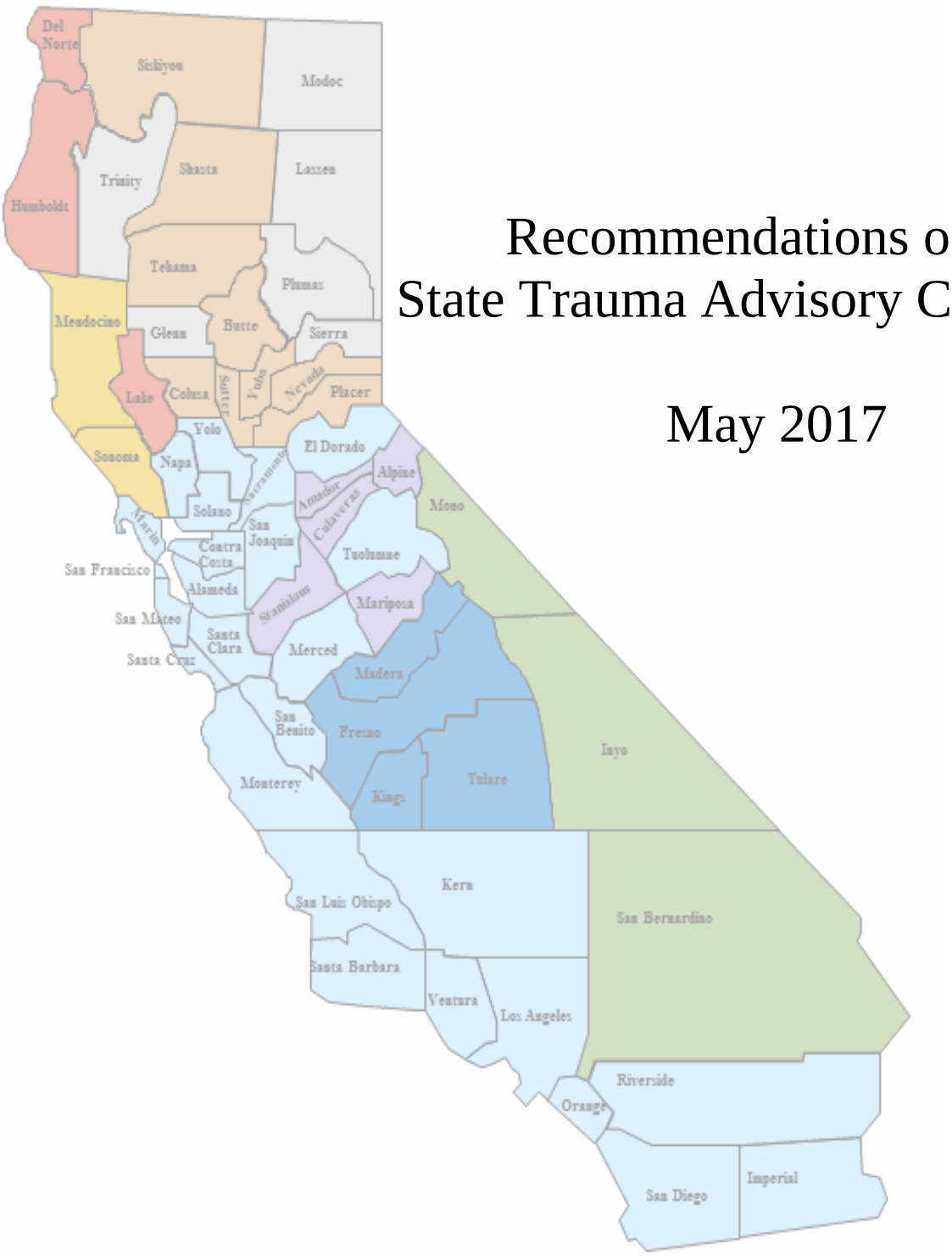
California Statewide Trauma System Planning



Recommendations of the
State Trauma Advisory Committee

May 2017

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I. Executive Summary

Death and long-term disability due to traumatic injuries are increasing at an alarming rate across America. In the State of California, traumatic injury is the most common cause of death in persons age 1 to 44 and accounts for more productive years of life lost than cancer and heart disease combined.[1] In 2010 the cost of fatal trauma in California was estimated at more than $17 billion with national data showing U.S. costs of over $189 billion.[2] According to the United States Centers for Disease Control and Prevention, injury-related deaths increased by 18% from 2010-2015. In 2015, just over 214,000 people died from injuries, 19,054 in California.[3]

The cost of healthcare and the loss of productivity from traumatic injuries cost Californians billions of dollars every year. California hospitals admitted over 250,000 injured patients in 2014. Thirty percent of these patients required further rehabilitation services with the highest percent between the ages of 65 and 84 years.[4]

Rapid diagnosis and specialized treatment is the key to reducing the morbidity and mortality rates of trauma patients. Most states, including California, have developed trauma systems to meet the needs of their diverse populations and to provide optimum patient care. In 2010, the California Emergency Medical Services Authority (EMSA) asked the State Trauma Advisory Committee (STAC) [***Appendix C***] to analyze the current California trauma care system and to provide recommendations to the EMSA director. These Statewide Trauma System Planning recommendations are designed to describe the analysis and provide recommendations for continued improvement of the trauma system to achieve best practices in care of the injured patient.

California's Trauma System

Currently, there are 80 designated Trauma Centers in California [***Appendix D***] that receive and admit over 70,000 trauma patients per year.[5] Trauma care in California is delivered and governed by a structure of public and private entities working together to prevent injuries, reduce trauma-related mortality and morbidity rates, and maximize cost-benefit of trauma healthcare for all Californians. EMSA is charged with providing oversight and leadership to 33 local emergency medical service agencies (LEMSAs) statewide. These LEMSAs are responsible for assessing, directing, developing, and implementing their local or regional EMS and trauma plans based on local topography, demographics, population density, available healthcare resources, and funding. The trauma systems in California are locally designed to allow for variation and flexibility in order to build a responsive and effective trauma system that is tailored to individual jurisdictions. However, the system operates within state regulations and requires consistent quality standards and protocols for patient transfers across local and regional jurisdictions. To further build on this delivery model and improve the quality of trauma systems across the state,

[1] CDC Injury Response, United States http://www.cdc.gov/injury/overview/leading_cod.html
[2] WISQARS™ Injury Prevention & Control: Data & Statistics 2010
[3] Centers for Disease Control and Prevention (CDC), National Center for Injury Prevention and Control, Fatal Injury Reports, 2015, for National, Regional, and States (WISQARS)[Internet. Available from http://www.cdc.gov/injury/wisqars/fatal_injury_reports.html
[4] California Department of Health Services EPICenter, Injury Reports. Available from http://epicenter.cdph.ca.gov/
[5] California EMS Information System (CEMSIS)-Trauma, volume count report for 2013-2016.

EMSA must support opportunities for LEMSAs to innovate and share best practices in order to improve patient outcomes.

Components of the Statewide Trauma System Planning Recommendations

The STAC developed these Statewide Trauma System Planning recommendations based on an evaluation of California's current delivery of trauma care [***Appendix A***]. The 2006 American College of Surgeons (ACS) Committee on Trauma *Regional Trauma Systems: Optimal Elements, Integration, and Assessment* guidance document, the 2006 Health Resources Services Administration (HRSA) *Model Trauma System Planning and Evaluation* report, and recommendations from the ACS's Trauma System Consultation Visit were reviewed to address national standards in these Statewide Trauma System Planning recommendations.

These Statewide Trauma System Planning recommendations outline 3 goals for trauma systems:

1. Timely Access to Trauma Care
2. Delivery of Optimal Trauma Care
3. Community Health and Wellness

The California system is mature at the local level with considerable expertise and responsiveness to local need. These Statewide Trauma System Planning recommendations focus on maximizing the benefit of regional and statewide coordination and integration of trauma care, while supporting local and sub-regional system development and quality.

There are fifteen (15) Statewide Trauma System Planning components and associated objectives that support these goals. EMSA, in collaboration with the STAC, LEMSAs, Regional Trauma Coordination Committees (RTCCs), Trauma Centers, and other applicable state departments and EMS stakeholders, should strive to achieve the vision of these Statewide Trauma System Planning recommendations through work on these objectives [***Appendix B***]. EMSA may lead efforts to implement some of the recommendations while LEMSAs, RTCCs, Trauma Centers and other groups will take the lead on other recommendations. The successful implementation of these Statewide Trauma System Planning recommendations depends on participation of a broad range of community partners.

Component	Objectives
Trauma System Leadership	• Collaborate with counties to support and share resources for a regionally based trauma system. • Work with the LEMSAs, STAC and the trauma regions to develop a consensus compendium of trauma-related policies, procedures, and clinical guidelines that may be shared throughout the state. • Evaluate current local trauma plans and work to update plans in the context of regional trauma care with input from Trauma Centers and trauma regions. • Establish basic quality and activity reporting standards and report templates for the LEMSAs to provide EMSA, STAC, and Performance Improvement and Patient Safety (PIPS) subcommittee with sufficient data to assess the performance of trauma systems.
System Development Operations	• Conduct a systematic review of local trauma plans in the context of these Statewide Trauma System Planning recommendations and the structures and processes it outlines. • Develop processes and mechanisms for providing optimal access and care to special populations; for example, pediatric populations. • Update regulations to define specific standards and requirements for LEMSAs that chose to implement a trauma system, and to address recommendations consistent with these California Statewide Trauma System Planning recommendations, 2017.
Trauma System Financing	• Identify new critical trauma system components and the cost to develop and maintain. • Establish a basis for estimating the actual cost for trauma care in California. • Explore sustainable funding sources to support regional infrastructure and planning.

Component	Objectives
EMS System: Prehospital Care	• Utilize the most current national standard for prehospital triage as the foundation for prehospital trauma triage guidelines. Based on specific environments (e.g., urban vs. rural) and presence or absence of Trauma Center resources, some local modifications may be required. • Develop definitions to study over-/under-triage with a mechanism to track on a regional basis. • Work with Office of Statewide Health Planning and Development (OSHPD) to obtain specified data on major trauma patients transported to non-trauma facilities and not subsequently transferred. • Improve the transfer of documented information from field units to receiving hospitals with the goal that prehospital care reports are available as part of the medical record for all trauma patients. • Explore the need for special population field trauma triage criteria, e.g., pediatric and geriatric. • Develop EMS protocol guidance for field trauma care.
EMS System: Ambulance and Non-Transporting Medical Units	• Develop minimum prehospital equipment inventory for EMS units specific to trauma needs. • Recommend air resource utilization guidelines applicable statewide including access to air resources.
EMS System: Communications	• Develop guidance for priority dispatch protocols for trauma and investigate process changes that improve dispatch effectiveness while improving outcomes. • Study the hospital alert systems currently in place to identify hospital capability, capacity, and specialty care availability (e.g., burns, pediatrics) and complete a gap analysis.
Definitive Care: Acute Care Facilities	• Develop guidelines outlining a process for the assessment of Trauma Center compliance with California Code of Regulations (CCR) Title 22, Chapter 7. • Outline the responsibilities and expected participation in the trauma system for non-designated acute care hospitals. • Establish EMSA guidelines to standardize the Trauma Center designation process across LEMSAs.
Definitive Care: Re-triage Interfacility Transfer	• Capture re-triage and Interfacility Transfer (IFT) data for statewide analysis and develop a map of re-triage and IFT movement within the state. • Explore the development of centralized re-triage/transfer coordination within the state. • Assist in the development of regional cooperative arrangements between sending and receiving centers that will facilitate re-triage, reduce delays, and ensure that patients are re-triaged to an appropriate level of care.

Component	Objectives
Definitive Care: Rehabilitation	• Improve the data collection for evaluation of rehabilitative needs and degree of access to rehabilitation throughout the state. • Adopt a standardized measure of functional recovery suitable for use throughout the trauma system.
Data Collection	• Improve data sharing. • Improve data quality and compliance. • Evaluate data validity.
System Evaluation and Performance Improvement	• Develop and implement a statewide comprehensive trauma PIPS Plan consistent with the elements of these Statewide Trauma System Planning recommendations. • Evaluate state data, identify regional opportunities for improvement, determine if similar opportunities are occurring in other regions, and explore mechanisms for shared resolution. • Create a policy, in coordination with the California Office of Health Information Integrity (CalOHII), regarding the sharing of data for the performance improvement process, recognizing hospital confidentiality and HIPAA regulations. • Benchmark individual systems, hospitals, LEMSAs, and trauma regions to the group as a whole, and to an outside standard including a comparative analysis of risk-adjusted outcomes.
Education and Training	• Develop a plan for providing information to the public regarding the structure and function of the trauma system. • Perform a needs assessment prior to developing new or additional trauma-related professional educational programs. • Encourage the use of the ACS's Rural Trauma Team Development Course, video conferencing, and online education. • Encourage development of telemedicine connections between non-trauma facilities and level III and IV Trauma Centers with level I and II Trauma Centers.
Research	• Develop a research agenda and collaborate with established investigators to conduct research projects. • Periodically review trauma system data derived from the state trauma registry, Office of Statewide Health Planning and Development (OSHPD), and other sources, and make a recommendation to various system stakeholders regarding potential areas of research.

Component	Objectives
Injury Prevention	• Develop a compendium of regional injury prevention programs. • Collaborate with the Department of Public Health to evaluate, implement, and determine the effectiveness of initiatives to reduce intentional and unintentional injuries.
Emergency/Disaster Preparedness	• Incorporate the role of the trauma system in the California Public Health and Medical Emergency Operations Manual. • Develop a recommended inventory for a trauma cache to be utilized at Trauma Centers in the event of a disaster. • Plan for trauma system surge capacity in collaboration with local Public Health and Medical Emergency Function (EF 8), depending on disaster risk assessment.

II. Purpose of Statewide Trauma System Planning Recommendations

EMSA assessed trauma care in California in the 2006 report, *"California Statewide Trauma Planning: Assessment and Future Direction"*. Guided by this report, and the 2016 ACS's Trauma System Consultation Report, these Statewide Trauma Systems Planning recommendations are a culmination of an extensive process that began in 2010. .

California, in addition to being the most populous state in the Union, is unique as it is the only state where the statutory responsibility for the EMS system, including local trauma systems, rests predominately with local EMS agencies (LEMSAs). California's 33 LEMSAs provide local flexibility and allow tailoring of regional trauma systems to individual jurisdictional demographics, population density, and available resources.

The LEMSAs design trauma systems that meet minimum state standards and regulations. The intent of these Statewide Trauma System Planning recommendations is to provide a roadmap for improving overall trauma care in California, promote best practices throughout the state, identify and resolve issues impacting the quality of care, and enhance the movement of patients across jurisdictions while allowing ample local flexibility to deliver high quality care within a locally organized system.

These Statewide Trauma System Planning recommendations analyze current trauma care in California, provide an updated trauma system status, and make specific recommendations for further coordination of the trauma system across the state. These Statewide Trauma System Planning recommendations are not immutable and will require periodic review and revision as changes occur within the EMS and healthcare environment.

III. History and Background

What is Trauma?

For the purposes of these Statewide Trauma System Planning recommendations, the trauma patient is a seriously injured person who requires timely diagnosis and treatment of actual or potential injuries by a multidisciplinary team of health care professionals, supported by the appropriate resources, to diminish or eliminate the risk of death or permanent disability.[6]

Multidisciplinary Team—an EMS responder, trauma surgeon, emergency physician, anesthesiologist, other medical and surgical specialists, nursing, radiology, laboratory, operating suites, and ancillary services

What is a Trauma System?

A trauma system is an organized, coordinated effort in a defined geographic area that delivers the full range of care to all injured patients and is integrated with the local medical and public health systems. Trauma systems, including specialized Trauma Centers, offer a highly effective, integrated approach to reducing the incidence and impact of major injury to society; they exist in most states in the United States.[7] The true value of a trauma system derives from the coordinated transition between each phase of care (prehospital, hospital, and rehabilitation), integrating existing resources to achieve improved patient outcomes. Injuries occur across a broad spectrum, and a trauma system must determine the appropriate level of care for each type of injury.[8]

Trauma systems may be regionalized, making efficient use of limited health care resources. Trauma systems are based on the unique requirements of the population served, such as rural, inner-city, urban, or Native American communities, all of which are found in California. Trauma systems emphasize preventing injuries in the context of community health.

The benefits of a successful trauma system include a reduction in death and disability caused by trauma, resulting in an increase in the number of productive working years. Years of potential life lost because of injury far exceed those of cancer, heart disease, or stroke.[9] The impact of injuries on society can be mediated by assuring that the more severely injured are treated at Trauma Centers. Opportunities exist for improving overall cost-effectiveness by assuring our systems are inclusive in their design, and that triage guidelines are effective in matching the right patient with the right facility.[10] Being cost effective with initial treatment and continued rehabilitation of trauma victims leads to a reduced burden on local communities in support of disabled trauma victims and a decrease in the impact of the disease on "second trauma"

[6] 2002 Trauma System Agenda for the Future. U.S. Department of Transportation, National Highway Traffic Safety Administration
[7] "*Access to Trauma Centers in the United States*" Charles C. Branas, PhD; Ellen J. MacKenzie, PhD; Justin C. Williams, PhD; C. William Schwab, MD; Harry M. Teter, JD; Marie C. Flanigan, PhD; Alan J. Blatt, MS; Charles S. ReVelle, PhD, Journal of American Medical Association, Volume 293 Issue 21 pages 2626-2633, June 2005
[8] 2002 Trauma System Agenda for the Future. U.S. Department of Transportation, National Highway Traffic Safety Administration
[9] WISQARS Leading Causes of Death Reports. Available at http://webappa.cdc.gov/sasweb/ncipc/leadcaus10.html.
[10] *The Value of Trauma Center Care*, The Journal of Trauma Injury, Infection, and Critical Care, volume 69, Number 1, July 2010.

victims— families. Second trauma is the emotional trauma/upheaval of the family when a loved one suffers a life-threatening injury or sudden illness.[11]

An organized trauma system is not only essential to deliver trauma care to seriously injured patients; it is also the foundation for disaster and terrorism readiness. It allows for consistent and effective care of patients across geographic boundaries, with the ability to expand to meet the medical needs of the community from a human-made or natural disaster.

