized in statute or regulation. For now, the providers in the RTCCs are reviewing cases with de-identified data, and the PI process is conducted in a manner to promote discussion and learning.

An essential aspect of system evaluation involves data. To successfully evaluate the state trauma system, the data need to be inclusive of all participants within the system including trauma centers, non-designated acute care facilities, EMS, rehabilitation, and dispatch centers. Trauma data collection and submission from non-designated acute care facilities were reported to be issues, and linking the data from various sources has not been accomplished. LEMSAs in larger, urban settings, reported utilizing their data to assess under- and over-triage. However, little has been done at the state level to determine if the right patient arrives at the right facility in the right amount of time. The state needs additional resources for data analysis and data system management to further the coordination of state and regional level PI.

The EMS Authority is exploring the possibility of creating of a California Statewide TQIP Collaborative to provide risk-adjusted benchmarking outcomes for trauma center, prehospital, and transfer processes. This resource would greatly enhance the EMS Authority's ability to provide comparative reports to trauma system participants. Fiscal and human resources are needed to support this effort.

The EMS Authority has the capability to run data reports regarding under- and over-triage and transfers on 2014 data for the 68 trauma centers. However, data from all acute care facilities are not collected at the state level. EMS patient care reports are not linked with trauma registry data and other system data sources. Therefore, a statewide system evaluation inclusive of trauma triage, transport, treatment, and transfer practices by all providers for all trauma patients, and for all types of injuries remains incomplete. See Appendix D for other potential trauma system measures and a strategy for monitoring system performance.

Recommendations

- **Expedite the adoption of the state *Performance Improvement and Patient Safety* (PIPS) *Plan* in collaboration with appropriate state advisory committees, local EMS agencies (LEMSAs), the Regional Trauma Coordinating Committees (RTCCs), and other trauma system stakeholders.**
    - **Solidify the state core trauma performance improvement measures within the state PIPS plan to include structure, process, outcome and patient safety metrics.**
    - **Consider incorporating the best practices, processes and metrics identified from LEMSAs with well-established PIPS plans.**
- Establish a multi-disciplinary state PIPS Subcommittee taking into consideration the urban, suburban and rural clusters of trauma centers, regions, hospital network affiliations, and Committee on Trauma representation.
- Encourage the LEMSAs to incorporate the state PIPS trauma performance measures as a minimum into their trauma plans.
- Identify additional staffing resources to assume responsibility for the overall implementation of the state PIPS program to ensure integration with regional and LEMSA trauma system plans and other relevant state plans.

- Seek funding opportunities to establish an inclusive data collection system representing all participants including dispatch, EMS providers, non-designated acute care facilities, trauma centers, rehabilitation centers, and medical examiners.

- Ensure data submission compliance by all trauma system participants.

- Utilize existing educational forums to provide information on the state PIPS plan, with an emphasis on the PIPS structure, process and metrics.

- Seek funding to support a California State Collaborative to provide risk-adjusted benchmarking outcomes.

- Continue to encourage the adoption of standardized trauma triage and transfer guidelines statewide.

- **Monitor the performance measures, especially timeliness of secondary transfers and under- and over-triage, and address trends in deviation of care through the PIPS plan process.**

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

The development of the current information system began in 2008 as a demonstration project funded through the Office of Traffic Safety. Prehospital data are captured at the state level in the CEMSIS. The data are stored by the Inland Counties EMS agency contractually utilizing ImageTrend ™ software. The CEMSIS-EMS database currently contains more than 1.3 million

records, which are compliant with current data standards of the National EMS Information System (NEMSIS).

The trauma registry data are collected and managed under the same contractual process, and data also stored at Inland Counties EMS agency. The product is known as CEMSIS-Trauma. Data are currently being collected from 73 of 76 trauma centers. The data are compliant with the current National Trauma Data Standard (NTDS), although it was reported that variation in interpretation of the data fields may exist between trauma centers. The number of data fields may be expanded at the LEMSA or individual trauma center level, but these additional fields are not submitted to the CEMSIS-Trauma. Due to a software vendor change in 2012, legacy data from 2008-2012 are not currently included in the registry. CEMSIS-Trauma currently contains more than 65,000 records dating from 2013 to the present. This number represents only a fraction of injured patients in California. The aggregate data are submitted 3 to 6 months post event, although it was noted that in some cases data are submitted on a more contemporary basis.

No data linkage between CEMSIS-EMS and CEMSIS-Trauma has occurred at the state level. Some data linkage was reported by various LEMSAs. Of note is a project in the Los Angeles LEMSA in which a unique alphanumeric identifier is attached to the prehospital record that is transposed to the hospital record, allowing absolute record matching. Little formal linkage has occurred between CEMSIS-Trauma and other external databases such as motor vehicle crash, law enforcement, uniform billing (UB04) hospital discharge data, rehabilitation, vital records, or dispatch.

Optimism about future linkage between CEMSIS-EMS and CEMSIS-Trauma is centered on the fact that both databases use the ImageTrend software and are warehoused at the Inland Counties EMS agency. Such linkage may have to be completed via contract with the vendor since the EMS Authority currently does not have sufficient data and statistical resources readily available to complete the process internally.

Recommendations

- Continue to clean and validate the California EMS Information System (CEMSIS)-Trauma data.

- Mentor and train trauma registrars to reduce the variability in interpretation of data fields.

- Run routine reports from CEMSIS-EMS and CEMSIS-Trauma on a regularly scheduled basis, correct and refine the reports.

- Query the databases to help answer specific performance improvement questions of interest, such as rates of over- and under-triage, and re-triage.

- Consider expansion of the unique record identifier project in Los Angeles County and/or explore Arkansas' trauma band project to aid in record linkage and patient tracking.

    - Seek preparedness funding to support the project.

- Continue CEMSIS-Trauma and CEMSIS-EMS linkage efforts at various local EMS agencies with an eye toward eventual statewide expansion.

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 non-designated 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

California has a long history of publishing trauma systems research dating back to the *Systems of trauma care: A study of two counties* published in 1979 by West JG, Trunkey DD, Lim RC. This was followed by other reports of the California experience such as *Impact of regionalization: The Orange County experience* by West JG, Cales RH, and Gazzaniga, AB in 1983. The interest in trauma systems issues continues today with recent publications concerning identification of low-risk pediatric abdominal injury and over/under triage as examples.

California has research nodes for both the Pediatric EMS for Children Applied Research Network (PECARN) and Resuscitation Outcomes Consortium (ROC). A significant number of well-qualified researchers are available at academic institutions and trauma centers to continue systems research. Improvements in the availability and fidelity of CEMSIS-EMS and CEMSIS-Trauma data will support additional examination of trauma systems issues facing the state.

No agenda exists that outlines priorities for trauma systems level research for the state.

Recommendations

- Encourage continued investigation of issues that may help inform trauma system evaluation and planning in California and the nation.

- Ensure unencumbered access to CEMSIS-EMS and CEMSIS-Trauma data to qualified researchers.

- Develop a research agenda with priority topics identified.

APPENDIX A: ACRONYMS

ACS – American College of Surgeons
ASPR – Assistant Secretary for Preparedness and Response

BIS – benchmarks, indicators, and scoring

CAAHEP – Commission on Accreditation of Allied Health Education Professions
CAAS – Commission on Accreditation of Ambulance Services
CAMTS – Commission on Accreditation of Medical Transport Services
CDC – Centers for Disease Control and Prevention
CDPH – California Department of Public Health
CEMSIS – California Emergency Medical System Information System
CHA – California Hospital Association
CME – continuing medical education

EMD – Emergency Medical Dispatch
EMS – emergency medical services
EMSA – Emergency Medical Services Authority
EMT – emergency medical technician

FTE – full time equivalent

GIS – geographical information system

H&SC – Health and Safety Code
HICS – Hospital Incident Command System
HPP – Hospital Preparedness Program
HRSA – Health Resources and Services Administration

ICD-9 – International Classification of Diseases, 9th edition
ISS – injury severity score
IT – information technology

LEMSA – local emergency medical services agency

MHOAC – Medical Health Operational Area Coordinators
MTSPE – Model Trauma System Planning and Evaluation

NEMSIS – National EMS Information System
NHTSA – National Highway Traffic Safety Administration
NIMS – National Incident Management System
NREMT – National Registry for Emergency Medical Technicians
NTDB – National Trauma Data Bank
NTDS – National Trauma Data Standard

PECARN – Pediatric EMS Care Applied Research Network
PI – performance improvement
PIPS – performance improvement and patient safety
PRQ – pre-review questionnaire
PSAP – public safety answering point

RDMHC – Regional Disaster Medical Health Coordinator
RDMHS – Regional Disaster Medical Health Specialist
RTCC – regional trauma coordinating committee
RTTDC – Rural Trauma Team Development Course

SAC – Safe and Active Communities
SCI – spinal cord injury
SEMS – Standardized Emergency Management System
SHSP – State Highway Safety Plan
STAC – State Trauma Advisory Committee
STEMI – ST elevation myocardial infarction

TBI – traumatic brain injury
TMAC – Trauma Managers Association of California
TPMs – trauma program managers
TQIP – trauma quality improvement program
TSC – trauma system consultation
TSP – trauma system plan

APPENDIX B: METHODOLOGY

The California EMS Authority requested this trauma system consultation, which was conducted under the auspices of the American College of Surgeons (ACS), Trauma System Consultation (TSC) program. The multidisciplinary trauma system consultation team consisted of: two trauma/general surgeons, one emergency physician, a state EMS/trauma director, a trauma program manager, two trauma systems consultants, and the ACS trauma systems program manager and additional supervisory staff. Biographical sketches for team members are included as Appendix C of this report.

The primary objective of the ACS trauma system consultation was to guide and help promote a sustainable effort in the graduated development of an inclusive and integrated system of trauma care for the California. 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 TSC team reviewed the ACS Pre-Review Questionnaire (PRQ) submitted by the EMS Authority, along with a number of additional supporting documents. Information available on government websites was also viewed.

The TSC team convened in San Diego, CA, on March 22 – 25, 2016, to review the California state trauma system. The meetings during the four-day visit consisted of plenary sessions during which the TSC team 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 TSC team also met in sequestered sessions for more detailed reviews and discussion, and for the purpose of developing team consensus on the various issues, preparing a report of their findings, and developing recommendations for future development of the trauma system in California. This report was developed independently of any other trauma system consultations or assessments.

APPENDIX C: REVIEWER BIOGRAPHIES

ROBERT J. WINCHELL, MD, FACS
Role: Surgeon, Team Leader

Dr. Winchell received his undergraduate degree from the California Institute of Technology, his M.D. from Yale University, and did his internship, General Surgery residency, and Trauma and Critical Care Fellowship at the University of California, San Diego, where he remained on the faculty as Associate Professor of Clinical Surgery in the Division of Trauma through 1999. After leaving the University of California, Dr. Winchell established and subsequently directed the Tacoma Trauma Center in Tacoma, Washington, which continues to operate successfully as a joint venture between two previously competing hospitals. In 2001, Dr. Winchell moved to the Maine Medical Center and assumed the role of Head of the Division of Trauma and Burn Surgery in 2004. He remained in that position for 10 years, also serving as an Associate Professor of Surgery at the Tufts University School of Medicine. Under his direction, Maine Medical Center became a verified Level I trauma center for the first time in 2007. After leaving Maine, Dr. Winchell served as Chief of Trauma and Visiting Professor of Surgery at the University of Texas Health Science Center at Houston and Chief of Trauma at Memorial Hermann -Texas Medical Center until assuming his current post. In July 2015, Dr. Winchell joined the faculty in the Department of Surgery at Weill Cornell Medical College as Chief of the Division of Trauma, Burns, Acute and Critical Care and Director of the Trauma Center at New York-Presbyterian Weill Cornell Medical Center.

Dr. Winchell has been deeply interested and involved in the development and evolution of trauma systems for his entire career. He has been involved in trauma center and trauma systems design and operation in a wide variety of settings covering the spectrum of system development. He was instrumentally involved in leadership roles with both the day-to-day operations and ongoing development of the San Diego County trauma system for over ten years and served as chair of the San Diego and Imperial County Committee on Trauma. He participated in the leadership, operation and ongoing development of the Washington state trauma system, serving on the state advisory board, and as chair of the Southwest EMS region. During Dr. Winchell's tenure in Maine, he helped to develop the Maine state system, serving as a member of the state advisory board and as a chairman of the Maine State Committee on Trauma. In Texas, he served on the Trauma Systems subcommittee of the Governor's EMS and Trauma Advisory Council. Dr. Winchell is a leader in international trauma systems development, and the founding representative from the American College of Surgeons to the World Health Organization's Global Alliance for the Care of the Injured.

In parallel to his clinical and research work, Dr. Winchell has had the honor to serve the American College of Surgeons Committee on Trauma for almost 20 years, first as a State Chair for San Diego County and for Maine, and currently as a member and part of the Executive Committee. His leadership and forethought have been instrumental to the Trauma Systems consultation program of the COT since 2006, and he currently serves as Chair of the Trauma Systems Evaluation and Planning Committee. In that role, he has conducted expert consultation in 18 states and regions, serving as team leader for 14 of these, and has also participated in trauma systems work internationally. Dr. Winchell is also a senior reviewer for the trauma center verification program of the College. He has participated in 18 state and regional trauma system consultations.

Dr. Winchell has dedicated almost two decades to the advancement care of the injured as a part of national public health policy, and the implementation of state and regional trauma systems based upon and supported by that policy.