Disaster medical response includes planning and integration of trauma system resources into the local Emergency Operational Area Plan operating within the Standardized Emergency Management System (SEMS). As demonstrated by catastrophic events occurring in California such as the Northridge and Loma Prieta earthquakes, La Conchita mudslide, Chatsworth train collision, and the Asiana Airlines crash, emergency preparedness must include a strong trauma system infrastructure that will deal with daily injuries and have the capacity to rapidly expand (surge capacity) to respond to the demands of an unconventional or natural disaster that creates casualties of greater magnitude.

National Efforts in Trauma System Development

In 1966, the National Academy of Sciences White Paper entitled "Accidental Death and Disability: The Neglected Disease of Modern Society," identified deficiencies in providing emergency medical care in the country. This paper was the catalyst prompting federal leadership toward an organized approach to emergency medical services (EMS) and trauma care.

The Trauma Care Systems Planning and Development Act was developed in response to a 1986 U.S. Government Accountability Office Report (GAO/HRD-86-132) that found severely injured individuals in a majority of both urban and rural areas of the United States were not receiving the benefit of trauma systems, despite considerable evidence that trauma systems improve survival rates. A subsequent report in 1999 by the Institute of Medicine (IOM), "Reducing the Burden of Injury," called on Congress to "support a greater national commitment to, and support of, trauma care systems at the federal, state, and local levels. An estimated 20-40 percent of deaths due to severe injury could be prevented if all Americans lived in communities that are organized to transport severely injured patients promptly to an area hospital that is staffed and equipped to provide expert trauma care."

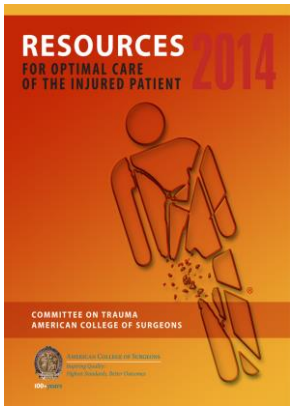
While an emergency department (sometimes referred to as an emergency room) is responsible for evaluation and stabilization with definitive care in some cases, Trauma Centers maintain a higher level of service both within and beyond a basic emergency department for victims of multi-system trauma. Operating rooms, anesthesia, surgical intensive care units, surgical recovery, and a multidisciplinary team of highly trained physicians and nurses is available to respond rapidly.

Multi-system trauma— injury to more than one body system, (e.g. orthopedic, cardiac, pulmonary, renal, neurologic) usually deemed serious.

ACS and its Committee on Trauma championed the development of Trauma Centers and trauma systems with the development of "Resources for Optimal Care of the Injured Patient." Published

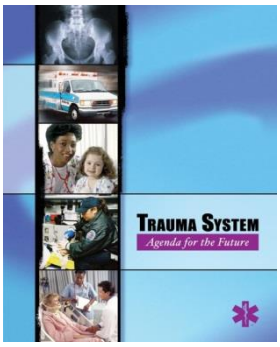
[11] American Trauma Society, *Second Trauma Course*, accessed at www.amtrauma.org

in 1976, this document provided guidelines for hospital and prehospital resources necessary for optimal trauma care. Since that time, this document has gone through numerous revisions, with the most recent published in 2014. These guidelines describe, in detail, the qualifications and level of commitment required of hospitals, medical and surgical personnel, and local communities to provide high-quality trauma care. The ACS guidelines have been adopted by state and regional trauma systems throughout the nation. Studies have shown that systems employing these standards have significantly reduced preventable deaths due to injury.



In 2002, the American Trauma Society, supported by the U.S. Department of Transportation, National Highway Traffic Safety Administration, issued the Trauma System Agenda for the Future. This report noted that:

> *Trauma systems should possess a distinct ability to identify risk factors and related interventions to prevent injuries in the community, and should maximize the integrated delivery of optimal resources for patients who ultimately need acute trauma care. Trauma systems should address the daily demands of trauma care and form the basis for disaster preparedness. The resources required for each component of a trauma system should be clearly identified, deployed and studied to ensure that all injured patients gain access to the appropriate level of care in a timely, coordinated and cost-effective manner.*



The ACS Committee on Trauma, along with the Coalition for American Trauma Care, commissioned Harris Interactive to conduct a public opinion poll on the public's awareness, knowledge, and perception of the importance of trauma care and trauma systems of care. The results were released during a Congressional Briefing on March 2, 2005. Some of the key findings were:

- Almost all Americans feel it is extremely or very important to be treated at a Trauma Center in the event of a life-threatening injury.
- Almost all Americans feel it is extremely or very important for their state to have a trauma system.
- The majority of Americans feel having a Trauma Center nearby is equally as important as or more important than having a fire department or police department.

A study published in the September 2010 Journal of Trauma found:

> *Triaging severely injured patients to hospitals that are incapable of providing definitive care is associated with increased mortality. Attempts at initial stabilization at a non-*

trauma facility may be harmful. These findings are consistent with the need for continued expansion of regional trauma systems.[12]

Cost of Trauma Care

The total lifetime medical and work loss costs of injuries and violence in the United States was $671 billion in 2013. The cost associated with fatal injuries was $214 billion, while nonfatal injuries accounted for over $457 billion. Injuries, including all causes of unintentional and violence-related injuries combined, account for 59% of all deaths among people ages 1-44 years of age in the U.S.—that is more deaths than non-communicable diseases and infectious diseases combined. Injuries killed more than 214,000 in 2015—one person every three minutes.[13] The cost of fatal trauma in California is estimated at more than $17 billion each year. These costs include medical and work loss costs.[14]

[12] Journal of Trauma 2010, Scoop and Run to the Trauma Center or Stay and Play at the Local Hospital: Hospital Transfer's Effect on Mortality, Nirula, Ram MD, MPH, FACS; Maier, Ronald MD; Moore, Ernest MD; Sperry, Jason MD, MPH; Gentilello, Larry MD

[13] WISQARS Injury Prevention & Control: Data & Statistics

[14] WISQARS™ Injury Prevention & Control: Data & Statistics

IV. Development of California's Trauma System

In California, state EMS leadership began in 1980 when the legislature added Division 2.5 of the Health and Safety Code that established EMSA (SB125, 1980). In the early 1980's, some LEMSAs such as Los Angeles, Orange, San Diego, and Santa Clara established local trauma care systems. In 1983, Article 2.5 Regional Trauma Systems was added to the Health and Safety Code to allow, but not require, development of local trauma care systems. In September 1986, trauma care regulations (California Code of Regulations, Title 22, Division 9, Chapter 7 -Trauma Care Systems) were promulgated to provide minimum standards for local trauma systems and locally designated Trauma Centers. These regulations were updated in August 1999 to reflect standards based on the ACS 1999 version of "Optimal Resources for the Care of the Injured Patient". In 2016, EMSA began the revision process, now based on the 2014 ACS Optimal Resources document.

State leadership of trauma care is vested in EMSA, providing statewide coordination, guidance, and technical assistance to the LEMSAs in their development of local trauma systems including

- reviewing and approving local trauma plans and annual Trauma System Status Reports,
- promulgating trauma system and Trauma Center requirements,
- facilitating participation in a statewide trauma registry,
- coordinating the activities of the STAC and its subcommittees, and
- liaising with other state departments regarding trauma system issues.

The American College of Surgeons is a scientific and educational association of surgeons founded to improve the quality of care for the surgical patient by setting high standards for surgical education and practice.

The following represent milestones in the development of California's Trauma System.

- **Changes to the Health & Safety code (1983)**
  Changes to the Health & Safety code enabled but did not require the development of local trauma care systems. LEMSAs may implement a trauma care system contingent upon meeting minimum regulatory standards, and may formally designate as well as limit the number of hospitals meeting a set of specific requirements as Trauma Centers.

- **The California Code of Regulations, Title 22, Division 9, Chapter 7 - Trauma Care Systems (1986)**
  Regulations for development of the trauma systems were first promulgated in 1986 as part of the California Code of Regulations, Title 22, Division 9, Chapter 7 (Trauma Care Systems). By this time, there were already 28 Trauma Centers, designated by their local EMS agencies, throughout California.

- **Trauma Regulations Updated (1999)**
  Trauma regulations were updated to reflect minimum Trauma Center standards based on the ACS 1999 edition of the "Optimal Resources for the Care of the Injured Patient". These regulations established Pediatric Trauma Centers which currently number 17, and Level IV Trauma Center standards. As the 2014 edition of the ACS document has been released, California is beginning the process of revising the trauma regulations.

- **Implementation of Standardized Reporting (2003)**
  The implementation of standardized reporting criteria for trauma patients to local trauma registries was initiated as required in Health and Safety Code Division 2.5 §1797.199 (k).

- **Formal Assessment of Trauma Care in California (2006)**
  Under the direction of the EMSA Director, the STAC completed a formal assessment of trauma care in California, making recommendations regarding state trauma leadership, regionalization, a statewide trauma data system, trauma system funding and education. The resulting report "California Statewide Trauma Planning: Assessment and Future Direction" was published to guide further trauma system coordination.

- **Assessments Put Into Action at First State Trauma Summit (2008)**
  Following the recommendations made in the 2006 trauma care assessment, EMSA convened its first Trauma Summit for trauma stakeholders from around the state. Five RTCCs were established based on a LEMSA survey by EMSA of transport and transfer patterns of injured patients to Trauma Centers. The RTCCs formulated their membership and preliminary goals and objectives and began to meet in late 2008. At this time, there were 65 designated Trauma Centers.

- **System Goals Developed at Second State Trauma Summit (2009)**
  Convened by EMSA, the second State Trauma Summit identified five (5) major goals for coordinating trauma care in California.

  1. Establish a structured relationship for the RTCCs with the LEMSAs and EMSA
  2. Profile best practices of the RTCCs
  3. Implement a state trauma registry with participation from the LEMSAs
  4. Write inclusive Statewide Trauma Systems Planning recommendations
  5. Involve non-trauma hospitals in a statewide trauma system.

- **Collection of Data with California EMS Information System (2009)**
  The California EMS Information System (CEMSIS) was established for the collection and analysis of statewide trauma registry data and began to accept data from Trauma Centers around the state. The data standards and inclusion criteria were vetted through a public comment process with final approval by the Commission on EMS.

- **Forum for Regional Trauma Coordinating Committees (2010)**
  EMSA convened the third State Trauma Summit that provided a forum for the RTCCs to report on their projects. The STAC membership was updated to include representation from the RTCCs.

- **State Trauma Summit IV (2012)**
  The fourth Trauma Summit was held in conjunction with the *UCSD Trauma and Resuscitation Conference* and presented information on trauma system performance improvement, access to trauma care, and provided an update on RTCC activities. It concluded with an open forum: "Where Do We Go From Here"?

- **State Trauma Summit V (2014)**
  The fifth Trauma Summit was held in collaboration with the Stanford University Medical Center and Santa Clara Valley Medical Center Trauma Symposium.
  Presentations covered "State of the State", the Affordable Health Care Act, Trauma Performance Improvement: A National Program, and Regional Best Practices.

- **State Trauma Summit VI (2015)**
  Trauma 2015: California's Future was held in both Southern California (San Diego) and Northern California (San Francisco). Presentations included The Evaluation of California's Trauma System from a National Perspective, Trauma System Advocacy and The Optimal Model for Pediatric Trauma Care. Case Studies were presented to illustrate system challenges.

- **American College of Surgeons Trauma System Consultation (2016)**
  ACS conducted a Consultative Trauma System Review for California in March 2016. The review process assessed all key areas of a trauma system based on national standards and provided EMSA with recommendations to improve the system.

- **State Trauma Summit VII (2016)**
  Trauma 2016: Yesterday, Today, Tomorrow was held in San Francisco and focused on the ACS consultation visit report adding presentations on prevention, rehabilitation, and system management of senior falls. Case studies that crossed jurisdictional lines were also presented along with a panel on the San Bernardino mass shooting incident.

California Trauma Center Financing

In 1987, the Assembly Office of Research described California's trauma care system as being in a state of medical and fiscal crisis, pointing to financial losses experienced by Trauma Centers. Multiple hospitals, particularly in Los Angeles, had dropped their Trauma Center designation, citing monetary losses. The closure or threatened closure of Trauma Centers in several areas of the state resulted in media attention and policy initiatives to increase state subsidies or develop alternative funding sources.[15] Physicians and hospitals indicated that the root problem of emergency and trauma care issues was the high level of uncompensated care. They believed that appropriate funding for trauma care would provide continued operation of existing Trauma Centers and lead to the establishment of new Trauma Centers.

Most of the efforts to increase California's trauma funding have focused on the direct reimbursement for patient care because of significant shortfalls reported by Trauma Centers. The main source of funding to compensate hospitals and physicians for uninsured and under-compensated emergency services, including trauma services for adults and children, comes through the Maddy Fund (HSC Division 2.5, Chapter 2.5). Additional revenues are derived from tobacco taxes that are earmarked, in part, for programs to provide health care services to indigent patients. Declining revenues from the tobacco tax have resulted in reduced support for trauma care. While the impact is yet to be seen, the expansion of both public and private insurance coverage through the Affordable Care Act may result in payment shifts that may drive new care models and fiscally benefit local trauma system efforts.

California statute (Health and Safety Code 1798.162-166) allows local trauma system development. Initially, funding from the State Trauma Fund (HSC 1797.198-199; 2001) was allocated to LEMSAs for Trauma Centers with a small amount earmarked for local trauma system development. Other statutes (HSC 1797.103, 1798.161) and regulations (CCR, Title 22, Division 9, Chapter 7, §100253) created significant EMSA responsibilities related to trauma care systems. No funding was provided for state or regional coordination, oversight, and evaluation of statewide trauma care. The only on-going funding source for EMSA for statewide trauma system coordination, data aggregation and analysis, and quality improvement activities is the Federal Preventive Health and Health Services (PHHS) Block Grant.

Two counties, Los Angeles and Alameda, have developed funding mechanisms for trauma care through assessments on property value. Other counties have established local fees to fund the coordination and administration of a trauma care system as authorized by HSC 1798.164.

Maddy Fund: The Maddy EMS Fund is financed through an additional penalty assessment on certain motor vehicle fines and forfeitures. The Legislature enacted Chapter 1240, Statutes of 1987 (SB 12), amended in 1988 (SB 612) allowing counties to establish a Maddy Emergency Medical Services Fund (Maddy EMS Fund) to compensate health care providers (hospitals and physicians) for emergency services for the uninsured and medically indigent, and to ensure the population has continued access to emergency care. A charge of $2 per $10 is levied on applicable fines, penalties, and forfeitures pursuant to Government Code 76000 and 76104 and section 42007 of the Vehicle Code. Although this funding is not specifically earmarked for

[15] Richard A. Narad and Daniel R. Smiley, *Trauma Care: System in Crisis*? California Policy Choices, Volume 7, University of Southern California, Los Angeles/Sacramento/Washington DC, 1991.

trauma care, it can be used for uncompensated emergency care reimbursements. Each county may establish an EMS Fund, upon the adoption of a resolution by the Board of Supervisors. Currently, 50 (86%) counties have established Maddy EMS funds pursuant to HSC Section 1797.98a.

Courts collect the penalty assessments or surcharges and forward them to the County. Ten percent of these revenues may be used by the county for the administration of the EMS Fund. The remaining funding is allocated as follows:

- 58% to the Physicians Services Account for payments made to physicians who care for patients who have no insurance coverage or are otherwise unable to pay for the emergency visit. Physicians may receive reimbursement for up to 50% of their claims;
- 25% to the Hospital Services Account for payments to hospitals for the provision of disproportionate trauma and emergency medical care services. Hospital costs may be reimbursed up to 100%;
- 17% to the Discretionary Account for other EMS purposes as determined by each county. Many LEMSAs depend on this funding to carry out mandated statutory EMS responsibilities, including trauma system administration.

An additional provision was enacted in 2006 (SB 1773, Alarcon) to allow a county to augment the Maddy EMS Fund from penalty assessments. This optional provision adds an additional penalty assessment of $2 per $10 and requires that 15% of the money deposited into the EMS fund from Government Code 76000.5 be allocated for funding pediatric trauma care (Richie's Fund[16]). The Alarcon penalty assessment has been implemented by 31 (53%) counties. SB 1465 signed in 2014, increased the transparency of the Maddy EMS Fund by requiring the local jurisdictions to report income and expenditures to EMSA, which aggregates and reports on the use of these funds.

AB 430: AB 430 (Cardenas, Chapter 171, Statutes of 2001), created the Trauma Care Fund (HSC §1797.198-199) to provide funding for trauma care to uninsured patients with a formula for distribution of funds by the LEMSAs for designated Trauma Centers. The funds were passed from EMSA to the LEMSA for distribution. From 2002 through 2005 a total of $55 million was provided for Trauma Center funding and $2.5 million was provided for planning and implementing trauma care systems for LEMSAs without a local Trauma Plan. The Trauma Care Fund has not received funding since 2005.

Local Data System Funding: Funds were made available to LEMSAs by EMSA as part of the Office of Traffic Safety and/or Federal Block Grants to modify their local data systems to be compliant with national standards and to participate in the California EMS Information System (CEMSIS). The total amount of funding provided from 2009 through 2016 was $1,527,637.

Regional Trauma Care Committee (RTCC) Funding: Funding was provided by EMSA to support the development of the RTCCs by funding regional summits and conference calls from

[16] California Health and Safety Code § 1797.98a: California Code - Section 1797.98a - See more at: http://codes.lp.findlaw.com/cacode/HSC/1/d2.5/2.5/s1797.98a#sthash.AhNKhS9Z.dpuf

the Federal Preventive Health and Health Services Block Grant. Each of the five RTCCs was allocated up to $10,000 per year during FY 2010/11 and FY 2011/12 for regional activities. Subsequently, due to financial limits at both the state and federal level, there has been no funding available since FY 2011/12 to fund the activities of the RTCCs.

V. Current Organization of Trauma Care in California

Trauma care systems in California are aligned with the two-tier regulatory structure of EMS in California consisting of EMSA and LEMSAs. EMSA is the state department responsible for developing statewide standards for local trauma care systems and Trauma Centers; providing coordination and leadership for the planning, development, and implementation of trauma care systems; and reviewing and approving local trauma care system plans.