Dr. Winchell is Board certified in General Surgery, with added qualifications in Surgical Critical Care. He is a Fellow of the American College of Surgeons as well as a member of the American Association for the Surgery of Trauma, the Association for Academic Surgery, the Southwest Surgical Congress, the Society of Critical Care Medicine and the New England Surgical Society. Dr. Winchell is author of more than 50 scientific papers and book chapters, and has given over 100 regional, national and international

presentations. He is an ad hoc reviewer for the Journal of Trauma and Acute Care Surgery, the Archives of Surgery and the World Journal of Surgery.

SHELLY D. TIMMONS, MD, PhD, FACS, FAANS
Role: Surgeon

Shelly D. Timmons is a neurological surgeon the Geisinger Health System (GHS) in Pennsylvania (2010 to present). She is Director of Neurotrauma for the Geisinger Health System, which includes a Level I Trauma Center in Danville, PA and two Level II Trauma Centers in Wilkes-Barre, PA and Scranton, PA. She is Associate Director for Neurosciences of the Adult Intensive Care Unit at Geisinger Medical Center in Danville, PA. Dr. Timmons also serves as the Program Director for a new residency training program in neurological surgery at GHS, recently accredited by the Accreditation Council on Graduate Medical Education in 2013. She is a Clinical Associate Professor in the Department of Neurosurgery at Temple University.

Dr. Timmons is board certified by the American Board of Neurological Surgery and has certification in Neurocritical Care from the Society of Neurological Surgeons Committee on Advanced Subspecialty Training. She holds a variety of professional organizational positions, including Director-at-Large for the American Association of Neurological Surgeons (AANS) Board of Directors, AANS Representative to the Board of Governors of the American College of Surgeons, Chair of the Neurosurgery Advisory Council of the American College of Surgeons, Past Chair of the Joint Section on Neurotrauma and Critical Care of the American Association of Neurological Surgeons (AANS) and the Congress of Neurological Surgeons (CNS), Chair of the Washington Committee of the AANS and CNS, and Secretary of the Pennsylvania Neurosurgical Society. Dr. Timmons has chaired several neurotrauma and emergency neurosurgery committees for the AANS, the Washington Committee, the Council of State Neurosurgery Societies and others, and has frequently served as a liaison for trauma-related issues to outside entities on behalf of the AANS, including the Department of Homeland Security and the Institute of Medicine. She served on the American College of Surgeons Committee on Trauma for eight years, two as a special member, and maintains active involvement with the COT via the Verification and Review Committee and the Trauma Systems Consultation Committee, having served as a reviewer for the States of Hawaii and Missouri and Clark County, Nevada. She serves on the Centers for Disease Control National Center for Injury Prevention and Control Board of Scientific Counsellors, and on the Board of Directors of ThinkFirst, a neurological injury prevention organization.

Dr. Timmons has been a clinical researcher for a number of years, and has participated as principal investigator in numerous clinical trials related to traumatic brain injury through local, industry, and NIH funding mechanisms. She has published and lectured on a variety of topics related to traumatic brain injury, neurocritical care, spinal cord injury, blunt vascular injury, and health care delivery throughout her career. Her primary research interests include clinical trials in traumatic brain injury, multi-modality monitoring in neurocritical care (in particular traumatic brain injury), prognostication in traumatic brain injury, diagnosis and treatment of blunt vascular injury, and optimal organization of healthcare delivery for brain-injured patients.

Dr. Timmons obtained undergraduate degrees from the University of Illinois at Urbana-Champaign in Honors Biology (BS 1987) and Rhetoric (BA 1988). She obtained her medical degree from the University of Illinois at Urbana-Champaign in Honors Biology (BS 1987) and Rhetoric (BA 1988). She obtained her medical degree from the University of Illinois College of Medicine at Peoria in 1991.She completed her residency training in neurological surgery at the University of Tennessee Health Science Center-Memphis from 1991 to 1997, during which time she served as Administrative Chief Resident from 1996-97. She later (2002) earned her Ph.D., also at UTHSC, in the Department of Anatomy and Neurobiology where she studied noradrenergic modulation of calcium channels in rat sensorimotor cortical pyramidal neurons via G-proteins in the laboratory of Robert C. Foehring, Ph.D.

Prior to assuming her current position, she practiced for thirteen years as a neurological surgeon with Semmes-Murphey Clinic in Memphis, TN. During that time, she was Assistant (1997-2008) and then

Associate Professor of Neurosurgery (2008-2011), Chief of the Neurotrauma Division of the University of Tennessee Health Science Center Department of Neurosurgery (1997-2010), and Chief of Neurosurgery at the Regional Medical Center at Memphis/Elvis Presley Memorial Trauma Center (1997-2010).

DREXDAL PRATT, CEM, CPM
Role: State EMS Director

Mr. Pratt retired as Director of the Division of Health Service Regulation (DHSR) in the North Carolina Department of Health and Human Services (DHHS) in January 2016. His division managed the all healthcare facility regulatory activities within the DHHS and included the Office of Emergency Medical Services and Trauma and the Assistant Secretary for Preparedness and Response (ASPR) Hospital Preparedness Cooperative Agreement.

Mr. Pratt is a graduate of the Institute of Government at the University of North Carolina at Chapel Hill, the EMS Management Institute at the University of North Carolina at Charlotte, and Forsyth Technical Community College. He is also a Certified Emergency Manager (CEM) and a Certified Public Manager (CPM).

Mr. Pratt joined the North Carolina Office of Emergency Medical Services in 1987 as a Regional Coordinator. He was promoted through the ranks, first to Regional Supervisor, and then to Chief of the agency in 1999. In August 2010 Mr. Pratt was promoted to the Director position of DHSR. Mr. Pratt served two terms as Chair of the Region I EMS Advisory Council. He received the National Association of County Commissioner's Achievement Award for coordinating the development of the Stokes County NC computer-aided dispatch program.

He has served as a Commissioner on the Governor's State Emergency Response Commission and served as Chairman of the Commission's Homeland Security Medical Committee. In addition, Mr. Pratt served as Secretary of the North Carolina Medical Care Commission, and Commissioner on the North Carolina Radiation Protection Commission.

In October 2009 Mr. Pratt received the North Carolina Medical Society's John Huske Anderson Award. This award recognizes individuals for whose contributions have made a positive impact on the medical profession and the public health. In addition, Mr. Pratt was presented the Order of the Long Leaf Pine in October 2010 from Governor Beverly Perdue. This is the highest civilian honor presented by the Governor and is presented to individuals who have a proven record of extraordinary service to the state.

KATHY J RINNERT, MD, MPH, FACEP
Role: ED Physician

Dr. Rinnert 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 an 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 Emergency Medical Services (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 is currently a Professor of the Department of Emergency Medicine at the University of Texas Southwestern Medical Center at Dallas (UTSWMC). Additionally, she is the Director of the EMS Fellowship Program and the EMS Medical Director. She was previously 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 oversaw 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 is a member of the Board of Directors for the Commission on Accreditation of Ambulance Services (CAAS), the national body for accreditation of EMS agencies in the United States and Canada. Dr. Rinnert is an active grant reviewer for the Centers for Disease Control and Prevention-National Institute for Occupational Safety and Health (CDC-NIOSH) and trauma systems consultant to the American College of Surgeons Committee on Trauma (ACS-COT).