State Trauma Advisory Committee (STAC)

The STAC is an 18 member body, appointed by the Director of EMSA under Health and Safety Code 1797.133, to assist in implementing trauma care and coordinating statewide activities. The STAC is comprised of physicians, nurses, administrators, and other EMS providers and personnel for the purpose of advising the EMSA Director on matters pertaining to the planning, development, and implementation of the local trauma systems (***Appendix C***). The Chair of the STAC has historically been a senior practicing trauma surgeon, recognized nationally for his/her experience and knowledge of trauma care and trauma systems. In 2009, the committee was reorganized to have broad representation with term limits from the major stakeholder groups in California.

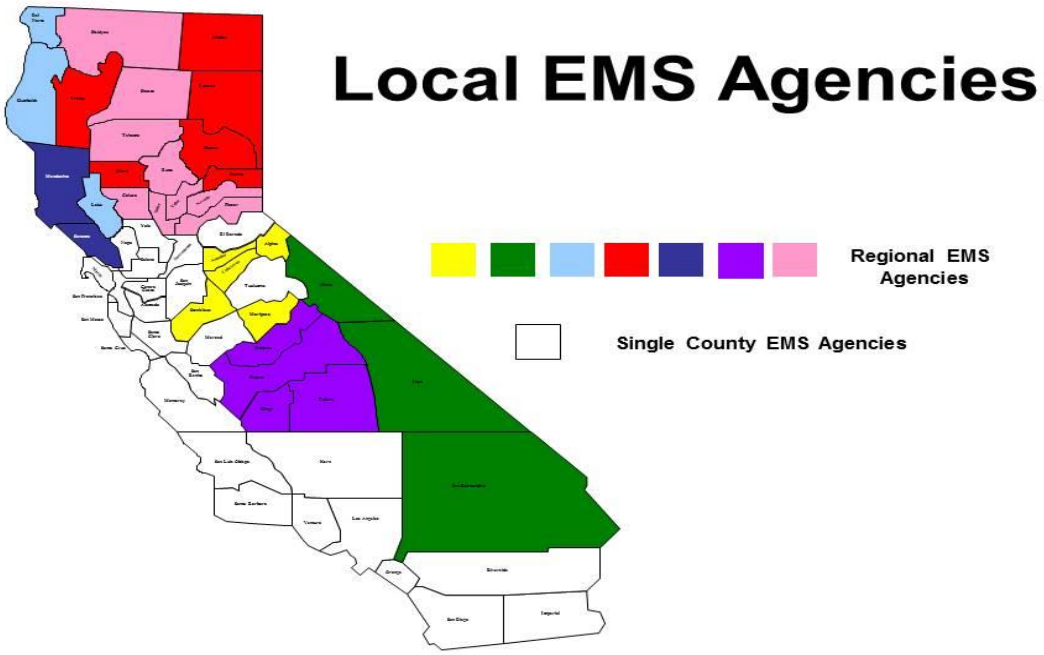


Figure 1

Local EMS Agency (LEMSA)

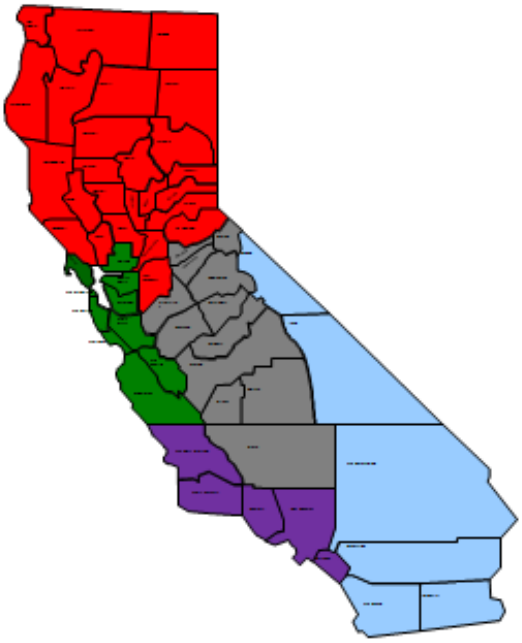
The LEMSA is charged with implementing statute, regulations, and local policy for trauma services in their area of jurisdiction, ensuring the system components function in concert

throughout the continuum of care. There are currently 33 LEMSAs (Figure 1) within the State of California; 26 are a single county and 7 have a multi-county jurisdiction. The LEMSA is responsible for:

- local trauma system plan development and implementation;
- local trauma system policy development;
- Trauma Center designation;
- monitoring compliance with contractual agreements in accordance with California statute, regulations and local policy;
- providing PIPS programs for ongoing review of trauma system performance and outcomes;
- facilitating a confidential and collaborative local trauma advisory committee;
- maintaining a local trauma database and participating in the State Trauma Registry (CEMSIS-Trauma); and
- participating in injury prevention, public and professional education.

Each LEMSA with a trauma care system is required by statute and regulation to submit a Trauma Plan for EMSA approval followed by annual Trauma System Status Reports. This Plan is designed to meet state minimum trauma system standards, and address local short and long term trauma system needs. Plans outline the number and level of Trauma Centers and patient destination, but do not necessarily address inter-county needs. All 33 LEMSAs have approved trauma plans.

Regional Trauma Coordinating Committees (RTCC)



North
North Coast EMS
NorCal EMS
Coastal Valleys EMS
Sierra-Sacramento Valley EMS
Napa County
Yolo County
Sacramento County
El Dorado County
San Joaquin County

Bay Area
Marin County
San Francisco County
Solano County
Contra Costa County
Alameda County
San Mateo County
Monterey County
San Benito County
Santa Clara County
Santa Cruz County

Central
Central CA EMS
Mountain Valley EMS
Merced County
Tuolumne County
Kern County

SouthEast
San Diego County
Riverside County
Imperial County
Inland Counties EM Agency

South West
Los Angeles County
Orange County
Santa Barbara County
Ventura County
San Luis Obispo County

Figure 2

As a result of recommendations made by the STAC and the 2006 *California Statewide Trauma Planning, Assessment and Future Direction* document, five trauma regions were defined by EMSA and corresponding RTCCs were created in 2008 (Figure 2). RTCCs function as a conduit between the regions and EMSA/STAC to aid in statewide coordination and development of local trauma systems. In addition, the RTCCs leverage a broad range of voluntary expertise within the five regions to facilitate communication and collaboration within and between regions, to share and support best practices, to assist with the interpretation of regional data, and to provide requested technical assistance to LEMSAs and to EMSA related to the development and operation of a system of trauma care for the State of California. RTCCs may facilitate discussions related to trauma care challenges within the region working towards resolutions to minimize variations in practice. Additional regional issues may include addressing geographic isolation, coordination of trauma care resources, and funding for out-of-county patients. RTCC membership is currently voluntary and is 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 Center Managers, non-trauma facility representatives, EMS providers, and CA Hospital Association representatives. State-level activity includes representation on the STAC, (acting as a subcommittee) reporting regional activities and issues, sharing regional work products, and relaying STAC information and decisions back to the region.

Trauma Centers

Trauma Centers are the key element in a trauma system and the focal point for trauma care. Many Trauma Centers participate in state and regional trauma system planning and development. Lead Trauma Centers (Level I and II) contribute administrative and medical leadership, and academic expertise to the system. Many of these lead Trauma Centers, in collaboration with the LEMSA, engage all other Trauma Centers (Level III and IV), and a few include non-trauma acute care facilities, in the performance improvement process.

As of April 2017 there are 80 designated Trauma Centers (Table 1) in California (***Appendix D.***) It is estimated that over 70,000 trauma patients are admitted to Trauma Centers in the state annually.

TOTAL TRAUMA CENTERS BY DESIGNATION	
Level I Pediatric Trauma Center Only	2
Level II Pediatric Trauma Center Only	3
Level I Trauma Center & Level I Pediatric Trauma Center	5
Level I Trauma Center & Level II Pediatric Trauma Center	3
Level II Trauma Center & Level II Pediatric Trauma Center	4
Level I Trauma Center	5
Level II Trauma Center	34
Level III Trauma Center	13
Level IV Trauma Center	11
TOTAL:	**80**

Table 1

LEMSAs may designate Trauma Centers that have the capability and willingness to demonstrate a commitment to trauma care based on population needs and meet state trauma regulation requirements. The designation process is locally controlled and may include a hospital site visit by the ACS's Surgeon's Verification Review Team or teams developed by the LEMSA consisting of trauma care experts. Contracts are developed between the LEMSA and the Trauma Center, and compliance is monitored by the LEMSA periodically.

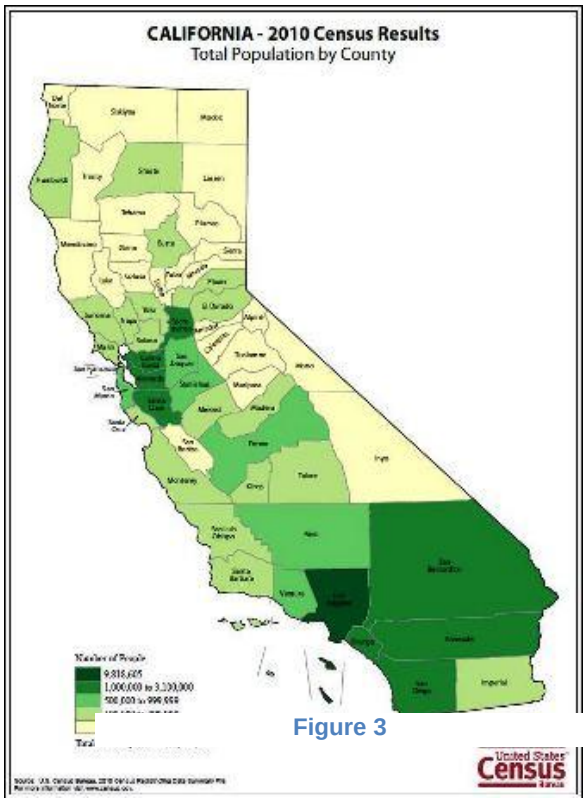


Figure 3

Trauma Center designations include Levels I – IV and Pediatric Levels I and II. Level I and II Trauma Centers (including pediatric Trauma Centers) have the greatest number of specialty personnel, services, and resources. Level I Trauma Centers are also research and teaching facilities. Level III Trauma Centers provide a surgical service for patients with less critical injuries which may or may not need surgery. Level IV Trauma Centers provide initial stabilization of trauma patients. Level III and IV Trauma Centers provide secondary transfer to a higher level of Trauma Center care when appropriate.

The participation of all acute care hospitals in the trauma system, providing initial assessment and care with appropriate transfer to Trauma Centers, is also a key component of an inclusive trauma system. Hospitals that are not Trauma Centers will see both patients brought by private transportation as well as patients not initially identified as having severe trauma by EMS transport providers.

System Challenges

There are many challenges and complexities for California related to trauma care, including the vast geographic area of the state with variation in terrain, population density, (Figure 3) diverse EMS cultures, weather, resources, hospital and health facility locations, and the decentralized nature of EMS in the state.

The current trauma care delivery system is an optional, locally based, decentralized trauma system as prescribed in the Health and Safety Code. Given the vast and diverse topography, transportation and access issues exist in varying degrees across the State.

The examples below illustrate some of the variation in transportation issues that are inherent between urban and rural trauma systems within California. These differences illustrate the need for coordination across the state. It is common for patients from the isolated rural areas to be

stabilized then transferred long distances to a higher level Trauma Center.

Urban California
Los Angeles and San Diego Counties have well-established trauma systems that began in the early 1980s with numerous designated Trauma Centers. San Mateo County has a coordinated trauma system without a designated Trauma Center, utilizing out-of-county Trauma Centers.

Rural California:
The entire northern geographic one-third of the State (counties of the North RTCC as described in Figure 2) has one designated Level I Trauma Center (also Pediatric Level I), six Level IIs, eight Level IIIs and eight Level IVs. The higher level centers tend to be in the more populated areas, leaving vast rural and remote sections of the State with no hospitals, few designated Trauma Centers and long transport distances over difficult terrain. Large portions of these areas experience weather extremes, periodic isolation and lack immediately available medical resources.

The northern coast of California typically experiences extended patient discovery and transport times due to difficult terrain and winding roads with no air medical resources based within the region. Prompt and efficient transport of patients to higher level Trauma Centers is extended due to distance to urban centers and, as a result, many cases are interfacility transfers. In the more southern portion of the north coast, air medical resources are more readily available resulting in direct transport from the scene to a higher level Trauma Center whenever possible.

Geographic areas with gaps in trauma service include North Eastern and Central California (east of Interstate 5 to the Nevada border, including Yosemite), and parts of the Central Coast area including the vacation and college town of Santa Cruz. While transport to a Trauma Center occurs, it requires use of limited air transport resources, long ground transport times, or a secondary transfer resulting in delays to definitive care. In addition, these transports remove patients from their community and family support as well as placing additional burdens on the receiving Trauma Center that is already serving its own community.

VI. Statewide Trauma System Planning: Project Approach and Methods

The STAC has developed these Statewide Trauma System Planning recommendations to assist EMSA in the implementation of best practices and system improvements for the trauma system in California. The STAC created an expert writing group for each planning component to assist in the recommendations. The lead for each group was chosen based on their knowledge of the assigned component. The writing groups reviewed and analyzed information related to current trauma care in the state, including statute and regulations, national standards and guidelines, trauma care costs and losses, and national trauma and emergency care reports to develop recommendations.

The Statewide Trauma System Planning development process included the following.

Review of Current Trauma Care in California
Regulations and statutory authority were reviewed to determine the current framework for how trauma care is delivered in California. In addition, this review considered how local optional systems for trauma care delivery in California were developed and the limitations of that approach.

The 2008 ACS Committee on Trauma "Regional Trauma Systems: Optimal Elements, Integration, and Assessment offers a guide to assist in trauma system development and implementation in line with the HRSA Model. The California Statewide Trauma System Planning recommendations are more in line with the context and substance found in the ACS document, taking into consideration HRSA's public health conceptual model.

ACS provided a trauma system assessment in March 2016 based on this document. The review team complimented EMSA on well written Statewide Trauma System Planning recommendations. Recommendations from the ACS Assessment Report were then integrated into the Statewide Trauma System Planning objectives. **(*Appendix B*)**

Review of the 2006 Institute of Medicine (IOM) Report on the Future of Emergency Care in the United States Health System
The report, released in June 2006, is the first comprehensive look by the IOM at hospital-based emergency and trauma care, emergency medical services, and emergency care for children. The STAC used some of the report's findings in making recommendations contained in these Statewide Trauma Systems Planning recommendations.

Analysis of National Standards for Trauma Care Delivery Systems and how they relate to California's Trauma Care Needs
California's current trauma care system was evaluated based on two nationally recognized authorities in trauma system development. In 2006, the Health Resources and Services Administration (HRSA) revised its previous *Model Trauma Care System Plan* and re-titled it *Model Trauma System Planning and Evaluation*. This document continues to emphasize the need

for a fully inclusive trauma care system. It provides a modern system development guide using the public health approach to the development and evaluation of trauma systems. A primary strategy of the public health approach is to identify a problem based on data, devise and implement an intervention, and evaluate the outcome.[17]

The ACS *Regional Trauma Systems: Optimal Elements, Integration, and Assessment* guide takes the concepts from the HRSA document and provides a self- assessment tool for trauma system planning, development and evaluation. In addition, the ACS Committee on Trauma's 2014 *Resources for Optimal Care of the Injured Patient* provides detailed descriptions of the organization, staffing, facilities, and equipment needed to provide state-of-the-art treatment for the injured patient at every level of trauma system participation.

The HRSA document is the standard model for the development of the administrative components of a trauma plan, and the ACS standards provide important organizational and clinical standards related to systems and Trauma Center designation. These two documents, when used together, form the typical approach to trauma system planning and evaluation.

The HRSA and ACS documents were consulted in the development of the California Statewide Trauma System Planning recommendations and provided the major functional components of an inclusive statewide trauma system, which were used to develop the fifteen components in the Statewide Trauma System Planning recommendations:

An Inclusive trauma system uses all available hospital resources to ensure rapid access to trauma care by prehospital personnel for all injured patients regardless of their geographic location, and will increase surge capacity in a traumatic disaster. The Trauma Center remains the key component in this system; however, all facilities are matched with a patient's needs. Other components include injury prevention, medical examiners and rehabilitation services.

1. Administrative Components
   A. Leadership—an identified lead agency with the authority, responsibility and resources to lead the development, operations, and evaluation of the trauma system
   B. System Development—a defined planning process for trauma system development, assessment, and evaluation
   C. Finance—financial forecasting and accountability by the State, local trauma systems, and Trauma Centers

2. Operational and Clinical Components
   A. Prehospital Care
   B. Ambulance and Non-Transporting Medical Unit Guidelines—regulations, medical control, and geographic boundaries for prehospital medical units
   C. Communication System—fully integrated with EMS and emergency/disaster preparedness systems

3. Definitive Care
   A. Trauma Care Facilities—uniform standards for Trauma Center designation; identified role and responsibilities for other acute care facilities

[17] **Model Trauma System Planning and Evaluation,** Health Resources and Services Administration, February 2006.

B. Interfacility Transfer—development of policies and procedures for appropriate and expeditious transfer
C. Medical Rehabilitation—coordinated post-acute care for trauma patients with permanent or long-standing impairment

4. Information System—timely collection of data from all providers in the form of consistent data sets meeting minimum established standards

5. System Evaluation and Performance Improvement—use of data to monitor the performance of the system components

6. Education and Training—education for all levels of trauma care personnel, both hospital and prehospital as well as public education

7. Trauma System Research—trauma related research to include epidemiologic research in prehospital care, acute care, rehabilitation and prevention

8. Injury Prevention and Control—comprehensive and integrated approach to injury prevention

9. Emergency/Disaster Preparedness—fully integrated with EMS system, local government, private sector and acute care facilities

HRSA Model Trauma Guidelines Assessment of California

The **"***2006 Health Resources Services Administration Model Trauma System Planning and Evaluation***"** demonstrates the interrelationship of the core functions, essential services and trauma system benchmarks. It depicts core research that drives the system and essential governance structure that supports system management, and system benchmarks that circulate around the core constructs. This model supports assessment, policy development and assurance representing core functions of public health necessary for successful trauma system development.[18] The document also provides an assessment tool to evaluate how California's delivery of trauma care meets the national standards set forth in the document. The document was developed by a group of national experts with input from each state, including California. The intent of the tool is to allow an individual trauma system to identify its strengths and weaknesses, prioritize activities, and measure progress against itself over time. Guidelines are designed to provide trauma care professionals and health policy experts with direction in developing integrated statewide trauma systems focused on a public health model for injury prevention and disability mitigation after injury. The document includes core functions with benchmarks and indicators for planning a statewide trauma system. Each core function in the tool (Assessment, Policy Development, and Assurance) contains a variety of benchmarks. These benchmarks are based, to the extent possible, on current literature on trauma system development. The benchmarks focus primarily on process measures. It is assumed that meeting these process measures should result in improved outcomes.

[18] **Model Trauma System Planning and Evaluation**, Health Resources and Services Administration, February 2006,

Using the HRSA document, the STAC assessed California's current system of trauma care and identified next steps to develop an inclusive and comprehensive State Trauma System. ***Appendix A*** provides California's current status of these benchmarks based on the 2006 Trauma System Assessment Indicators. Although all components of the HRSA assessment are important, because of the nature of California's system, these Statewide Trauma System Planning recommendations configure the national indicators into 15 components allowing for a more manageable and tailored approach to the implementation of trauma care/system improvements.

Surge Capacity Assessment

EMSA used the HRSA bioterrorism standards to determine California's readiness related to surge capacity for the care of critical trauma. The HRSA benchmark states that systems shall be established that, at a minimum, can provide triage, treatment, and initial stabilization above current daily staffed bed capacity for adult and pediatric patients requiring burn and/or trauma care hospitalization within three hours in the wake of a terrorism incident or other public health emergency. HRSA has established an ad hoc surge capacity target of 500 extra hospital patients per million population in urban areas. [19] To date, this benchmark has not been evaluated, independent of general hospital surge capacity.

Surge Capacity—health care system's ability to expand quickly beyond normal services to meet the increased demand for medical care in the event of bioterrorism or other large-scale public health emergencies.

A trauma/burn bed is much more than an acute hospital bed as it implies that a multidisciplinary trauma team, with trauma care expertise and adequate ancillary support and facilities, is immediately available to perform emergency surgery. Multiple critical trauma and burn patients arriving at a Trauma Center create a unique surge challenge to such a system.

Incorporation of the recommendations made in the 2006 *California Statewide Trauma Planning: Assessment and Future Direction*

In addition to the findings from the HRSA assessment, there were three primary recommendations that were cited for the trauma system in the 2006 *California Statewide Trauma Planning: Assessment and Future Direction* document. Progress on these recommendations was evaluated, as work continues:

1. Strengthen State Trauma Leadership

The development of trauma systems is not required in statute or regulations; however all 33 LEMSAs have Trauma Plans approved by EMSA. The Annual Trauma System Status Report from each LEMSA must show that the LEMSA is in compliance with its approved Trauma Plan as well as statute and regulations. Since the publication of the *California Statewide Trauma Planning: Assessment and Future Direction* in 2006, 22 additional Trauma Centers have been designated.

[19] Bioterrorism and Health System Preparedness. Rockville (MD): Agency for Healthcare Research and Quality; Optimizing surge capacity: regional efforts in bioterrorism readiness. Issue Brief No. 4. AHRQ Publication No. 04-P009. Also available from: URL: http://www.ahrq.gov/news/ulp/btbriefs/btbrief4.htm.

In 2008, EMSA established five RTCCs as a method to address gaps and inconsistencies and improve surge capacities. The RTCCs bring together system stakeholders and member LEMSAs to facilitate communication and coordination to minimize variations in practice, and provide regional performance improvement activities to advance the delivery of quality trauma care. Standardization occurs through state coordination, collaboration between RTCCs to support state standards, sharing of best practices, and promoting uniformity of data collection. EMSA participates in each RTCC by providing updates on statewide EMS issues and soliciting feedback on current projects under development. Each RTCC is a subcommittee of the STAC and provides representation where RTCC activities are shared and discussed. The STAC provides guidance to the RTCC as needed.

2. Develop Statewide Trauma Registry

The California EMS Information System (CEMSIS) was developed as a demonstration project funded by the Office of Traffic Safety. Data collection at the state level is dependent on the local EMS and trauma data systems managed by the local EMS agencies. The current regulations require the integration of prehospital and hospital trauma system data into the LEMSA and the EMSA data system (CCR, Title 22, Division 9, Chapter 7, §100253). Trauma Centers send trauma data into CEMSIS – either directly or through their LEMSA. From 2009 through 2012, CEMSIS collected over 250,000 patient care records. The standards for data collection are based on national standards established by the National Trauma Data Bank. In 2013, the State migrated CEMSIS into new data system software. As a result, LEMSAs have modified their systems for submission to the state. Participation has improved significantly over time. From 2013 through 2016, CEMSIS has collected over 250,000 patient care records.

3. Consider Trauma System Funding

Limited funds were made available to LEMSAs to modify their local data systems to be compliant with national standards and participate in CEMSIS. In addition, seed monies were provided to the RTCCs to assist in regional summits and conference calls. These monies are no longer available and there is no dedicated funding for state oversight of the Trauma System.

VII. Trauma System Strategies and Directions

Based on the HRSA benchmarks (Figure 4) and a current evaluation of California's trauma system, utilizing the ACS's trauma system guidance document, the following 15 components outline the future recommendations to continue the successful development and implementation of an effective Trauma System. Details on the proposed development for each component are found in ***Appendix B*** including the recommendations found in the ACS State Trauma System Assessment Report.

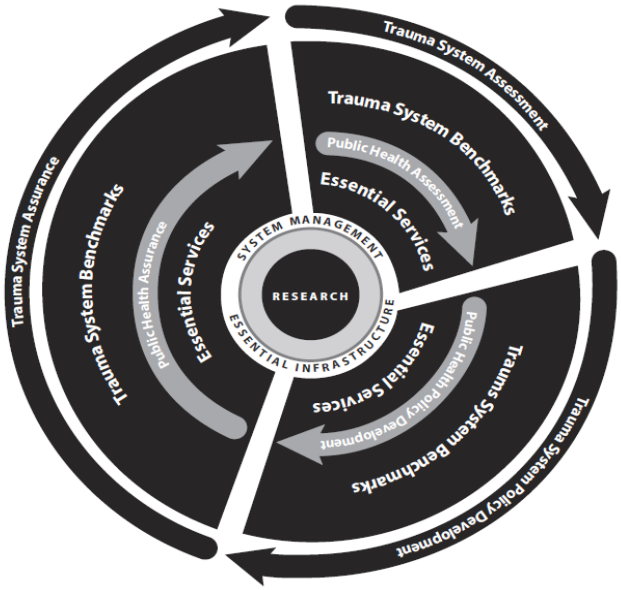


Figure 4

1. State Leadership—HRSA Benchmark #202 (200 series: policy development). *Trauma system leaders use a process to establish, maintain, and constantly evaluate and improve a comprehensive trauma system in cooperation with medical, professional, governmental and citizen organizations. This requires strong state leadership.*

Barriers

Under the current statutory and regulatory framework, trauma is an optional local program. Since all 33 local EMS agencies have trauma plans in place, care is being provided locally; however, the trauma community perceives the need for improved coordination of patient movement between LEMSA systems in addition to greater consistency in standards of care. EMSA has staff to review and approve statutorily mandated trauma plans but insufficient staff or central resources to fully coordinate a statewide trauma system. Limited resources at the state level mean that there is limited oversight of the locally based systems including lack of comprehensive regional and statewide performance analysis to assess such issues as field triage and timely access to care. While California's decentralized approach to EMS permits flexibility and the tailoring of EMS practices to local needs, it has also allowed problematic variability in trauma care practices, as previously described under system challenges.

Opportunities

LEMSA and EMSA leadership remains essential to the overall success of the trauma system. The creation and development of RTCCs represent a principal change in the structure of the trauma system, including the composition of the STAC that now includes regional representatives from each RTCC.

The RTCCs do not replace LEMSAs or supplant the authority that EMS agencies currently maintain over EMS and trauma systems, but should have State support to build upon existing local EMS jurisdictions to address challenges of access, geographic isolation, coordination and optimal distribution of trauma care resources, and funding of out-of-county patients.

A regional structure, supported by the LEMSAs and RTCCs encourages optimal sharing of resources and information. Patient flow patterns, provisions for uncompensated care, and quality of care are improved through optimal sharing of resources throughout the region. The STAC and EMSA promote interregional standardization.

Goal: EMSA provides coordination, guidance, and assistance to the LEMSAs and RTCCs to enhance the consistency of trauma-related standards and guidelines throughout the state and improve the overall quality of trauma care

Objectives:

1. EMSA to encourage the collaborative efforts of the counties to support and share resources for a regionally-based trauma system.
2. EMSA to work with the LEMSAs, STAC and the RTCCs to develop a consensus compendium of trauma-related policies, procedures, and clinical guidelines that may be shared throughout the state.
3. LEMSAs to develop local trauma plans in the context of regional trauma care with input from Trauma Centers and RTCCs.
4. Establish basic quality and activity reporting standards and report templates for the LEMSAs to ensure that EMSA, STAC, and PIPS subcommittee receive sufficient data to assess state trauma system performance.

2. System Development—HRSA Benchmark #203 (200 series: policy development). *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 emergency management. The written trauma system plan is developed in collaboration with community partners and stakeholders.*

Barriers

Since trauma system development is optional, and the commitment to advanced trauma care by an existing facility with the population to support it is necessary, there is a wide range of trauma system models in California. The variance runs from LEMSAs with well-established trauma systems with designated Trauma Centers at various levels to LEMSAs that have limited implementation of the plan or no designated Trauma Centers. The ability to help coordinate trauma system activity and facilitate related interactions among all the LEMSAs by EMSA and STAC has historically been limited.

Opportunities

The LEMSA may assist EMSA in providing for a comprehensive analysis of trauma resources throughout the State including access-to-care assessment. The STAC may provide guidance and coordination for specific RTCC activities and projects with statewide implications.

Goal: Develop an inclusive statewide trauma system that provides an appropriate level of care for all individuals following major injury.

Objectives:

1. Conduct a systematic review of local trauma plans in the context of these Statewide Trauma System Planning recommendations and the structures and processes it outlines.
2. Develop processes and mechanisms for providing optimal care to special populations; for example, pediatric populations.
3. Update regulations to set specific standards and requirements for trauma system implementation, and to address changes to be consistent with the California Statewide Trauma System Planning recommendations, 2017.

3. Trauma System Financing—HRSA Benchmark #204 (200 series: policy development) and #309 (300 series: assurance). *The financial aspects of the trauma systems are integrated into the overall quality improvement system to assure ongoing "fine-tuning" and cost-effectiveness.*

Barriers

Beyond the Maddy EMS Fund, there is limited statewide funding to support local trauma systems, Trauma Centers or emergency/trauma care. Previously, legislation has been proposed to identify funding through levying taxes or fees on products associated with trauma, (i.e. alcohol, ammunition, firearms). However, these efforts have not been successful. The Tobacco Tax in 1990 was the last approved tax for uncompensated care; however, the majority of these funds have been redirected to other programs at the State, and the limited remaining funds do not go to the organization, coordination, and development of the State Trauma System. The lack of standardized data collection across the State leads to limited information about trauma care to inform policy based on cost effectiveness and efficiency. Beyond very limited federal grant funds, there is no stable funding source to manage the Trauma System.

There are three areas where funding is needed to develop an effective State Trauma System:

1. Support for uncompensated care
   There are insufficient data to analyze the current fiscal status of our Trauma Centers. Historically, trauma system providers have indicated that additional Trauma Center funding is required. Health and Safety Code §1797.199 created the Trauma Care Fund for the purposes of compensating Trauma Centers for high percentages of uninsured patients, but this fund has not had appropriation since 2005. As more patients obtain coverage through the Affordable Care Act, and insurance coverage is expanded in both the public and private sector, the changes to trauma care reimbursement patterns should be studied under these changing payment mechanisms.

2. Support for EMSA and LEMSA administration of the program
   Under current law, some LEMSAs receive only a small percentage of existing funds (Tobacco, Maddy, etc.) to support administrative, hospital, and physician costs. Some LEMSAs support local trauma system administrative and data costs through Trauma Center designation fees, which vary (from $0 to $100,000) across the State. There is

insufficient information about local funding to determine if there are enough resources to meet trauma system regulatory mandates and national guidelines. System requirements for performance improvement necessitate stable funding. In addition to funding, data are required for system evaluation, including fiscal information and post-discharge outcome data from rehabilitation facilities.

Current State Trauma System oversight is funded through the Federal Preventive Health and Health Services Block Grant.

3. Increase participation of community hospitals in the trauma system
   Funding is necessary to initiate development of level III and IV Trauma Centers to provide regional trauma care in rural areas without nearby higher level trauma capacity. Existing local funding sources in rural areas are insufficient to fund both facilities and system administration.

Opportunities

The Affordable Care Act reauthorizes and improves the trauma care program by providing competitive grants, administered by the U.S. Health and Human Services Secretary, to states and Trauma Centers to strengthen the nation's trauma system. The prerequisites for some of this funding may include the establishment of tracking communications systems and participation in the National Trauma Data Bank. Although the Affordable Care Act reauthorizes the trauma care program, funding has not been appropriated.

Goal: EMSA, in collaboration with the STAC, LEMSAs, and RTCCs, to explore the feasibility of a State Trauma System Business Plan to identify the system's current financial status, perform a needs assessment to identify specific aspects of the system that need funding, and identify opportunities for future trauma system funding. It is important to recognize that dollars spent on infrastructure are returned through improved performance and quality of care that lead to better patient outcomes.

Objectives:

1. Identify critical Trauma System components and the cost to develop and maintain them.
2. Work with researchers and hospitals to establish a basis for estimating the actual cost for trauma care in California
3. Identify sustainable funding sources to support regional infrastructure and planning.

4. EMS System: Prehospital Care—HRSA Benchmark #302 (300 series: assurance). *The trauma system is supported by an EMS system that includes communication, medical oversight, prehospital triage, and transportation; the trauma system, EMS system, and public health agency are well integrated.*

Barriers

Trauma triage and destination policies often reflect the availability of trauma services within a specific community. With varying availability of resources, along with dense and sparse

populations there is variation in trauma triage criteria and destination determinations. The study of under and over triage has been limited due to differing triage policies and definitions.

Opportunities

The Centers for Disease Control and Prevention and the ACS Committee on Trauma have developed national trauma triage guidelines. These guidelines have been adopted by many of the LEMSAs both locally and regionally through RTCC collaboration.

Goal: Develop a minimal statewide standard for the triage of trauma patients to enable study of under and over triage.

Objectives:

1. Utilize the most current national standard for prehospital triage as the foundation for prehospital trauma triage guidelines. Based on specific environments (e.g. urban vs. rural) and presence or absence of Trauma Center resources, some local modifications may be required.
2. Develop definitions to study over and under triage with a mechanism to track on a regional basis.
3. Work with OSHPD in obtaining specified data from non-trauma facilities on major trauma patients transported to the facility and not transferred.
4. Adopt standards for transfer of documented information from field units to receiving hospitals with the goal that prehospital care reports be made available as part of the medical record for all trauma patients.
5. Explore the need for minimal special population field trauma triage criteria,

   e.g. pediatric and geriatric.
6. Develop EMS protocol guidance for field trauma care

5. EMS System: Ambulance and Non-Transporting Medical Units—HRSA Benchmark #302 (300 series: assurance). *The trauma system is supported by an EMS system that includes communication, medical oversight, prehospital triage, and transportation; the trauma system, EMS system, and public health agency are well integrated.*

Barriers

Non-transporting prehospital medical units are configured in various ways throughout California. In urban regions, it's common for non-transporting units to be fire apparatus staffed by EMT or paramedic level personnel. Rural areas (including state and federal parks, forests, and beaches) may have staff cars or rescue units in various configurations and capabilities staffed with trained first responders, EMTs, or in some cases paramedics; many have volunteer personnel. Organized search and rescue teams also fit the category of non-transporting EMS units. Because of the diverse population and environmental challenges in California, response and transport times for EMS units vary significantly from area to area.

Opportunities

National recommendations have been developed for standards for equipment inventories of EMS resources. EMSA enforces EMS Aircraft regulations and publishes statewide Prehospital EMS Aircraft Guidelines.

Goal: Provide a minimum standard and align the use of ground vs. air resources for the transport of trauma patients to the closest appropriate level of Trauma Center that is equipped and staffed to best meet the needs of the injured patient.

Objectives:

1. Develop minimum prehospital equipment inventory for non-transport/transport EMS units specific to trauma needs.
2. Recommend air resource utilization guidelines applicable state-wide including access to air resources.

6. EMS System: Communications—HRSA Benchmark #302 (300 series: assurance). *The trauma system is supported by an EMS system that includes communication, medical oversight, prehospital triage, and transportation; the trauma system, EMS system, and public health agency are well integrated.*

Barriers

The current 911 alert system has limited integration with cell phones or internet-based communication methods. Many small dispatch centers and rural regions are without priority dispatch or protocols.

Opportunities

PIPS Programs and processes are found in systems utilizing Emergency Medical Dispatching (EMD). Opportunities exist to expand the implementation of PIPS in dispatch centers regardless of implementation of an EMD program.

Goal: Standardized communications to be coordinated between all EMS systems on a given incident, utilizing current technology, to notify the trauma care team of essential information about the injured patient and ensure that appropriate destination decisions are made.

Objectives:

1. Develop guidance for priority dispatch protocols for trauma and investigate process changes that improve dispatch effectiveness while improving outcomes.
2. Study the hospital alert systems currently in place to identify hospital capability, capacity, and specialty care availability (e.g., burns, pediatrics,) and complete a gap analysis.