JOLENE R. WHITNEY, MPA
Role: Trauma Program Manager

Jolene R. Whitney has worked with the Bureau of Emergency Medical Services and Preparedness, Utah Department of Health for 35 years. She spent the first 6 years of her career as a regional EMS consultant. She became Assistant Training Coordinator in1986. She has been a program manager for EMS systems and trauma system development since 1991. She is currently serving as the Director of Specialty Care and Performance Improvement. She also served as Deputy Director for the Bureau for seven years, which included managing 22 staff and several programs including Trauma System Development, state grants program, fiscal reporting, Chemical Stockpile Emergency Preparedness, EMS Strike teams, ED, Trauma and Prehospital databases, CISM, medical direction coordination, EMS Licensing and Operations, and EMS for Children.

Ms. Whitney has a Master in Public Administration from Brigham Young University and a B.S. in Health Sciences, with an emphasis in Community Health Education from the University of Utah. She was certified as an EMT-Basic in 1979. She also obtained certification as an EMT instructor and became certified as an EMT III (Intermediate) in 1983.

Ms. Whitney is a co-author of eight publications on preventable trauma mortality, domestic violence, challenges of rural trauma in the western states, pediatric vital signs, Crisis Standards of Care Framework and Toolkit and medical surge capacity planning. She served as Chair, Vice Chair and Regional Representative for the State Trauma Managers Council with the National Association of State EMS Officials. She served on the Highway Information and Traffic Safety Committee for NASEMSO and participated in the development of a rural MCI assessment tool. She is a member of the American Trauma Society, Utah Public Health Association, International Association of Emergency Managers and Utah Emergency Managers Association.

In 2010, Ms. Whitney participated on an Institute of Medicine planning committee and served as a panel Chair for a Rural Response to MCI workshop. She also served on the IOM Crisis Standards of Care Committee which developed the CSC Framework and Toolkit. She recently participated on the IOM planning committee and workshops for Regional Disaster Response Coordination to Support Health Outcomes. Ms. Whitney spent 250 hours in the Olympic Command Center and served as the hospital liaison for the 2002 Winter Olympics in Salt Lake City, Utah. She has completed the ICS training for 100, 200, 300, 700 and 800 series. She assisted in the development of the Utah DMAT-1 and has served as a member of the team since its inception in 2010.

She has served on several national committees and teams, including 10 state EMS system assessments for NHTSA, 8 trauma system consultations for the American College of Surgeons, reviewed rural trauma grant applications for HRSA, contributed to the HRSA model trauma system plan, the National Trauma Data Standards, the NASMESO trauma system planning guide, and the NHTSA curriculum for an EMT refresher course.

NELS D. SANDDAL, REMT, PHD

Role: Technical Advisor

Dr. Sanddal is the former Manager of the American College of Surgeons (ACS) Trauma Systems and Verification Programs. Upon his retirement in January 2016 he continues to work closely with the Trauma Systems Program as a consultant to the ACS COT Trauma Systems Evaluation and Planning Committee.

Prior to his position at the ACS, Dr. Sanddal served as President of the Critical Illness and Trauma Foundation (CIT), in Bozeman, Montana for 25 years. He 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 served as the Chairperson of the National Council of State EMS Training Coordinators and as the lead staff member for that organization, and similarly for the National Association of EMT.

Dr. Sanddal completed his undergraduate work at Carroll College, received his Master's degree from Montana State University and his doctorate in Health Science from Walden University. He has been a co-investigator for numerous state or regional rural preventable trauma mortality studies and has conducted additional research in the areas of training for medical personnel, suicide, and rural injury prevention and control. Nels served on the Institute of Medicine's Committee on the Future of Emergency Care in the U.S. Healthcare System.

He received his EMT training in Boulder, Montana, in 1973 and has been an active EMT with numerous volunteer ambulance services since that time and has managed three EMS agencies. When he is at his home in Montana, Nels responds with the Gallatin River Ranch Volunteer Fire Department where he serves as the Chief EMS Officer and Assistant Fire Chief.

JANE W. BALL, RN, DRPH
Role: Technical Advisor

Dr. Ball has served as a consultant to the Trauma Systems Evaluation and Planning Committee of the American College of Surgeons Committee on Trauma since 2006. As such, she has participated on more than 20 state and regional trauma system consultations. She was the Director of the National Resource Center (NRC) at the Children's National Medical Center in Washington, D.C. from 1991 through 2006. The NRC provided support to two Federal Programs in the U. S. Department of Health and Human Services' Health Services and Resources Administration (HRSA): the Emergency Medical Services for Children (EMSC) Program and the Trauma-Emergency Medical Services Systems Program. As director of the NRC, she participated in the development of the HRSA Model Trauma Systems Evaluation and Planning document. She also provided technical assistance to states regarding strategic planning, providing guidance in securing funding, developing and implementing grants, developing injury prevention plans and programs, building coalitions, shaping public policy, conducting training, and producing educational resource materials.

Dr. Ball has authored numerous articles and publications as well as several health care textbooks, including Mosby's Guide to Physical Examination (8 editions), Child Health Nursing (3 editions), Pediatric Nursing: Caring for Children (6 editions), Maternal and Child Nursing Care (4 editions), and Pediatric Emergencies: A Manual for Prehospital Care Providers (2 editions). One of these texts, Pediatric Nursing: Caring for Children, received the1999 and 2001 Robert Wood Johnson Foundation Last Acts Coalition Outstanding Specialty Book Award. Child Health Nursing was recognized as an American Journal of Nursing Book of the Year in 2010. As an expert in the emergency care of children, Dr. Ball has frequently been invited to join committees and professional groups that address the unique needs of children.

Dr. Ball served as the President of the National Academies of Practice, an organization composed of distinguished health care practitioners from 10 disciplines that promote education, research, and public policy related to improving the quality of health care for all through interdisciplinary care.

Dr. Ball graduated from the Johns Hopkins Hospital School of Nursing. She obtained her master's degree and doctorate in Public Health from John Hopkins University School of Hygiene and Public Health. She is a Certified Pediatric Nurse Practitioner. She received the Distinguished Alumni Award from the Johns Hopkins University in 2010.

MARIA ALVI, MHA
Role: ACS Staff (Trauma Systems and Quality Programs Manager)

Ms. Alvi joined the American College of Surgeons (ACS) Trauma Department as the Trauma Systems and Quality Programs Manager in May 2015. In this role, Ms. Alvi provides administrative support to the COT subcommittees of Trauma Systems Evaluation and Planning, Advocacy and Injury Prevention and Control. She also serves as the program manager for the Trauma Systems Consultation Program, the BIS Facilitation Program, and other Trauma Systems and Quality initiatives.