7. Definitive Care: Acute Care Facilities—HRSA Benchmark #303 (300 series: assurance). *Acute care facilities are integrated into a resource-efficient, inclusive network that meets required standards and that provides optimal care for all injured patients.*

Barriers

There are currently 343 acute care facilities with emergency departments in the state of California. Of these, 80 are designated Trauma Centers. Twenty California counties currently have no designated Trauma Centers within county lines. The process by which a non-trauma facility applies for and achieves formal LEMSA designation, as well as the process for re-designation varies throughout the state.

Opportunities

The Trauma System with respect to its acute care facilities should strive towards providing basic trauma care throughout the state, make every effort to provide definitive care regardless of the type and severity of injury, have designated centers maintain capabilities commensurate with their level of designation, and improve the consistency of processes related to initial and recurring designation.

Goal: Develop a network of acute care facilities intended to provide universal access to the appropriate level of trauma care.

Objectives

1. Develop guidelines outlining a process for the assessment of Trauma Center compliance with CCR Title 22, Chapter 7.
2. Outline the responsibilities and expected participation in the trauma system for non-designated acute care hospitals.
3. Establish EMSA guidelines to standardize the Trauma Center designation process across LEMSAs.

8. Definitive Care: Re-triage[20] Interfacility Transfer—HRSA Benchmark #303 (300 series: assurance). *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 the patients are expeditiously transferred to the appropriate, system-defined trauma facility.*

Barriers

The frequency, location, and severity of related injuries involved with re-triage and interfacility transfer within the state are largely unknown. Obstacles to transfer and re-triage include lack of a proximally located Trauma Center, lack of knowledge regarding the capacity and capabilities of potential receiving centers, concern about potential EMTALA violations if patients are not fully evaluated and treated before transfer to a higher level of care, local geographical and climatic obstacles to transportation (e.g. remote location, mountains, fog, etc.), or transportation availability.

[20] *For purposes of this document, re-triage means the immediate evaluation, resuscitation and transport of a seriously injured patient from a lower level trauma facility or NTC to a designated Trauma Center at a higher level of care. This process involves direct ED to ED transfer of patients that have not been admitted to the hospital. Interfacility transfer (IFT) refers to the transfer of an admitted patient, under the care of an admitting physician-of-record, from one facility to another.*

Opportunities

Re-triage/Interfacility Transfer (IFT) protocols have been developed in several areas in the state, and their effectiveness has just begun to be monitored.

Goal: Develop mechanisms, processes, and guidelines that will optimize timely access to trauma care at a level commensurate with the severity of injury, regardless of geographic location.

Objectives:

1. Capture re-triage and IFT data in CEMSIS for statewide analysis and develop a map of re-triage and IFT traffic within the state.
2. Explore the development of centralized re-triage/transfer coordination within the state.
3. Assist in the development of regional cooperative arrangements between sending and receiving centers that will facilitate re-triage, reduce delays, and provide that patients are re-triaged to an appropriate level of care.

9. Definitive Care: Rehabilitation—HRSA Benchmark #308 (300 series: assurance). *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.*

Barriers

California trauma regulations currently contain specific requirements for early rehabilitation involvement and the utilization of physical, occupational, and/or speech therapies for the trauma patient, some of which may be provided through a written transfer agreement. Most rehabilitation facilities are independent facilities and the degree of integration into the trauma system varies considerably. In addition, the degree of access to level-of-care post-injury rehabilitation throughout the state is unknown.

Opportunities

The rehabilitative needs of trauma patients in the context of a statewide system of care should be systematically addressed using acceptable standards.

Goal: Develop a plan to assess the availability and capabilities of rehabilitation facilities in the state and integrate them into the regional planning and performance improvement process.

Objectives:

1. Improve the data collection for evaluation of rehabilitative needs and degree of access to rehabilitation throughout the state
2. Adopt a standardized measure of functional recovery suitable for use throughout the trauma system

10. Information System—HRSA Benchmark #101(100 series: assessment). *There is a thorough description of the epidemiology of injury in the system jurisdiction using both population-based data and clinical databases.*

Integration of our trauma and EMS data with performance dashboards and more in-depth analysis is imperative to improving and continuously monitoring the Trauma System. Continued collection of trauma system data is necessary to assess performance, quality, utilization and prevention, benchmark against existing national standards, and to inform future policy decisions and directions.

Barriers

With the exception of the counties included in the multi-county EMS agencies, participation in CEMSIS by LEMSAs is inconsistent. While data-related regulations exist for Trauma Centers and LEMSAs, compliance with these requirements from LEMSAs and non-trauma facilities is disparate. In addition, data elements and their definitions vary among LEMSAs, and thus interpretation of outcomes or processes is inconsistent. In the absence of statewide trauma system data, including financial data, a reliable assessment of system performance and determination of additional system resource needs is imprecise.

CCR Title 22 §100257 states:

(a) The local EMS agency shall develop and implement a standardized data collection instrument and implement a data management system for trauma care.
(1) The system shall include the collection of both prehospital and hospital patient care data, as determined by the local EMS agency;
(2) trauma data shall be integrated into the local EMS agency and State EMS Authority data management system; and
(3) all hospitals that receive trauma patients shall participate in the LEMSA data collection effort in accordance with LEMSAs policies and procedures.
(b) The prehospital data shall include at least those data elements required on the EMT-II or EMT-P patient care record, as specified in Section 100129 of the EMT-II regulations and Section 100176 of the EMT-P regulations.

Opportunities

The State Trauma Registry should be linked with the EMS Data System (prehospital care data) to create a robust program in support of the EMS system core measures to achieve process and outcome measures to better measure trauma care across the state. In addition, the system should be expanded to include a minimal dataset from non-trauma facilities. There should be a process to evaluate the quality, timeliness, completeness, and confidentiality of data.

Effective January 2016, Health and Safety Code, Division 2.5, Chapter 3, Article 2, permits the release of patient-identifiable medical record information to an EMS provider, LEMSA and EMSA for quality assessment and improvement purposes.

1797.122. (Sharing of Patient-Identifiable Data)
(a) Notwithstanding any other law, a health facility as defined in subdivision (a) or (b) of Section 1250 may release patient-identifiable medical information under the following circumstances:

(1) To an EMS provider, information regarding a patient who was treated, or transported to the hospital by, that EMS provider, to the extent that specific data elements are requested for quality assessment and improvement purposes.
(2) To the authority or the local EMS agency, to the extent that specific data elements are requested for quality assessment and improvement purposes.
(b) An EMS provider, local EMS agency, and the authority shall request only those data elements that are minimally necessary in compliance with Section 164.502 (b) and Section 164.514 (d) of title 45 of the Code of Federal Regulations.

Goal: Establish linkages of databases to create a complete patient record.

Objectives:

1. Improve data sharing
2. Improve data quality and compliance
3. Evaluate data validity

11. System Evaluation and Performance Improvement—HRSA Benchmark #301(300 series: assurance). *The trauma management information system is used to facilitate ongoing assessment/analysis and assurance of system performance and outcomes and provides a basis for continuously improving the trauma system including a cost-benefit analysis.*

Barriers
The role of the RTCCs in overall system performance improvement is still being developed. Participation by non-trauma facilities in the local trauma system PIPS Program, including contributing data to the LEMSA's trauma registry, is inconsistent across LEMSAs. Without consistent metrics to measure performance across the LEMSA boundaries effectiveness of a statewide system cannot be demonstrated.

Opportunities
In order to evaluate the Trauma System, the continuum of care from dispatch to prehospital to hospital disposition must be connected through a data system. Only then can we begin to understand how care provided translates to improved outcomes and system effectiveness.

Goal: A PIPS Program to be developed by EMSA in collaboration with the LEMSAs and RTCCs to evaluate statewide trauma system performance.

Objectives:

1. In collaboration with the LEMSAs, and with the participation from the RTCCs, formulate a statewide comprehensive Trauma PIPS Plan consistent with the elements of these Statewide Trauma System Planning recommendations. Utilizing State Trauma Registry data:
    a) Measure performance and quality through the development and analysis of system-wide performance improvement standards that are applicable statewide.

b) Develop methodologies for outcomes analysis, using both registry data and OSHPD hospital and emergency department discharge data and medical examiner/coroner data.

c) Promote case-based performance improvement whereby sentinel events relative to trauma system deficiencies are identified.

d) Develop a methodology to assess over and under triage to support evaluation of field triage protocol.

2. Evaluate state data, identify regional opportunities for improvement, determine if similar opportunities are occurring in other regions, and explore mechanisms for shared resolution.
3. Create a policy regarding the sharing of data for the PI process, recognizing hospital confidentiality and HIPPA regulations.
4. Benchmark individual systems, hospitals, LEMSAs and RTCCs to the group as a whole and to an outside standard including a comparative analysis of risk-adjusted outcomes.

12. Education and Training—HRSA Benchmark #105 (100 series: assessment), #205 (200 series: policy development) and #310 (300 series: assurance). *Education for trauma system participants is developed based on a review and evaluation of trauma data. 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 those courses that are readily available throughout the State. An assessment of the needs of the general public concerning trauma system information should be conducted.*

Barriers

Private and public surveys indicate that the general public regards all hospitals as Trauma Centers and few can indicate where their closest Trauma Center is located; furthermore, many citizens are not aware that the EMS system is the best avenue to receive trauma care.

Education and training of trauma care professionals is compartmentalized into prehospital, nursing, and physician education with limited trauma systems education.

Opportunities

State, regional and local education needs should be identified, and resources readily available to meet those needs. Guidance for education competencies should exist, and each region's individual educational offerings should address local needs.

Goal: Identify statewide educational needs through the PIPS Program in consultation with the community, EMS providers, hospitals, LEMSAs, and RTCCs.

Objectives:

1. Develop a plan for providing information to the public regarding the structure and function of the Trauma System.
2. Perform a needs assessment prior to developing new or additional trauma-related professional educational programs.

3. Encourage the use of the ACS Rural Trauma Team Development Course, video conferencing, online education, and telemedicine connections between non-trauma facilities and lower level Trauma Centers with higher level Trauma Centers.

13. Research—HRSA Benchmark #301 and #306 (300 series: assurance). *A process is in place to facilitate the access to data for evaluation and research. The trauma system has developed mechanisms to engage the general medical community and other system participants in their research findings and performance improvement efforts.*

Barriers
Most research projects are being conducted by single institutions or agencies and are not utilizing the opportunities of collaborative, multidisciplinary research.

Opportunities
Trauma system research involving both local and state agencies should be part of local/regional trauma system.

Goal: The CEMSIS, LEMSAs, and Trauma Centers should become the basis for collaborative systems research.

Objectives:

1. Develop a research agenda (possibly through a local research committee) and collaborate with established investigators to conduct research projects.
2. Periodically review trauma system data derived from CEMSIS, OSHPD, and other sources, and make a recommendation to various system stakeholders regarding potential areas of research.

14. Injury Prevention—HRSA Benchmark #203 (200 series: policy development). *A written injury prevention and control plan is developed and coordinated with other agencies and community health programs. The injury program is data driven, and targeted programs are developed based on high injury risk areas. Specific goals with measurable objectives are incorporated into the injury plan.*

Barriers
Statewide injury control in California has been established primarily under the direction of the Department of Public Health; however EMSA recognizes the need to interface these efforts and with Trauma System objectives.

Opportunities
Recommend the application of the public health model in reducing trauma and subsequent injuries by applying basic public health principles and guidelines to identify risk factors and help develop and choose prevention strategies that are comprehensive. It is important to know which injury prevention strategies are proven effective, and those that are less effective, in order to have the greatest impact.

Goal: Improve coordination and utilization of public health and trauma systems injury prevention resources at the state, regional and local levels.

Objectives:

1. Develop a compendium of regional injury prevention programs.
2. Collaborate with the Department of Public Health to evaluate, implement, and determine the effectiveness of initiatives to reduce intentional and unintentional injuries.

15. Emergency/Disaster Preparedness—HRSA Benchmark #203 (200 series: policy development). *The trauma system plan has established clearly defined methods of integrating with emergency preparedness plans (all hazards).*

Barriers

Funding from HRSA and FEMA is limited to assist Trauma Centers in preparing for the next inevitable event when they are already under economic duress. There is inconsistent coordination of Trauma Centers with disaster response planning to fully utilize the specialty resources of the trauma system.

Opportunities

EMSA can advocate utilizing federal hospital preparedness funds, emphasizing the integration of the trauma system into the statement of work. Funds may be used to assess the trauma system's emergency preparedness including coordination with the public health agency, EMS system, and the emergency management agency. Funding through the Affordable Care Act for States, when appropriated, can serve to improve pre-hospital and trauma care at a regional level on a day-to-day basis and could have implications for surge management and regional disaster response.

Goal: Have the Statewide Trauma Planning Recommendations integrated with, and complementary to, the comprehensive mass casualty plan for natural and manmade incidents, including an all-hazards approach to planning and operations.

Objectives:

1. Incorporate the role of the trauma system in the California Department of Public Health and Medical Emergency Operations Manual.
2. Develop a recommended inventory for a trauma cache to be utilized at Trauma Centers in the event of a disaster.
3. Plan for trauma system surge capacity in collaboration with local Public Health and Emergency Health Management, depending on disaster risk assessment.

VIII. Priorities for Trauma System Objectives

The following priorities are based on these Statewide Trauma System Planning recommendations for strategies and policy direction:

1. Strengthen State Trauma Organizational Structure and Leadership
(Goal 1: State Leadership; Goal 2: System Development)

EMSA should explore mechanisms within state rules and existing funding sources to better leverage resources to support trauma care in California. EMSA's infrastructure should have appropriately trained personnel in Trauma System development to provide management and evaluation of the system in collaboration with the STAC, LEMSAs, and RTCCs.

The RTCCs are well-established through consensus practice and volunteer effort. They provide for regional needs assessments and set priorities based on the results that encourage optimal sharing of resources to improve access to quality trauma care throughout their regions. To move forward, the RTCCs, LEMSAs and EMSA should work towards standardization within the region as well as inter-regionally where appropriate.

2. Examine Trauma System Funding Options
(Goal 3: Trauma System Finance)

There are three areas where funding options should be further evaluated in order to improve the existing trauma care system in California:

A. <u>To provide support for state, regional, and local administration of the trauma program</u>
Neither EMSA nor LEMSAs currently receive state general funds to support administrative development and oversight of the Trauma System. EMSA funding is dependent in part on the Preventive Health and Health Services Block Grant. There are other time-limited grants to support data and performance improvement activities. Permanent funding sources may be necessary to maintain and advance the Trauma System.

Local systems receive only a small percentage of existing funds (Tobacco Tax, Maddy EMS Fund, Richie's Fund) to support administrative costs. The majority of these funds are applied to trauma care reimbursement. Many LEMSAs receive designation fees from the Trauma Centers which may be applied to trauma system costs. Two LEMSAs receive monies from property taxes to support the trauma system. Stable funding sources are desirable at the local level to maintain essential trauma systems.

B. <u>To help increase system participation by community hospitals</u>
An inclusive Trauma System requires the participation of all acute care facilities to increase trauma care capacity and to collect and analyze essential data. Some hospitals have limited resources to provide a level of trauma care needed for the critically injured who arrive at their facility. Financial support for these facilities would facilitate an

inclusive system and a regional approach to trauma care. Specifically it would provide a coordinated process to stabilize and transfer trauma patients to the level of care commensurate with their injuries. The exchange of data and participation in local and regional performance improvement by all facilities that receive trauma patients advances the system and provides the tools to improve care.

C. Support for Uncompensated Care
At this time, there are insufficient data to determine if additional funding for indigent patient care is needed and at what level to cover uncompensated trauma care. EMSA should work with researchers and hospitals to establish the basis for estimating the actual cost of trauma care in California. In addition, the effect of the Affordable Care Act and insurance coverage expansions (both public and private) on trauma care reimbursement should be studied to determine the future impact of uncompensated care with payment shifts driving new care models and changing payment mechanisms. Decreasing reimbursement may cause some Trauma Centers to downgrade or de-designate. Alternatively, the formation of Medicare Accountable Care Organizations may stimulate interest in Trauma Center designation to keep patients within the service network.

3. Establish a Statewide Performance Improvement and Patient Safety (PIPS) Program
(Goal 11: System Evaluation and Performance Improvement)

A PIPS Program is a structured effort to demonstrate a continuous process for improving care for injured patients. EMSA should provide the leadership necessary to coordinate the PIPS program supported by a reliable method of data collection that consistently obtains valid and objective information necessary to identify opportunities for improvement. The PIPS method involves guideline development, process assessment, process correction, and monitoring for improvement. The California PIPS program would be characterized by

- authority and accountability for the program;
- a well-defined organizational structure;
- appropriate, objectively defined standards to determine the quality of care; and
- explicit definitions of outcomes derived from relevant standards where available.

Patient safety is inseparable from the PIPS process and underscores an important program goal. The patient safety process will direct its efforts at the environment in which care is given, and the PIPS process will be directed at the care itself.

4. Design the State Trauma Registry to support the PIPS Program
(Goal 10: Information System)

Development of a statewide trauma data system is imperative to improving and continuously monitoring trauma systems. Data is necessary to assess performance, quality, utilization and prevention, benchmark against existing national standards, and inform future policy decisions and directions. The State Trauma Registry should be linked with the EMS Data System (prehospital care data) and hospital emergency medical record to create a robust program in

support of the EMS system core measures. In addition, the system should be expanded to include a minimal data set from non-trauma facilities.

The National Trauma Data Standard (NTDS) has served as a key mechanism to assess Trauma Centers. The State Trauma Registry should utilize NTDS as well as additional data elements which will serve to assess trauma system function in the state.

LIST OF APPENDICES

Appendix A: HRSA/EMS Authority Benchmark Status
Spreadsheet showing HRSA Benchmarks from the 2006 Model Trauma System Planning and Evaluation document and how California is currently meeting each benchmark

Appendix B: Statewide Trauma System Planning Components and Assesment
The functional components of the Statewide Trauma System Planning recommendations are divided into 15 components. Each component contains two parts: 1) Background and Current Status; a brief description of the existing component and 2) Planned Development; a listing of objectives outlining how the component is expected to develop over the next 3-5years.

Appendix C: State Trauma Advisory Committee Membership
Listing of STAC membership with associated affiliation

Appendix D: Designated Trauma Centers
Listing of current designated Trauma Centers with Level of designation noted

Appendix E: Trauma System Research
A selection of trauma system articles reflecting national and California research on trauma system development

Appendix F: Scudder Oration
The Scudder Oration on Trauma was presented by Brent Eastman, MD, FACS at the American College of Surgeons 95th Annual Clinical Congress in Chicago, Illinois, October 2009. Much of the oration surrounds the development of trauma systems with specific reference to California

Appendix A

HRSA/EMS Authority Benchmark Status

APPENDIX A: HRSA/EMS Authority Benchmark Status

Each indicator from the 2006 HRSA *Model Trauma System Planning and Evaluation* document was evaluated and a 2013 status is provided. Prioritization is as follows: Short Term (within 1 year); Intermediate (within 3 years); and Long Term (3-5 years).

Priority	#	Benchmark	Solution	Status
Short Term	102	There is an established trauma management information system for ongoing injury surveillance and system performance assessment.	Trauma Registry	Met ☒ Partially Met ☐ Majority Met ☐ Not Met ☐ The California EMS Information System (CEMSIS) was created as a demonstration project funded by the Office of Traffic Safety. As of August 2014, 16 of the 26 LEMSAs with designated Trauma Centers were submitting data totaling 52 of the 76 designated Trauma Centers.
Short Term	201	Comprehensive state statutory authority and administrative rules support trauma system leadership and maintain trauma system infrastructure, planning, oversight, and future development.	State Leadership & Coordination	Met ☐ Partially Met ☐ Majority Met ☒ Not Met ☐ The EMS Authority has legislative authority to manage the State Trauma System. In 2008 a regional infrastructure composed of five (5) Regional Trauma Coordinating Committees was established building upon the local EMS agency structure. The development of standardized policies for regions is in process in varying degrees in the regions.

Priority	#	Benchmark	Solution	Status
Short Term	202	Trauma system leadership (lead agency, Trauma Center personnel, and other stakeholders) is used to establish, maintain, and constantly evaluate and improve a comprehensive trauma system in cooperation with medical, professional, governmental, and citizen organizations.	State Leadership & Coordination	Met ☐ Partially Met ☐ Majority Met ☒ Not Met ☐ The State Trauma Advisory Committee is advisory to the Director of the EMS Authority. Membership is multidisciplinary and provides overall guidance to trauma system planning. These Statewide Trauma System Planning recommendations provide a decision-making process for system issues with measurable goals and objectives.
Short Term	203	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 emergency management. The written trauma system plan is developed in collaboration with community partners and stakeholders.	State Leadership & Coordination	Met ☐ Partially Met ☐ Majority Met ☒ Not Met ☐ These Statewide Trauma System Planning recommendations integrate EMS, public health, emergency preparedness and emergency management and were developed in collaboration with trauma system partners.

Priority	#	Benchmark	Solution	Status
Short Term	204	Sufficient resources exist, including those both financial and infrastructure related support, system planning, implementation, and maintenance.	Trauma System Funding	Met ☐ Partially Met ☐ Majority Met ☐ Not Met ☒ Due to ongoing budget constraints, improving the financial support of the State Trauma System was not feasible. Federal Block Grant funding continues to support state trauma program staff. Benchmark will be moved to Long Term priority.
Short Term/ Ongoing	103	A resource assessment for the trauma system has been completed and is regularly updated.	State Leadership & Coordination	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ Many of the Regional Trauma Coordinating Committees have either completed or are working on a resource assessment for their region followed by a gap analysis. Reports on status are given routinely to the State Trauma Advisory Committee. As the CEMSIS program becomes more mature and complete, morbidity and mortality assessment will be done. Each Local EMS agency provides for outside consultation to assist with Trauma Center designation and re-designation.

Priority	#	Benchmark	Solution	Status
Short Term/ Ongoing	302	The trauma system is supported by an EMS system that includes communication, medical oversight, prehospital triage, and transportation; the trauma system, EMS system, and public health agency are well integrated.	Leadership & Coordination	Met ☐ Partially Met ☐ Majority Met ☒ Not Met ☐ The regionalization of the trauma system has provided 5 avenues for support of a State Trauma System. Most regions have worked toward triage standardization utilizing the national CDC standards. Each region encourages communication with the region's trauma partners. The state trauma registry, while still under development, provides data on the system which is shared with its regions and State Trauma Advisory Committee upon request.
Short Term/ Ongoing	303	Acute care facilities are integrated into a resource-efficient, inclusive network that meets required standards and that provides optimal care for all injured patients.	Leadership & Coordination	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ While regions have improved communication with all acute care facilities in the region, standards do not exist specific to trauma. Re-triage standards are under development in some of the regions that improve the coordination of care when a patient requires urgent transport to a Trauma Center with the higher level of care needed. The state registry is under revision and will include specific data to describe the transfer.

Priority	#	Benchmark	Solution	Status
Short Term/ Ongoing	310	The lead trauma authority assures a competent workforce.	State Leadership & Coordination	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ Regulations only partially require a specific level of training for physicians and/or nurses. The Rural Trauma Team Development Course is being offered throughout the State sponsored by the Trauma Mangers Association, California. Other trauma-specific education is provided by the LEMSA as needed and may be part of the accreditation process for paramedics. Compliance assessment for Trauma Centers is the responsibility of the LEMSA.

Priority	#	Benchmark	Solution	Status
Short Term/ Ongoing	311	The lead trauma authority acts to protect the public welfare by enforcing various laws, rules, and regulations as they pertain to trauma system components and the system overall.	State Leadership & Coordination	Met ☒ Partially Met ☐ Majority Met ☐ Not Met ☐ The Trauma Center (through Title 22) and the LEMSA (through statute and Title22) are required to provide for performance improvement of the local system. Regions have included system case reviews as part of their mission. Local Trauma Plans are required to describe their PI program and how they ensure Title 22 compliance. The majority of LEMSAs require ACS verification and/or consultation for continued designation. The State has developed guidance documents to assist LEMSAs in the compliance reviews. The State is responsible for approving local Trauma Plans prior to system implementation to ensure statute and regulatory compliance. Annual reports are due from each LEMSA to ensure continued compliance.

Priority	#	Benchmark	Solution	Status
Intermediate	104	An assessment of the trauma system's disaster/ emergency preparedness has been completed including coordination with the public health and EMS systems and the emergency management agency.	State Leadership & Coordination	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ The EMS Authority coordinates its trauma system with the California Office of Emergency Services. An assessment needs to be completed.
Intermediate	105	The system assesses and monitors its value to its constituents in terms of cost/benefit analysis and societal investment.	Trauma Registry	Met ☐ Partially Met ☐ Majority Met ☐ Not Met ☒ The State Registry has been developed and in part collects information to assess the fiscal impact of the trauma system. As the registry becomes more complete, the state will publish trauma system information to educate the public and professional population on the trauma system. LEMSAs have a mechanism in place to partially support the system through designation fees. An organized approach to public information about the trauma system is limited to local/regional activities.

Priority	#	Benchmark	Solution	Status
Intermediate	205	Collected data are used to evaluate system performance and to develop public policy.	Trauma Registry	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ The State Trauma Registry has been developed based on national standards. 56/76 Trauma Centers participate with 100% participation anticipated by the end of the fiscal year. Linkage has yet to be done. A new system for EMS and trauma data is now in place which should improve the linkage capabilities.
Intermediate	206	Trauma system leadership, including its multi-performance reports, in disciplinary advisory committees, regularly reviews system.	Trauma Registry	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ While data exists for much of the system, performance reports have yet to be developed. A quality and consistency review of the data needs to be completed before the system can rely on the data reports to guide policy.

Priority	#	Benchmark	Solution	Status
Intermediate	207	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.	State Leadership & Coordination	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ The 5 regions are collaborative groups that foster system enhancement. Most projects are focused on post-injury system issues. Some of the regions are beginning to work on prevention activities such as pediatric and elderly falls. The Department of Public Health focuses on prevention. Injury prevention activities are shared through the Strategic Highway Safety Program.
Intermediate	304	The jurisdictional lead agency, in cooperation with other agencies and organizations, uses analytical tools to monitor the performance of population- based prevention and trauma care services.	State Leadership & Coordination	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ Data from the state registry is provided to the regions upon request for the monitoring of trauma care in the region. Common mechanisms of injury are also identified which has resulted in prevention activities related to pediatric and elderly falls. The development of these Statewide Trauma System Planning recommendations is a significant step towards the development of a State Trauma System. Many of the Plan's objectives are already being addressed.

Priority	#	Benchmark	Solution	Status
Intermediate / Ongoing	208	The trauma, public health, and emergency preparedness systems are closely linked.	State Leadership & Coordination	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ The State Trauma System and the Disaster Preparedness Operations are loosely linked with need for more formal integration.
Intermediate / Ongoing	305	The lead agency assures its trauma system plan is integrated with, and complementary to, the comprehensive mass casualty plan for natural disasters and manmade disasters, including an all-hazards approach to disaster planning and operations.	State Leadership & Coordination	Met ☐ Partially Met ☐ Majority Met ☐ Not Met ☒ Integration of the State Trauma System with all disaster preparedness activities is state as a goal in these Statewide Trauma Planning System recommendations.
Intermediate / Ongoing	306	The lead agency ensures that the trauma system demonstrates prevention and medical outreach activities within its defined service area.	State Leadership & Coordination	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ Regional activities may incorporate prevention and medical outreach. Pediatric and elderly falls have become a focus throughout the state. The Strategic Highway Safety Plan links Department of Public Health with EMS.

Priority	#	Benchmark	Solution	Status
Intermediate / Ongoing	307	To maintain its state or regional or local designation, each hospital must continually work to improve the trauma care as measured by patient outcomes.	Registry/Local Trauma System	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ Each Trauma Center and its LEMSA are responsible for measuring patient outcomes. The State will be formalizing its Performance Improvement Program once the State Trauma Registry is complete with quality and consistent data. Outcomes for trauma patients seen at non-Trauma Centers needs to be addressed with utilization of OSHPD data.
Intermediate / Ongoing	308	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.	State Leadership & Coordination	Met ☐ Partially Met ☐ Majority Met ☐ Not Met ☒ There are no standards to integrate rehabilitation services into the trauma system except for minor requirements for acute rehabilitation services in Title 22. The State Trauma Registry has minimal information regarding functional outcome and rehabilitation costs.

Priority	#	Benchmark	Solution	Status
Long Term	101	There is a thorough description of epidemiology of injury in the system jurisdiction using both population-based data and clinical databases**.**	Coordinate with agencies that collect data/make available to participants.	Met ☐ Partially Met ☒ Majority Met ☐ Not Met ☐ While the State Trauma Registry contains detailed information on the epidemiology of injury, there has been no true analysis. However, coroner and non-trauma facility data is limited and not linked to the trauma registry. Regional reports are provided upon request describing the injury patterns of the region.
Long Term/ Ongoing	301	The trauma management information system (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.	Trauma Registry	Met ☐ Partially Met ☐ Majority Met ☒ Not Met ☐ 52/76 Trauma Centers provide data to the State Trauma Registry. Regional reports are provided upon request to assist in regional performance improvement. LEMSAs are responsible for local system performance review including costs (many require Trauma Centers to pay annual fee). Limited state reports are generated due to incomplete participation.

Priority	#	Benchmark	Solution	Status
Long Term/ Ongoing	309	The financial aspects of the trauma systems are integrated into the overall quality improvement system to assure ongoing "fine-tuning" and cost-effectiveness.	Trauma System Funding	Met ☐ Partially Met ☐ Majority Met ☐ Not Met ☒ No cost data is available in the State Trauma Registry. Payer mix and charges can be analyzed. While specific financial data is not available, length of stay, ICU length of stay etc. can be evaluated based on cost estimates.

Appendix B

Statewide Trauma System Planning Components and Assessment

Appendix B: Statewide Trauma System Planning Components and Assessment

Organized approaches within single trauma care facilities to treat victims of severe injury have repeatedly demonstrated improved patient outcomes, an observation that has led to the development of the Trauma Center designation process. But individual facilities are insufficient, since patient distribution and health system capabilities are not optimized or consistent. Since high level Trauma Centers are not available in all areas of the state, regional coordination is required to provide care across all geographic areas so all patients get the level of care they need in a timely manner.

Regionalized trauma systems should have a process for triaging patients, which would provide that a patient gets to the level of trauma care that matches his/her injury severity and results in improved outcomes. Moreover, using a rigorous disease management approach to injury across the entire spectrum, from prevention to rehabilitation, has shown improved outcomes.[21]

A broad approach to policy development through laws and regulations should include building a system infrastructure that can provide system oversight and future development, routine monitoring of system performance, updating laws, regulation, policies and procedures, and the establishment of standard operating methods across all phases of intervention.[22]

These Statewide Trauma System Planning recommendations depend on the exercise of regulatory authority by the local EMS agencies (LEMSAs), and are not designed to interfere with or compromise this authority. The recommendations also rely on the activities of the Regional Trauma Coordinating Committees (RTCCs) and the State Trauma Advisory Committee (STAC) to provide expertise, support, and technical assistance to both the LEMSAs and the State EMS Authority (EMSA) in matters pertaining to state and regional trauma care and trauma system development.

As described by the American College of Surgeons' (ACS) *Regional Trauma Systems: Optimal Elements, Integration, and Assessment* the functional components of a State Trauma System are divided into 15 parts:

1. Trauma System Leadership
2. System Development Operations
3. Trauma System Finance
4. EMS System: Prehospital Care
5. EMS System: Ambulance and Non-Transporting Medical Units
6. EMS System: Communications
7. Definitive Care: Acute Care Facilities
8. Definitive Care: Inter-Facility Transfer and Re-Triage

[21] *Resources for Optimal Care of the Injured Patient 2014*, Committee on Trauma American College of Surgeons
[22] *Regional Trauma Systems: Optimal Elements, Integration, and Assessment*, American College of Surgeons Committee on Trauma, 2007

9. Definitive Care: Rehabilitation
10. Information Systems
11. System Evaluation and Performance Improvement
12. Education and Training
13. Trauma System Research
14. Injury Prevention
15. Emergency/Disaster Preparedness

Each component contains two parts: 1) Background and Current Status with a brief description of the existing component; and 2) Planned Development with a list of objectives with assigned responsibility outlining how the component is expected to develop over the next 3-5 years.

The recommendations provided by ACS as part of the Consultative State Trauma System Review for California in March 2016 are consistent with these Statewide Trauma System Planning recommendations. The ACS recommendations are incorporated and indicated either by footnotes or *italicized* (if verbatim) throughout this appendix. Objectives in **bold** are considered priority by ACS.

It is understood that many objectives require resources that may not be available. These objectives have been designated as long-term goals with suggested prioritization and should be met through collaborative efforts between EMSA, LEMSAs, the STAC, the RTCCs, Trauma Centers, and other interested groups and organizations. Through voluntary collaboration and coordination, improvements in patient care quality can be achieved.

Component 1—Trauma System Leadership

Trauma System Partners

State EMS Authority

EMSA was established in 1980 through the Emergency Medical Services System and Prehospital Emergency Care Personnel Act (SB 125). EMSA is one of 13 departments within the State of California Health & Human Services Agency and has statutory responsibility (Health and Safety Code §1797.103) for:

- 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

EMSA's role specific to trauma programs

- 1798.161 Required to Establish Regulations
- 1797.199 Trauma Care Fund Distribution
- 1798.166 Approval of local Trauma Plans in Accordance with Regulations

Local EMS Agencies

There are currently 33 LEMSAs within the State of California; 26 are single-county and seven have a multi-county jurisdiction. The LEMSA has statutory responsibility to plan, implement, and evaluate an emergency medical services system in accordance (in part) with the following sections within the California Health and Safety Code:

- 1797.204 Plan, implement, and evaluate EMS system
- 1797.206/1797.218 Implementation and Approval of ALS & LALS Systems
- 1797.208 Compliance of EMT Training Programs
- 1797.214 Additional Training Requirements
- 1797.220 Local Medical Control Policies & Procedures
- 1797.252 EMS System Coordination
- 1798.100 Designation of Base Hospitals
- 1798.163 Trauma Care System Policies & Procedures
- 1797.151 Coordination of Disaster Preparedness

The LEMSA is charged with implementing statutes (1798.162, 1798.163), regulations and local policy for trauma services in their area of jurisdiction including designation of Trauma Centers. Using State trauma guidelines, LEMSAs design trauma systems that meet minimum State standards and regulations, which provide a level of consistency between counties. The LEMSA ensures the system components operate in an effective and compliant manner throughout the continuum of care.

State Trauma Advisory Committee
The STAC's 18 member committee is comprised of physicians, nurses, administrators and other EMS providers and personnel for the purpose of advising the EMSA Director on matters pertaining to the planning, development, and implementation of the State Trauma System.

Regional Trauma Coordinating Committees
As the result of recommendations made by the STAC and the 2006 *California Statewide Trauma Planning, Assessment and Future Direction* document, five (5) trauma regions were defined by EMSA; corresponding RTCCs were created in 2008. These committees are composed of trauma system providers, LEMSA staff, and trauma system stakeholders from within each region for the purpose of promoting regional cooperation, enhancing and developing best practices, assisting in the interpretation of regional data, and working collaboratively with the State and LEMSAs in support of a state trauma system.

Trauma Centers
Trauma Centers are a key element in a trauma system and the focal point for trauma care. Lead Trauma Centers (Level I and II) contribute administrative and medical leadership and academic expertise to the system. These lead Trauma Centers, in collaboration with the LEMSAs, engage all other Trauma Centers (Level III and IV) and other non-trauma acute care facilities in the performance improvement process. Many Trauma Centers participate in state and regional trauma system planning and development.

Planned Development

LEMSA and EMSA leadership remain critical to the overall success of the Trauma System. The creation and development of RTCCs represent a principal change in the inclusion of expertise and participants of the trauma system, including the composition of the STAC, which now includes regional representatives from each RTCC.