Prior to joining the ACS, Ms. Alvi worked as a healthcare consultant at Truven Health Analytics for 2 years, providing data reporting support to US clients, through the company's trademarked financial, marketing and clinical programs. Her focus at Truven also allowed her to assist with critical analysis and assessment of client data towards improving health outcomes in their patients, and better management of their healthcare programs.

In December 2013, Ms. Alvi earned her Masters of Healthcare Administration (MHA) from UIC School of Public Health in Chicago. As part of her curriculum, she also completed a Preceptorship at Cook County Health and Hospitals System (CCHHS). Through this opportunity, Ms. Alvi employed her strategic planning and program management skills to clinical programs and non-clinical initiatives at John H Stroger Hospital of Cook County and CCHHS.

Although interested in clinical sciences (pre-med curriculum), and licensed as an EMT-B for the State of Illinois until June 2012, Ms. Alvi found her passions truly lay within healthcare management. Ms. Alvi serves as a volunteer member on the ACHE CHEF Communications Committee, is a Young Professional member for the Chicago Council on Global Affairs, and partakes in various early careerist, networking and charitable events throughout the greater Chicago area.

MELANIE NEAL
Role: Observer – ACS Staff (Manager, TQIP/NTDB)

Ms. Neal has been with the American College of Surgeons for thirteen years, and is the Manager of the National Trauma Data Bank (NTDB) and the Trauma Quality Improvement Program (TQIP). In this position, she provides strategic direction and high level management for scientific, business, and product operations areas.

In addition, Ms. Neal works with a variety of data and quality initiatives of the Committee on Trauma, which support the mission of the COT to improve care for the injured patient. She represents the COT programs of the ACS on this consultation.

Ms. Neal has a Master's degree in Social Science Research Methods.

JIMM DODD
Role: Observer – ACS Staff (Program Manager, TQIP)

Jimm joined the American College of Surgeons (ACS) Trauma Department as the Trauma Quality Improvement Programs Manager in July 2015. In this role he is responsible for Performance Improvement and Patient Safety for TQIP facilities.

Prior to joining ACS, Jimm served in the US Army and US Army Reserves as a medical officer commanding hospitals in support of Operation Iraqi Freedom and Operation Enduring Freedom. He was selected to work on a special task force developing procedures and policies for the integration of Army medicine into State and Local disaster planning and response. He also served on various committees developing initiatives for returning Veterans who were transitioning into civilian careers, creating programming to facilitate their transition. During his time in the military Jimm served as a flight paramedic and an independent duty medic. Jimm still serves in the Army Reserves as a staff officer with CEMARS-G at Fort Sheridan, Illinois.

Jimm graduated from Western Carolina University, in Cullowhee North Carolina, with a Bachelor's degree in Emergency Medical Care. He has completed his Masters in Organizational Leadership with a concentration in Servant Leadership from Gonzaga University, in Spokane Washington. Jimm served as a NREMT- P within the EMS community at various systems during his time in the Army. With his education Jimm has had the opportunity to teach future leaders in Army medicine and apply combat experience to help shape the Army healthcare system.

Jimm was recognized for his combat duty while serving through being awarded the Bronze Star Medal, Meritorious Service Medal and Army Commendation Medals.

APPENDIX D: SAMPLE SYSTEM PATIENT SAFETY MEASURES

UTAH TRAUMA PROGRAM			
Utah Patient Safety Trauma Initiative			
	Process Measures	**Performance Measures**	**Outcome Measures**
	9. Trauma pts transported by EMS without ambulance report in medical record	2. Trauma pt. with > 1 inter hospital transfer prior to definitive care	1. Trauma Patients who die >one hour and < 24 hours ED arrival
		3. Ground transport with ED RTS </= 5.5 and scene transport time > 20 min	7a. Trauma pts who die with TRISS > 50%
		4. Trauma pts ISS >15 and EMS scene time > 20 min	7b. Trauma pts who live with TRISS < 50%
		5. Transferred pts ISS > 15 and transfer time > 6 hrs. for rural and > 4 hrs. for urban to definitive care	
		6. Trauma pts with ISS >15 and ED time > 2hours	
		10. Trauma pts < 13 yrs. with ED GCS </= 8, intubation or ISS >15 not transferred to regional pediatric trauma center	
		8. Trauma patients with ISS > 15 discharged from non-state designated trauma centers	
Patient Safety Events	**Types of Errors**	**Key Process Factors**	**Measures**
Medication errors	Dose, route, wrong med		
Hand off/transfer errors	Miscommunication of information, loss of continuity, OR delays		
Device related errors	Device failure, lack of needed device, wrong device		
Diagnostic errors	Failure to recognize, wrong interpretation of results, incomplete diagnosis		
Triage errors	Failure to appropriately assess level of need, too low of classification, too high of classification		
Hemorrhage			
Airway management/control			
CNS/C-spine			
Fluid Resuscitation			

APPENDIX E: SAMPLE SYSTEM PERFORMANCE MEASURES

Trauma Audit Dashboard

User Manual

Draft Date: November 17, 2015

1. Where to Find the Trauma Audit Dashboard

The Trauma Audit Dashboards can be found by going to the Utah Trauma Registry homepage, http://www.utahtrauma.org/, and clicking on "Registry Members" in the left side navigation panel. Links to the Trauma Audit Dashboards are located at the bottom on this page under the heading "Access to Trauma Audit Dashboards". Currently there are two dashboards available; the permissions for each are described below.

2. Trauma Audit Dashboard Description

The goal of the audit dashboard is to give hospitals a way to gain insights into specific patient groups in the Utah Trauma data set. The visualizations provided in the dashboard highlight patients, within individual hospitals, whose injury attributes or care offered "triggered" an audit filter. Descriptions of the audit filters are provided below. *Triggering an audit filter does not equate to the likelihood of suboptimal care.* On the contrary, these audit filters are designed to help hospital representatives identify areas where performance assessments might prove fruitful. The Audit Dashboard is separated into two dashboards:

1. **State Level Dashboard:** gives detailed information on all aspects of the trauma audit filters, for all hospitals. Access is restricted to key individuals within the Utah Bureau of EMS and Preparedness.

2. **Hospital Level Dashboard:** gives detailed information on all aspects of the trauma audit filters, only for the hospital for which a user has been granted access. Access is restricted to individual hospitals. The hospital view also provides an overall view of statewide findings for purposes of comparison.

2.1 Overview of the Audit Filters

The following defines the different patient groups represented across the ten audit filters (represented as tabs in the dashboard).