State EMS Authority
As part of the responsibility to coordinate the planning, development and implementation of the State Trauma System, EMSA, with recommendations from the STAC, should work to provide coordination, guidance, and assistance to the LEMSAs and RTCCs with the goal of enhancing the consistency of trauma-related standards and guidelines throughout the state and improving the overall quality of trauma care.

The EMS Authority's objectives should include:
1. ***Establish basic quality and activity reporting standards and report templates for the LEMSAs that are individualized based upon size, activity, available resources, and degree of system development.***
2. Use system reports to educate the public regarding trauma system accomplishments and post on the EMSA's website.
3. Develop policy to facilitate communication among the LEMSAs, RTCCs, and STAC for purposes of system development.
4. Facilitate the utilization of CEMSIS data by LEMSAs and RTCCs.

5. Coordinate the development and activities of ad hoc working groups for system development projects such as data utilization, performance improvement, and regional transfer network.
6. Develop a compendium of trauma-related policies, procedures, and clinical guidelines that may be shared throughout the state.
7. Receive information and advice from the STAC pertaining to the further development, monitoring, and operation of the Trauma System.
8. Convene a statewide forum to brief stakeholders and receive feedback on system-wide developments and review the overall operation and performance of the Trauma System.

State Trauma Advisory Committee
Membership on the State Trauma Advisory Committee (STAC) is determined by the EMSA Director and includes broad representation from trauma system stakeholders, including representatives from each of the RTCCs.

The STAC Chair should be a nationally recognized trauma surgeon with experience and demonstrated expertise in Trauma Center evaluation and trauma system planning. The Vice-Chair of the STAC should ideally be a LEMSA medical director or LEMSA administrator.

The STAC advises EMSA in matters pertaining to the development, monitoring, and operation of the State Trauma System to include the following:

1. *Expand representation on the State Trauma Advisory Committee (STAC) to include Level III and Level IV Trauma Centers, non-designated acute care facilities and public member(s).*
2. *Develop subcommittees to the STAC around targeted issues to increase the number of engaged trauma stakeholders.*
3. Assist EMSA in facilitating the activities of the RTCCs.
4. Set priorities for specific guideline, protocol, and policy development/review for the state-wide work groups.
5. Receive periodic reports on LEMSA trauma plans and make related recommendations to the EMSA Director.
6. *Make recommendations to the EMSA Director in regards to modification to existing regulations pertaining to trauma systems and consistent with these Statewide Trauma Planning recommendations*.
7. Respond to requests from EMSA Director to assess trauma-related policies, procedures, regulations, or guidelines proposed by other groups or committees.
8. Receive and analyze reports from the RTCCs, making specific recommendations to the EMSA Director as needed.
9. Work with EMSA in conducting periodic (every 3-5 years) assessment and modifications to these California Statewide Trauma System Planning recommendations.

Local EMS Agencies
The authority and responsibility of the LEMSAs in implementing and monitoring local/regional trauma systems remain unchanged. The specific responsibilities of each LEMSA, with respect to the future direction of the State Trauma System, should include the following:

1. Participate in the RTCC with LEMSA Medical Director, Administrator, or Trauma System Coordinator.
2. Utilize the expertise, resources, and technical assistance of the RTCCs to assist with regional trauma care issues. This may include:
   2.1. Encourage all hospital to participate in improving regional trauma care.
   2.2. Identify and promote clinical guideline development.
   2.3. Implement a system-based Performance Improvement and Patient Safety (PIPS) program.
   2.4. Review and modify trauma-related policies within the region.
   2.5. Review local trauma plans in the context of regional trauma care, with input from Trauma Centers.
3. Implement data collection by non-trauma receiving facilities.
4. Share pre-hospital and trauma registry data via submission to CEMSIS.
5. Assess Trauma Center compliance with CCR, Title 22, Division 9, Chapter 7 regulations.

Regional Trauma Coordinating Committees

RTCCs are a key component of the California State Trauma System and were created for the purpose of utilizing a broad range of expertise within the five regions to enhance collaboration, share and support best practices, provide requested technical assistance to the LEMSAs and to EMSA regarding the ongoing development and operation of a system of trauma care for the State of California. The RTCCs function as a conduit between the regions and the EMSA/STAC to aid in the overall Trauma System development and standardization. Regional roles include the establishment of regular communication and collaboration within and between regions. Examples of regional activities include regular meetings, sharing best practices, exploring common issues and themes and working toward resolutions to minimize variations in practice within the region and ultimately the state. State level activity includes representation on the STAC, (acting as a subcommittee for the STAC) reporting regional activities and issues, sharing regional work products, relaying STAC information and decisions back to the region. The RTCCs:

1. *Cultivate relationships with public health, injury prevention, rehabilitation, emergency management organizations, EMS providers, transport agencies, public safety, and academic institutions to support the trauma system coalition.*
   1.1. Identify an individual in California with past leadership success to guide the RTCC.
2. *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 regional trauma stakeholders.*
3. *Formalize the structure and charge of the RTCCs and continue to develop their function, especially in domains of clinical practice guidelines and quality assurance programs.*
   3.1. Seek resources to provide administrative and liaison support to the RTCCs.

Trauma Center

Each designated Trauma Center should have its own trauma program leadership to:

1. Participate on their respective LEMSA and RTCC committees, including Performance Improvement

2. Provide expertise to the LEMSA in the development and ongoing updates of the local Trauma Plan
3. Minimum compliance with CEMSIS data standards and inclusion criteria

Component 2–System Development Operations

Background and Current Status

California is unique from the other States insofar as its systems of trauma care are administered at the local EMS level. Currently, 33 LEMSAs administrate trauma care in California's 58 counties. Of these LEMSA jurisdictions, 27 have at least one designated Trauma Center and six (6) do not. There is no statutory or regulatory requirement for a regional or county trauma system; the statute is permissive, making all local systems optional. However, all LEMSAs have developed a trauma system and have an approved trauma system plan.

LEMSAs plan, implement and manage local trauma systems based upon state regulations. Local Trauma Plans are submitted to the EMSA for review and approval. The plans outline local trauma systems but do not necessarily address inter-county needs. The LEMSAs are responsible for designating Trauma Centers within their jurisdictions that meet state trauma regulation requirements as stipulated in CCR, Title 22, Division 9, Chapter 7.

Since trauma system development is optional and locally based, there are a wide range of trauma system models in California. The variance runs from LEMSAs with well- established trauma systems, with designated Trauma Centers at various levels, to LEMSAs that have limited implementation of the plan or no designated Trauma Centers.

Planned Development

The vision for California is to develop an inclusive state trauma system that assures timely access to an appropriate level of care for all individuals following major injury.

The system should focus on prevention, quality care improvements and rehabilitation and be informed by a robust system for data collection and analysis.

State EMS Authority
EMSA, advised by its State Trauma Advisory Committee, in order to strengthen state trauma resources, should:

1. Utilize available resources for trauma system functions to fulfill EMSA's statutory function.[23]
2. *Develop a staff succession plan to ensure trauma system stability in the event of future personnel changes.*
3. Provide medical advice for trauma system activities by a clinically active trauma surgeon experienced in trauma systems to act as the Chair of the STAC.
4. *Ensure adequate personnel for data management, data analysis, and reporting for the statewide EMS and trauma information systems.*
5. Facilitate participation in and utilization of the state trauma registry.

[23] Consistent with ACS recommendation

6. Collaborate with the California Department of Public Health in an analysis of injury throughout the State of California utilizing existing databases (EPICenter, Statewide Integrated Traffic Records System (SWITRS), California EMS Information System (CEMSIS) and Office of Statewide Health Planning and Development (OSHPD).
7. *Identify and collaborate with other state agencies and external resources to enhance trauma system development.*
8. Work with the LEMSAs to conduct an analysis of trauma resources throughout the state including access-to-care at:
    8.1. Non-trauma facilities with emergency departments
    8.2. Trauma Centers and their specific (sub-specialty) capabilities, e.g. Neurosurgical Interventional Radiology, re-implantation, etc.)
    8.3. Rehabilitation facilities and their specific capabilities (e.g. neurological-cognitive rehabilitation).
9. Facilitate communication and information transfer among the RTCCs, LEMSAs, and EMSA through:
    9.1. Existing website resources
    9.2. Phone conferencing
    9.3. Video-conferencing.
10. *Provide liaison support to the RTTCs as resources allow.*
11. Work through the STAC to provide guidance and coordination for specific RTCC activities and projects with statewide implications.
12. Support statewide working groups for high priority projects that might include:
    12.1. Performance Improvement & Patient Safety programs
    12.2. System-wide trauma data procurement and analysis
    12.3. Regional Network for re-triage and interfacility transfers.

State Trauma Advisory Committee

The STAC to provide expertise, advice and guidance to the State EMS Authority, LEMSAs and RTCCs should:

1. Prioritize the needs of the state system, identifying related issues or problems, and assist the EMS Authority in coordinating efforts to address these specific issues and problems.
2. Review and make recommendations to the EMSA Director for revisions to these Statewide Trauma Planning recommendations.
3. Review reports from the RTCCs and make recommendations for statewide policy.
4. Advise the Authority on applications for trauma-related prehospital clinical studies.
5. Develop guidance for consistent and periodic assessment of Title 22 compliance for designated Trauma Centers throughout the state.
6. Make recommendations regarding revisions to Title 22 regulations:
    6.1. Establish in regulation scalable minimum operational standards based on the size and resource capabilities of the urban, suburban, and rural LEMSAs.
7. Make recommendations, as requested by a LEMSA, regarding the number, level, location, and capacity of Trauma Centers in regions throughout the state.
8. Prioritize the development of statewide protocols and guidelines that may be adapted to local needs by LEMSAs throughout the state.

9. Develop processes and mechanisms for providing optimal access and care to special populations specifically including pediatric populations.
10. Develop guidance for transfer, re-triage and interfacility transfer of trauma patients regionally.
11. Identify high priority areas for system-wide research projects.

Local EMS Agency

The LEMSAs will maintain the authority and responsibilities as outlined in statute and regulations. In addition, LEMSA activities should include:

1. Conduct a review of local trauma plan in the context of these Statewide Trauma Planning recommendations and the structures and processes it outlines
2. Utilize the expertise of the RTCC to provide technical assistance for the review of local trauma plans as needed

Regional Trauma Coordinating Committees

The RTCCs, by providing a broad range of expertise and experience, are instrumental in assisting the LEMSAs and EMS Authority in ongoing system development and assisting with the implementation of these Statewide Trauma System Planning recommendations. The role of the RTCCs should include the following:

1. Assist with a gap analysis of regional resources including acute care facilities, rehabilitation facilities, prevention programs, prehospital components, etc.
2. Assist the LEMSA with Trauma Plans upon request as it relates to regional trauma care.
3. Participate in the development and implementation of a regional process for ongoing Performance Improvement (as outlined in the "Evaluation" section) that includes data and case-based analyses.
4. Assist in the development of regional standards for performance improvement.
5. Work collaboratively with the LEMSA to perform regional analyses of trauma-related data.
6. Make recommendations to the STAC regarding revisions to state-wide policies and regulations.
7. With guidance from the LEMSA, contribute to the development of state and regional protocols and guidelines.
8. Assist in the development of regional trauma-related educational programs or offerings.
9. Evaluate or collaborate with regional partners on trauma-related research projects.
10. Provide technical assistance to the LEMSAs as needed for:
    - 10.1. Assessment and modification of existing trauma-related policies/guidelines/protocols, and the development of new trauma-related policies/guidelines/protocols as they relate to regional trauma care
    - 10.2. Identification of system performance improvement issues and solutions as they relate to regional trauma care
    - 10.3. Identification of regional resource issues and solutions
    - 10.4. Assist with the creation of Trauma Center survey teams to work with the LEMSA upon request
    - 10.5. Respond to ad hoc requests from LEMSAs for other types of technical assistance.
11. Submit or present reports to STAC that include:
    - 11.1. Assessment of RTCC meetings and attendance

11.2. Regional trauma system development and configuration
11.3. Regional Performance Improvement activity.

Component 3—Trauma System Finance

Background and Current Status

Funding for Trauma Systems are typically considered in two general categories: reimbursement for direct patient care, and administrative support for system oversight. Most of the efforts in improving trauma funding have focused on the direct reimbursement for uncompensated and undercompensated patient care. Fewer financial resources have been available to support development, oversight, and quality of the Trauma System (including governance, planning, a statewide trauma registry, and performance improvement efforts).

Funding of Trauma Care

An ongoing and stable source of funding is important to the success of trauma care systems.

Financial support for trauma care has been available through Senate Bill (SB) 12/612 that created the Maddy EMS Fund in 1987, Proposition 99 (California Tobacco Tax and Health Protection Act of 1988) revenue in 1990, and Assembly Bill (AB) 430 in 2001 which established a Trauma Care Fund for the State. The Maddy EMS Fund continues to be funded through penalty assessments on various traffic violations. The Trauma Care Fund was funded for 3 years until 2005. Funding specific for state coordination of the Trauma System is not available through these funds, but is available in a limited manner under the Federal Preventive Health and Health Services Block Grant.

Maddy EMS Fund

Optionally, many counties (86%) utilize the Maddy EMS Fund to reimburse physicians for uncompensated emergency services, hospitals that provide disproportionate trauma and emergency medical care services, including trauma services for adults and children, and for discretionary EMS purposes. In 2007, SB 1773 amended the statute to allow counties to increase the amount of the penalty from $2 per $10 to $4 per $10 penalty. Information from 2015 indicates that 53% of the counties have established this fund. A subsection of SB 1773, known as Richie's Fund, sets 15 percent of the funds collected in the supplemental penalty assessment to be utilized for all Pediatric Trauma Centers throughout the county. It further defines the expenditure of money with the intent for augmenting pediatric trauma care. Approximately $80 million annually is available for local distribution from the Maddy EMS Fund.

Tobacco Tax (Proposition 99)

Revenues from tobacco taxes (Enabled by AB75, Chapter 1331, Statutes of 1989) were earmarked, in part, for programs to provide health care services for hospitals and physicians for indigent patients. The money from the Tobacco Tax is deposited by using the following formula: 20 percent is deposited in the Health Education Account (HEA); 35 percent in the Hospital Services Account; 10 percent in the Physician Services Account; 5 percent in the Research Account; 5 percent in the Public Resources Account; and 25 percent in the Unallocated Account (Revenue and Taxation Code 30124). Although Proposition 99 dollars have dwindled because of a decrease in the number of smokers, there is approximately $85 million annually available for hospital services and $24 million available for physician services.

Trauma Care Fund
The Trauma Care Fund was established to provide designated Trauma Centers funding for trauma care to uninsured patients. The funds were passed through the LEMSAs for distribution through a competitive grant-based system. The Trauma Care Fund allocated $55 million for three years including $2.5 million provided to LEMSAs for the planning and implementation of new local trauma systems. Trauma Care funds have not been allocated since FY 2005-06.

Local Funding
Two counties, Los Angeles and Alameda, have developed local funding for trauma care through earmarked assessments on property value. Another source for funding local trauma systems is paid by the Trauma Centers to the designating agency for costs associated with audits and in some cases, review by the American College of Surgeons. The fees are also used for data collection and system management.

Planned Development

The Patient Protection and Affordable Care Act (ACA) includes funding language for regional trauma systems. While not appropriated since its inception, there is a need to align the elements of the California's Trauma System with any anticipated trauma system funding requirements in the future.

Establishing health insurance programs for all citizens is expected to have a positive effect on Trauma Center financing. It is unclear how healthcare reform policies will affect the payment for trauma care, specifically the relationship between the percentages covered by the private and public payers.

State EMS Authority/State Trauma Advisory Committee

1. Explore the feasibility of a Trauma System Plan that could:
   1.1. Research existing funding statutes, regulations, and processes and identify the system's current financial status including distribution of any trauma system funds and sustainability.[24]
   1.2. Perform a needs assessment to include the identification of specific aspects of the system that need funding, i.e. trauma care, infrastructure, data systems, performance improvement programs, rehabilitation, etc.
   1.3. Identify funding options for the implementation of the Trauma Plan, trauma system planning, oversight, and evaluation at the state level.
2. *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.*
3. Establish relationships with University Business, Financial, and Public Policy schools to collaborate on projects using open data and information to:

[24] 2016 ACS Recommendation from State Trauma System Consultation report

3.1. Identify critical Trauma System components (including local and State data systems, local EMS agency system oversight, and RTCC activities) and the cost to develop and maintain.
3.2. Research appropriate funding opportunities for identified critical trauma system components.
3.3. *Seek other sources of funding to support development of trauma care capabilities in rural California acute care facilities, such as the Rural Flex grant program.*
3.4. Work with researchers and hospitals to establish a basis for estimating the actual cost for trauma care in California.
3.5. Produce a report of the costs, the benefit of the trauma system and trauma care, and the importance of maintaining Trauma Center readiness to treat persons with severe injuries.
3.6. ***Use information within the Cost and Benefit Trauma Report to inform the public about the importance of the trauma system and the challenges in sustaining the existing Trauma Center resources.***

4. Collaborate with the local EMS agencies and California Hospital Association to determine the cost-benefit of a Trauma System to advocate for trauma system enhancements.

Regional Trauma Coordinating Committee

1 Identify opportunities for funding to support regional coordination activities.
2 Make recommendations to the STAC and the EMSA Director regarding potential sources of revenue for consideration in supporting trauma system coordination and infrastructure at both the state and local levels.

Component 4—EMS System: Prehospital Care

Background and Current Status

In California, the EMSA has overall statutory authority for the development of prehospital care program regulations. The LEMSAs have local responsibility and oversight of these programs at county and regional government levels. The medical direction and management of EMS is under the control of the Medical Director of the LEMSA. This medical control is in accordance with standards established by EMSA. The LEMSA is responsible for trauma system management including the development of local EMS trauma triage criteria, destination policy, and accreditation of local paramedics and EMTs to include knowledge of the local trauma system.

Trauma education for prehospital providers is incorporated into prehospital training programs as a standard part of the U.S. Department of Transportation, National Highway Transportation Safety Administration National Educational Standards for EMT, Advanced EMT, and Paramedic. Multidisciplinary continuing education programs for trauma are available to prehospital personnel through local Trauma Centers, LEMSAs, and continuing education providers. At present, there is no specific trauma continuing education hours considered to be a minimum for prehospital personnel.