Audit Filter	Definition
Patients who Die Between 1 and 24 Hours After Admission	[DC Disposition Code] is 'D', and the difference between [Ed Adm Date Time] and [Discharge Date Time] is less than one hour or greater than 24 hours.
Patients who have More than One Transfer	[Transport Destination 2] is a value for a hospital.
Patients with RTS < 5.5 and Scene Transport Time > 20 minutes	RTS (calculated) less than 5.5 and [Scene Transport Time] greater than 20 minutes.
Patients with ISS > 15 and Scene Time > 20 minutes	[Injury Severity Score] greater than 15 and [Scene Time] greater than 20 minutes.

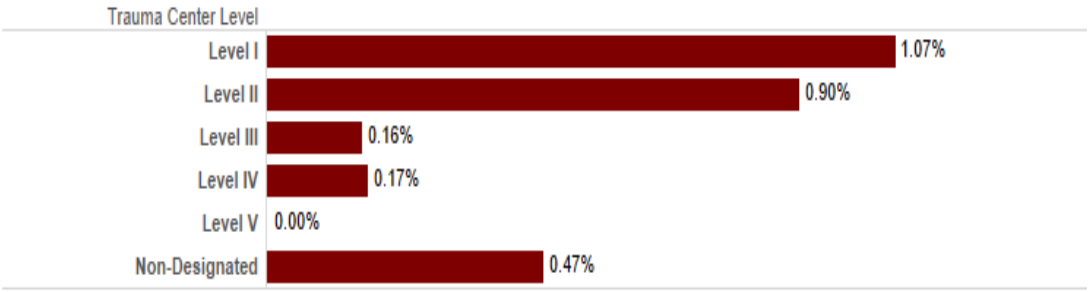
Patients with ISS > 15 and Long Transport Time	[Injury Severity Score] greater than 15 and [Scene Transport Time] greater than 6 hours for a rural place of injury or greater than 4 hours for an urban place of injury. Rural/urban distinction is determined by county, with Davis, Salt Lake, Utah, and Weber as "Urban" and Beaver, Box Elder, Cache, Carbon, Daggett, Duchesne, Emery, Garfield, Grand, Iron, Juab, Kane, Millard, Morgan, Piute, Rich, San Juan, Sanpete, Sevier, Summit, Tooele, Uintah, Wasatch, Washington, and Wayne as "Rural".
Patients with ISS > 15 and ED Time > 2 hours	[Injury Severity Score] greater than 15 and the difference between [Ed Adm Date Time] and [Ed Dc Date Time] is greater than 2 hours.
TRISS Values and Unexpected Outcomes	Defines two groups of patients: 1.TRISS (calculated) less than or equal to 50% and [Outcome] is 'A' 2.TRISS (calculated) greater than or equal to 50% and [Outcome] is 'D'
Patients with ISS > 15 Discharged from a Non- Designated Hospital	[Injury Severity Score] is greater than 15 and Trauma Center Level (calculated) is 'Non-designated'
Patients Transported by EMS with No Ambulance Report	[Transport Mode] is 'FIX' or 'AMB' or 'HELI' and [Trip Form1] is NULL or 'N'
Patients under 13 Years with GCS < 8, Intubation, or ISS > 15 not at Primary Children's	[Age in Years] is less than 13 and ([Glascow1] less than 8 or [Injury Severity Score] greater than 15 or [Ed Airway] is 'ORAL' or [Ed Airway] is 'ORALETT' or [Comp Type1] is 'INTUB' or [Comp Type2] is 'INTUB' or [Comp Type3] is 'INTUB' or [Comp Type4] is 'INTUB') and [Hospital Name] is not 'Primary Children's'

Each audit filter is represented as a tab in the dashboard. The tabs appear at the top of the screen and can be used to move through different audit filters. The small arrows on the ends of the tab bar can be used to scroll through the different tabs one-by-one or to move directly to the first or last audit filter.

For each audit filter, two visualizations are provided. On the left side of the screen is a statewide set of visualizations that provide some comparative information on each patient group. On the right side of the screen are similar visualizations specific to patients treated at the authenticating hospital. In other words, patients triggering the audit filter, treated at your hospital, appear on the right side. Similar patients across the state, triggering the audit filer, appear on the left side of the screen.

2.2 Comparison of Audit Filter to Total Trauma Population

Near the top of a dashboard, we have a visualization designed to show how the patient sample described under the audit filter is distributed throughout the trauma data set:



This visualization shows the percentage of the total Utah registry population that meets the audit filter criteria for each level of trauma center designation, as well as the current hospital, which will appear underneath. Note that for all remaining visualizations on the page, you will only see specific data associated with the hospital for which you authenticated, as well as statewide for the trauma center designations.

This visualization can be used as a filter to control the rest of the dashboard. To see only information on a specific trauma center designation, click on either the label or the bar for that designation. To exit the filtering, click on the bar or label a second time. Any filtering selected in this visualization will only affect visualizations under the heading “Breakdown for Selected Trauma Center Level” on the left side of the dashboard.

2.3 Age Clusters

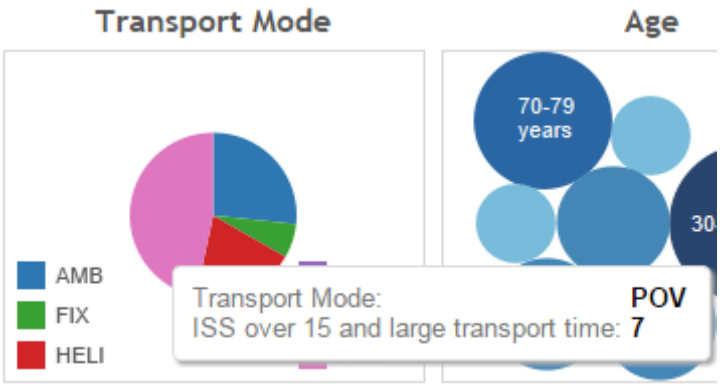
This visualization is present twice on each tab, once under “Breakdown by Selected Trauma Center Level” (i.e., statewide data) and once under “Breakdown by Selected Hospital”. It shows age demographic information for each group using 10 year age groups, i.e. “0-9”, “10-19”, “20-29”, and so on. The larger and darker colored bubbles represent more patients. Hovering over a bubble will bring up the following tooltip, which provides more information about that bubble, in this case, the age group and a count of patients in that group:

Additionally, this visualization can also be used as a filter for the corresponding side of the dashboard. Clicking once on a bubble will filter all visualizations on the side of the dashboard it is located under (Hospital or Trauma Center Level) to show only patients contained in that age group. Click on the bubble again to exit the filter.

2.4 Transport Mode Pie Chart

This visualization shows up twice on each tab, once under “Breakdown by Selected Trauma Center Level” (i.e., statewide data) and once under “Breakdown by Selected Hospital”. It displays information on how patients were transported to the hospital. The codes used in this visualization, AMB, FIX, HELI, LAW, OTH, and POV represent Ambulance, Fixed Wing, Helicopter, Law Enforcement Vehicle, Other and Personal Vehicle, respectively. As in other

visualizations, hovering over a pie slice will bring up a tooltip with more information, such as the number of patients in that slice:



Additionally, this visualization can also be used as a filter for the corresponding side of the dashboard. Clicking once on a slice will filter that side of the dashboard to just that transport group. Click on the slice again to exit the filter.

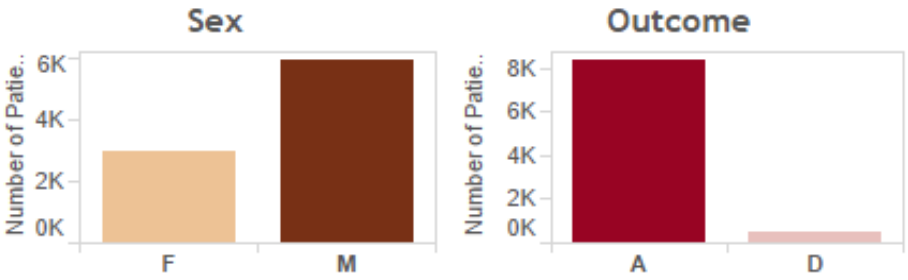
2.5 Sex Bar Chart

This visualization shows up twice on each tab, once under “Breakdown by Selected Trauma Center Level” and once under “Breakdown by Selected Hospital”. It displays demographic information on patient sex. As in other visualizations, hovering over a bar will bring up the tooltip with further information.

Like other visualizations in this dashboard, it can be used as a filter. Clicking on a bar will filter all the visualizations on that side of the dashboard, clicking again will remove the filter.

2.6 Outcome Bar Chart

This visualization shows up twice on each tab, once under “Breakdown by Selected Trauma Center Level” and once under “Breakdown by Selected Hospital”. It shows hospital outcomes for patients in the given audit group. The codes A and D represent “Alive” and “Dead” respectively. This visualization does not show up for every audit filter, the reason behind this is that some audit filters incorporate patient outcome in the audit filter definition.



Like other visualizations in this dashboard, it can be used as a filter. Clicking on a bar will filter all the visualizations on that side of the dashboard, clicking again will remove the filter.

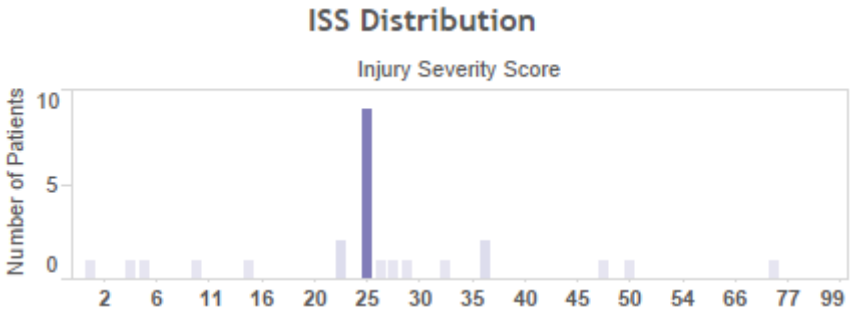
2.7 Cause of Injury Tree Map

This visualization shows up twice on each tab, once under “Breakdown by Selected Trauma Center Level” and once under “Breakdown by Selected Hospital”. It shows the different values for cause of injury for patients in the given audit group. The definition for the cause codes can be found in the Utah Trauma Registry Data Dictionary. As in other visualizations, hovering over a block in the tree map will bring up the tooltip with further information.

Like other visualizations in this dashboard, it can be used as a filter. Clicking on a block will filter all the visualizations on that side of the dashboard, clicking again will remove the filter.

2.8 ISS Distribution

This visualization shows up twice on each tab, once under “Breakdown by Selected Trauma Center Level” and once under “Breakdown by Selected Hospital”. It shows the distribution of ISS scores for patients in the given audit group. Both darker colors and taller bars indicate more patients with that given score. As in other visualizations, hovering over a bar will bring up the tooltip with further information.



Like other visualizations in this dashboard, it can be used as a filter. Clicking on a bar will filter all the visualizations on that side of the dashboard, clicking again will remove the filter.

2.9 Tracking Numbers List (Hospital Specific)

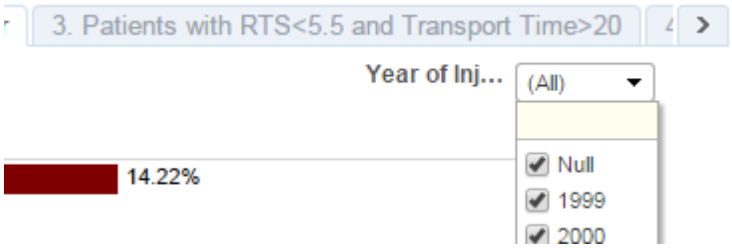
On the bottom right side of the dashboard, a visualization lists the Utah Trauma Registry Tracking Numbers reported by the selected hospital that populate the visualization currently available. In other words, this list provides a way to identify the specific patients that are included in the current visualization. Clicking on a given tracking number will filter the hospital specific side of the dashboard to show detailed information from that single patient record. Clicking a second time will leave the filter. This tracking number list only shows information on patient records submitted to the Utah Trauma Registry from the authenticated hospital. Tracking numbers from other hospitals are NOT listed.

2.10 Additional Drop Down Filters

In addition to the filtering options in the visualizations, there are a couple of drop down filters provided:

- Year
- TRISS/Outcomes Selector

The year drop down menu appears in the top right of every tab. This is a multi-select dropdown menu, which means the user can look at any year or combination of years desired by unchecking the relevant boxes.



The TRISS/Outcomes Selector is found only the tab “7. TRISS Outcomes”. It is located at the top of the dashboard at the center.

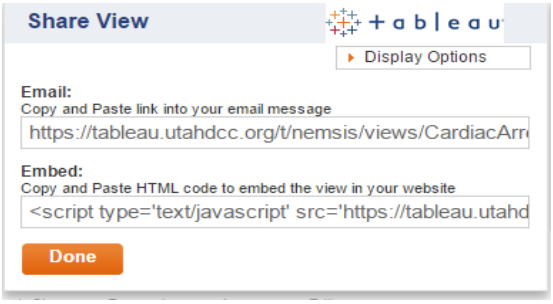
Clicking on the arrows at the right of this selector will switch between this dashboard’s two views, “TRISS<50%, Outcome=A” and “TRISS>50%, Outcome=D”.

3 Tableau Toolbar

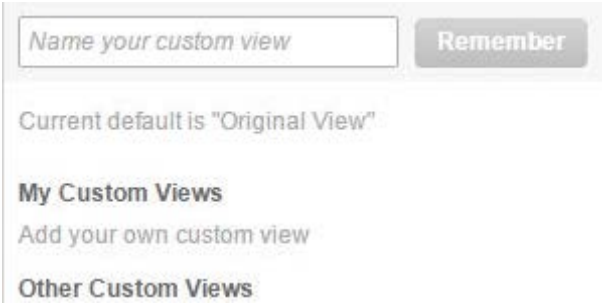
All Tableau dashboards share the same toolbar at the bottom of the view. Note that while most dashboards will have the same selections, some items may differ based on user permissions.

3.1 Share and Remember my changes

The left side of the toolbar contains three options to help manipulate and share data. “Share” provides links to email the dashboard visualization to another person or to embed the dashboard in a website.



“Remember my changes” provides a way to save any filtering or selections you may have made while using the dashboard, for use when you revisit the dashboard.



3.2 Export, Revert, Pause Updates and Refresh

The middle set of buttons provides several options to help explore the dashboard. “Export” provides options to save the dashboard as an image or PDF. “Revert” returns the dashboard to its original filtering position (which in this case is no filters). “Pause Updates” is useful when you want to look at a complicated set of filters. Normally every time a filter selection is made, the dashboard will automatically update the data to reflect the selection. Clicking the Pause Updates button will prevent this from happening, enabling the user to implement several filters and have the visualization update all at once. Once multiple filtering selections are made, automatic updates can be resumed by clicking the button a second time, or clicking the refresh button to the right to refresh the data just once.

Export, Revert, Pause Updates and Refresh buttons.

3.3 Subscribe and Download

The last two icons in the Tableau toolbar are Subscribe (small mail icon) and Download. Subscribe will sign you up for email notifications as changes are made to the dashboard and Download will allow you to download a copy of the workbook to open on Tableau Desktop. In the future, more information will be made available regarding use of Tableau Desktop.

APPENDIX F: STATE PARTICIPANTS LIST

#	Name	Title	Organization
1	Adams, Christy	Trauma Prevention Coordinator	UC Davis Med Center
2	Almadhyan, Abdulmajeed	EMS/Disaster Fellow	UC Irvine Med Center
3	Anderson, Reba	Event Planner	EMSA
4	Ayers, Kathi	Trauma Program Manager	Sharp Memorial Hospital
5	Backer, Howard	Director, EMS Authority	EMSA
6	Bartleson, BJ	VP, Nursing & Clinical Services	CA Hospital Association
7	Barton, Bruce	Director, Riverside County	Riverside County EMS Agency
8	Blough, Lois	Director, Trauma Services	Community Regional MC
9	Chapman, Joanne	Trauma Systems Coordinator	Coastal Valleys EMS Agency
10	Chidester, Cathy	Director, EMS Agency	Los Angeles County EMS Agency
11	Cruz-Manglapus, Gilda	Trauma Program Manager	Henry Mayo Newhall Hospital
12	Cryer, H. Gill	Trauma Director	UCLA Medical Center
13	Cunningham, Connie	Executive Director, Emergency & Trauma	Loma Linda Medical Center
14	Diaz, Linda	Trauma Manager	Santa Clara County EMS
15	Doucet, Jay	Medical Director, Surgical ICU	UC San Diego Med Center
16	Gardina, Les	Manager, EMS Agency	San Diego EMS Agency
17	Gausche-Hill, Marianne	Ems Medical Director	Los Angeles County EMS Agency
18	Gawlik, Melanie	Trauma Service Director	Scripps Memorial La Jolla
19	Goldman, Jay	Medical Director, Emergency Services	Kaiser
20	Gough Smith, Robynn	Chief Administrative Officer	Surgical Affiliated Mgmt Group
21	Haddock, Katy	Trauma System Manager	Ventura County EMS Agency
22	Harley, Jim		Radys Children's Hospital
23	Hinsdale, Jim	Executive Medical Director	California Shock/Trauma Air Rescue
24	Holmes, James	Vice Chair, Research	UC Davis Med Center
25	Hotz, Heidi	Trauma Program Manager	Cedars-Sinai Medical Center
26	Johnson, Craig	Manager, Resp9onse Resource Unit	EMSA
27	Kennedy, Frank	Trauma Director	Sharp Healthcare

28	Kissell, Shanna	Trauma Manager	Riverside County EMS Agency
29	Maas, Frank	Emergency/Trauma Director	Children's Orange County
30	Makersie, Robert	Trauma Director	San Francisco General Med Ctr
31	Margulies, Dan	Chief, Trauma/Emergency/Surgical ICU	Cedars-Sinai Med Center
32	McCord, Brian	Senior Director, Trauma/Emergency/Critical Care	Scripps Mercy
33	McGinnis, Tom	Chief, EMS Systems	EMSA
34	Mzahim, Bandr		UC Irvine Med Center
35	Newton, Chris	Trauma Director	Children's Oakland
36	O'Neill, Kevin		San Benito County EMS Agency
37	Pierson, James	Chief Operations Officer	Medic Ambulance
38	Pinnette, Vickie	Executive Director	SSV EMS Agency
39	Ponce, Santa	Trauma Program Manager	Kern Medical Center
40	Preciado, Leigh	Trauma Registrar	Scripps Health La Jolla
41	Roberts, Mark	Data Manager	ICEMA
42	Roberts, Pamela	Director, Physical Medicine & Rehabilitation	Cedars-Sinai Med Center
43	Schoenheit, Candy	EMSC/Trauma System Coordinator	San Diego EMS Agency
44	Serrano, Jan	Manager, Emergency & Trauma Services	Arrowhead MC
45	Shatz, David	Trauma Surgeon	UC Davis Med Center
46	Sherck, John	Trauma Surgeon	Regional Medical Center, San Jose
47	Sinz, Bonnie	Trauma Coordinator	EMSA
48	Skinner, Ruby	Trauma Medical Director	Kern Medical Center
49	Smiley, Dan	Chief Deputy Director	EMSA
50	Smith, Myron		Hall Ambulance
51	Smith, Renee	Trauma Program Director	St. Francis Medical Center
52	Spain, David	Trauma Director	Stanford Medical Center
53	Steele, John	Trauma Program Medical director	Palomar Med Center
54	Stratton, Sam	Medical Director	Orange County EMS Agency
55	Thomas, Desiree	Trauma Program Director	Long Beach Memorial
56	Trask, Sean	Chief, EMS Personnel	EMSA

57	Tufuoh, Nana	Research Scientist	EMSA
58	Tyler, Robin	Trauma Program Manager	Harbor/UCLA Med Center
59	Venezio, Heather	Trauma Program Director	North Bay Med Center
60	Weivoda, Kristin	EMS Administrator	Yolo County EMS Agency
61	Wirtz, Steve	Chief, Injury Surveillance and Epidemiology	CDPH
62	Woodfall, Michelle	Trauma Program Director	Stanford Medical Center
63	Woods, Amber	Trauma Manager	Kaweah Delta Medical Center
64	Wraa, Cheryl	Grant Manager	North Coast EMS Agency
65	Yates, Judith	Senior Vice President	Hospital Association San Diego/ Imperial
66	Yoshida McMath, Christine	Speciality Care Coordinator	ICEMA