Triage, Destination Policies for Trauma
Trauma triage and destination policies often reflect the availability of trauma services within a specific community. The Centers for Disease Control Guidelines for Field Triage of Injured Patients (2011) have been adopted by many of the LEMSAs both locally and regionally through RTCC collaboration. While there is still needed local variation due to geography and resource availability, these guidelines have become accepted as the minimum trauma triage standards for all of California.

Medical Direction
The LEMSA, using state minimum standards, establishes policies and procedures including dispatch, patient destination, patient care guidelines, and quality improvement requirements. For trauma systems, medical direction is commonly accomplished by two complementary methods:

- Trauma system policies and procedures in written form and accepted as valid by and for the trauma community to which they apply,
- Policies such as equipment required for field stabilization of trauma victims.

Planned Development

While the prehospital component of the Trauma System is well defined and has been functioning as a key partner, there are opportunities for improvement as the system matures.

State EMS Authority
1. Support the current national standards for prehospital Trauma Triage Guidelines as the minimum statewide standard.

2. Through its State Trauma Advisory Committee, develop benchmarks for the state and regional over- and under-triage rates, analyze data, and develop process improvement strategies to address gaps.[25]
    2.1. Work with OSHPD in obtaining specified data from non-trauma facilities on trauma patients transported to the facility and not transferred.
3. *Obtain CDPH and LEMSA epidemiological support 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.*

Local EMS Agency

As part of the local Trauma Plan, LEMSAs should:

1. Establish a Trauma System Manager/Coordinator position with appropriate qualifications.
2. Have prehospital care reports part of the electronic health record for all trauma victims.
3. Develop policy to ensure prehospital resources are available for transfer and re-triage including roles and responsibilities of prehospital personnel.
4. Adopt the current Guidelines for Field Triage of Injured Patients for prehospital trauma triage as guidelines tailored to local needs and resources, incorporating the needs of pediatric and geriatric populations.

Regional Trauma Coordinating Committee (upon request by the LEMSA)

1. Assist LEMSAs in developing California -specific continuing education programs for the training of first responders, EMTs, paramedics and Mobile Intensive Care Nurses (MICN) in the region.
2. Assist LEMSAs in developing pediatric and geriatric-specific field trauma triage criteria for regional standardization.
3. Assist LEMSAs in analyzing regional over and under triage.

[25] 2016 ACS Recommendation from State Trauma System Consultation report

Component 5—Ambulance and Non-Transporting Medical Units

Background and Current status

Non-transporting prehospital medical units are configured in various ways throughout California. In urban regions, it's common for non-transporting units to be fire apparatus staffed by either EMT or paramedic level personnel. Rural areas (including state and federal parks, forests, and beaches) may have staff cars or rescue units in various configurations and capabilities staffed with trained first responders, EMTs, or in some cases paramedics. Organized search and rescue teams also fit the category of non-transporting EMS units.

Transport units, ground and air, are regulated and meet policies of the jurisdictional LEMSA and applicable state and federal laws and regulations. EMS transport agencies are operated by public and private agencies. The EMS Authority enforces EMS Aircraft regulations (CCR, Title 22, Chapter 8) to ensure medical quality, and publishes statewide Prehospital EMS Aircraft Guidelines (EMSA #144).

Minimum ground ambulance equipment standards are established by the California Highway Patrol for basic life support supplies and equipment. Equipment standards to support the scope of practice are established by the LEMSA and vary between non-transporting and transporting units. Recommendations for national standards for equipment inventories for EMS resources have been developed by Commission on Accreditation of Ambulance Services, Commission on Accreditation of Medical Transport Services and California EMS for Children Program.

Planned Development

California has a complex EMS transport system utilized to expeditiously transport the critically injured patient to the most appropriate facility. As the system expands to provide universal access to trauma care, transport decisions become more multifaceted, coordinating both ground and air resources in a safe manner.

EMS Authority/State Trauma Advisory Committee

1. Recommend triage guidance for EMS Dispatch Agencies receiving automated vehicular telemetry data and Advanced Automatic Collision Notification (AACN).
2. Develop minimum prehospital equipment inventory guidelines for non-transport/transport EMS units specific to trauma needs.
3. Develop guidance for EMS Provider Agencies in providing for or allowing scene photography to aid in the assessment of the mechanism of injury and its effect on injury.

Regional Trauma Coordinating Committee

1. Assist, upon request by the LEMSA**,** in the development of inter-regional agreements for management and transport of mass casualty victims.
2. Assist the LEMSA, upon request, in the development of re-triage guidelines and transfer processes including necessary prehospital resources for the rapid transport of patients from non-trauma facilities to Trauma Centers that cross LEMSA jurisdictional lines within the region.
3. Recommend air transport utilization guidelines applicable to regional trauma care issues.

Component 6–Communications Systems

Background and Current status

The nation's 911 system has been an unqualified success for more than 40 years. Computer aided E911 access system is standard in California. Unfortunately, the 911 system has been challenged by changing technology such as expanding cell phone and voice-over- internet protocol (VOIP) usage. Cellular telephone and VOIP communication systems do not easily fit current computer aided 911 dispatch systems that allow for immediate identification of the precise location of a caller.

The current state and local 911 alert system is poised to advance with communication technology and to integrate cell phones or Internet-based communication methods as part of Next Generation 911 (NG9-1-1); however, this will be done incrementally with an estimated date of completion of 2020. The lack of precise locations and transfer of callers sometimes results in a delayed response of first responders to the scene of a trauma event.

In large urban California systems, it is common for Emergency Medical Dispatch programs (EMD) to be employed. Pre-arrival instructions and protocols are often used. While some non-urban systems utilize EMD, many small dispatch centers and rural regions are without priority dispatch or protocols.

A standard public safety radio frequency has been identified for use in California for communication between all air and ground units.

Some LEMSAs maintain computer logging systems that provide diversion data to hospitals in the region. Some LEMSAs have developed on-line computer communication systems for inter-hospital communication.

Planned Development

Standardized communications should be coordinated between all EMS systems on a given incident, utilizing current technology, to notify the trauma care team of essential information on the injured patient and provide appropriate destination decisions are made.

State EMS Authority/State Trauma Advisory Committee

1 Explore, in coordination with CalOES, an integrated prehospital-base hospital-receiving hospital communication system to aid in mass casualty and disaster events, such as FirstNet.
2 Promote statewide usage of common communication frequencies between ground and air transport units (700mHz Broadband Public Safety).

Local EMS Agency

1 Continue to advance efforts to develop priority medical dispatch for trauma and investigate process changes that improve dispatch effectiveness while improving outcomes.
2 Participate in statewide gap analysis to determine ambulance to ambulance communication capability and formats with identification of shortfalls.

Regional Trauma Coordinating Committee

Study the statewide and regional hospital alert systems currently in place to identify hospital capability, capacity, and specialty care availability (e.g. burns, pediatrics, etc.) and assist the LEMSA, upon request, in a gap analysis.

Component 7–Definitive Care Facilities: Acute Care Facilities

Background and Current Status

The mainstay of a trauma system is its network of specially designated acute care hospitals that have the resources and personnel capable of providing timely care to victims of serious injury. The current characteristics of local trauma systems, with respect to its acute care facilities, include the following:

- An existing network of designated Trauma Centers that have demonstrated compliance with established standards and regulations for Trauma Center resources, personnel, and processes of care
- The number of Trauma Centers within a system is restricted to allow volume performance by the highest level centers
- An inclusive system of higher and lower level centers providing care to patients with higher and lower injury severity respectively. In the more mature systems, the LEMSA defines a role for all acute care facilities as participants in the delivery of trauma care. Markers for participation include a structured institutional and system performance improvement program, data submission to regional registries, educational outreach, injury prevention, and operational agreements between sending and receiving hospitals within the system

Given the diversity of population density, geography, economics and other factors, California presents unique challenges to the creation of optimally located, appropriately resourced networks of acute care facilities. There are currently 343 acute care facilities with emergency departments (Comprehensive, Basic, and Standby) in the state of California. Of these, 80 are designated Trauma Centers. (***Appendix D)*** Twenty California counties currently have no designated Trauma Centers within their county borders.

Recognizing that under-triage will occur in the prehospital setting, and that patients with significant injuries will present themselves to hospitals not specifically equipped or designated; non-trauma facilities play a critical role in the care of trauma patients. With some of the mature local trauma systems, these facilities are integrated into the regional trauma system with their roles specifically defined and codified in the local Trauma Plan. The "inclusivity" of counties and regions within the state with respect to the spectrum of Trauma Center levels (I-IV and non-trauma facilities) varies from those counties served by a sole Level I Trauma Center (San Francisco), to those areas served by a greater number and wider variety of designated centers (Los Angeles).

Planned Development

The primary goals for the statewide system of trauma care with respect to its acute care facilities is to help provide timely access to basic trauma care throughout the state, timely access to definitive care regardless of the type and severity of injury, have designated centers maintain capabilities commensurate with their level of designation, and to improve the consistency of

processes related to initial and recurring designation. The further development of the network of acute care facilities should involve the following aims.

EMS Authority

1. Periodically assess the number and level of Trauma Centers within the state by region to evaluate access to trauma care and work with LEMSA to identify areas of insufficient coverage.
2. ***Provide EMS Authority guidelines for needs-assessment methodology supporting the authority of the LEMSAs to designate Trauma Centers based upon the needs of the population served.***
    - ***2.1. Provide EMS Authority guidelines to refine metrics of Trauma Center need in addition to the current regulation measure of one level I-II Trauma Center per 350,000 population.***
3. ***Establish guidelines to further uniformity of the Trauma Center designation process across LEMSAs.***
    - ***3.1. Explore use of the ACS verification process for all Level I and Level II Trauma Centers.***
    - ***3.2. Explore use of the ACS verification process for Level III Trauma Centers operating in proximity to higher-level Trauma Centers within a LEMSA.***
    - ***3.3. Explore modifying 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.***
4. Identify members of the trauma community (surgeons, emergency medicine physicians, trauma program managers) within the state with the expertise, experience & willingness to serve as site surveyors under Title 22 to be provided to LEMSAs upon request.

State Trauma Advisory Committee

1. Develop a template for 'operational' agreements between sending (non-trauma facility/lower level TC) and receiving (LII, LI) centers.
2. Develop guidance documents comparing Title 22 requirements with current ACS verification requirements.

Local EMS Agency

1. Outline the responsibilities and expected participation in the trauma system for non-designated acute care hospitals.
    - *1.1.* ***Exercise the regulatory authority to collect data from all acute care facilities in the region.***
2. *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.*

Component 8—Inter-Facility Transfer and Re-Triage

Background and Current Status

Although accurate field triage and direct transport to an appropriate level of care is a goal for all trauma systems, under-triage to non-trauma facilities or lower level Trauma Centers lacking the capabilities of caring for the most seriously injured will likely occur. For purposes of this document, re-triage means the immediate evaluation, resuscitation and transport of a seriously injured patient from a lower level trauma facility or non-trauma facility to a designated Trauma Center for a higher level of care. This process involves direct ED to ED transfer of patients that have not been admitted to the hospital. Interfacility transfer (IFT) refers to the transfer of an admitted patient, under the care of an admitting physician-of-record, from one facility to another.

There is currently no mechanism for the ongoing monitoring of under-triage or the number of re-triaged or transferred patients within the state. The frequency, location, and severity of related injuries involved with re-triage and inter-facility transfer within the state are largely unknown. In situations where re-triage or inter-facility transfer does occur, it may be delayed, and patients may not be managed according to evidence-based practice guidelines (e.g. traumatic brain injury). Re-triage/IFT protocols have been developed in several areas of the state, but are not in widespread use, and their effectiveness has just begun to be monitored.

Obstacles to transfer and re-triage include lack of a proximally located Trauma Center, lack of knowledge regarding the capacity (e.g. diversion status) and capabilities of potential receiving centers, concerns regarding EMTALA violations if procedures are not followed, local geographical and climatic obstacles to transportation (e.g. remote location, mountains, fog, etc.), transportation availability, insurance or financial status of the patient, and bed availability at receiving facilities.

Planned Development

The overall goal for the state with respect to re-triage/Interfacility transfer is to develop mechanisms, processes, and guidelines that will optimize timely access to trauma care at a level commensurate with the severity of injury, regardless of geographic location. The specific elements needed to achieve this goal include the following:

State EMS Authority

1. Develop a process that will allow ongoing analysis of all re-triage and IFT activity within the state based on CEMSIS data
   1.1. 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.
2. *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.*

3. Evaluate current paramedic scope of practice to enable and facilitate rapid re-triage and transport of severely injured trauma patients (i.e. Traumatic Brain Injury).
4. Identify receiving centers for special injuries (i.e. spinal cord, reimplantation).
5. Develop web-based compendium of Trauma Centers, Burn Centers, Pediatric Trauma Centers, their specialized capabilities and contact information for rapid communication when needed.
6. Investigate integration of real-time information on California Trauma Center status: open/on-diversion/partial diversion, etc. to all receiving facilities in California.
7. Explore development of centralized re-triage/transfer coordination within the state.
8. Develop specific EMTALA-based guidelines for the transfer and acceptance of trauma patients within the state. These should address:
   8.1. The EMTALA 'non-discrimination' provision in regards to the obligation (or not) to accept non-level-of-care patients,
   8.2. EMTALA allowance for the transfer of 'unstable' trauma patients for documented medical need to a higher level of care.

Local EMS Agency/Regional Trauma Coordinating Committee

1. Identify areas in the state where timely access to Trauma Centers may be improved (needs assessment).
2. Develop specific physiological and anatomical indicators for re-triage on a level-of-care basis (e.g. Level III center to LI/LII, etc.).
3. Develop models for education and outreach that will promote timely re-triage/IFT where appropriate.
4. Promote the development of regional cooperative arrangements between sending and receiving centers that will facilitate re-triage, reduce delays, and ensure that patients are re-triaged to an appropriate level of care.
5. Develop clinical management guidelines for the early (re-triage phase) treatment of high-risk injuries such as TBI, pelvic fractures, mangled or crushed extremity injuries, peripheral vascular injuries, etc.
6. Explore the development of clinical management guidelines that would allow lower level facilities in remote areas to manage selected types of injuries (e.g. 'minimal' Traumatic Brain Injury).
7. Develop structured relationships (regional cooperative agreements), including educational outreach between sending and receiving hospitals in order to facilitate the inter-facility transfer and re-triage and clinical management guidance to allow lower level facilities to keep selected patients.
8. Explore and promote the use of telemedicine for trauma patients where appropriate.
9. Identify and promote educational resources suitable for improving re-triage and inter-facility transfers (i.e. the ACS Rural Trauma Team Development Course).

Component 9—Rehabilitation and Trauma Recovery

Background and Current Status

Rehabilitation services are optimally provided along a continuum beginning with admission to a Trauma Center and continuing through community reintegration. While California regulation Title 22 for Level I/II contains requirements for Physical Therapy/Occupational Therapy/Speech Therapy, standardized early treatment guidance does not exist. Most rehabilitation facilities are independent facilities and the degree of integration into the trauma system varies considerably. In addition, the degree of access to level-of-care post-injury rehabilitation throughout the state is unknown. In many cases, the access to post-injury rehabilitation is a function of the needs of the patient but also of their insurance status and rehabilitation resources within the region.

Planned Development

In an effort to more effectively address the rehabilitative needs of trauma patients in the context of a statewide system of care, the following objectives should to be applied:

State EMS Authority

1. Develop a compendium of rehabilitation facilities throughout the state to include:
    1.1. A plan to assess the availability and capabilities of rehabilitation facilities in the state (and neighboring states) and integrate them into the regional planning and performance improvement process[26] and perform a gap analysis to identify shortfalls in services including:
        1.1.1. Specialized centers for Traumatic Brain Injury & spinal cord injuries
        1.1.2. Pediatric centers
        1.1.3. Burn & other specialty recovery facilities
2. Improve the data collection for evaluation of rehabilitative needs and degree of access to rehabilitation throughout the state.
    2.1. *Utilize trauma rehabilitation data, such as functional outcomes and costs, to inform injury prevention programs across the state.*
3. Explore possible amendments to CCR, Title 22, Division 9, Chapter 7 to incorporate the rehabilitation needs of the trauma patient including rehabilitation as part of the continuum of care.
4. *Integrate rehabilitation specialists at the state, regional, and local level trauma system planning and evaluation.*

State Trauma Advisory Committee

Recommend a standardized measure of functional recovery suitable for use throughout the trauma system.

Local EMS Agency/Regional Trauma Coordinating Committee

1. *Encourage Trauma Centers to partner with rehabilitation services internal and external to their centers.*

[26] 2016 ACS Recommendation from State Trauma System Consultation report

2. Develop guidelines for the current incorporation of rehabilitation into the continuum of trauma care. These guidelines might include:
   2.1. A mechanism to initiate rehabilitation services or consultation upon patient admission.
   2.2. Policies regarding coordination of transfers between acute care and rehabilitation facilities.
   2.3. A template for operational Memorandum of Understanding's between definitive care facilities and rehabilitation centers to include:
      2.3.1. Complications and outcome follow-up,
      2.3.2. Data sharing for performance improvement activities,
      2.3.3. Educational outreach.

Component 10—Information Systems

Background and Current Status

Data collection at the state level is dependent on the local EMS and trauma data systems managed by the LEMSAs. The majority of the data is transmitted to CEMSIS from the LEMSA data systems and not directly from the EMS provider or Trauma Center. CEMSIS is divided into two components: CEMSIS-EMS, which contains prehospital data and CEMSIS-Trauma which contains Trauma Center data.

Participation in CEMSIS is voluntary by local EMS agencies and is currently managed for EMSA through a subcontract with Inland Counties EMS Agency with Image Trend as the vendor. CEMSIS is presently funded from the California Office of Traffic Safety by annual competitive grants.

CEMSIS-EMS
Select prehospital data elements are included in the state trauma data standards. Data is integrated into the data management systems of both the LEMSA and EMSA. The CEMSIS-EMS data standards are in compliance with the National EMS Information System (NEMSIS) standards.

CEMSIS-Trauma
Each designated Trauma Center is responsible for the collection of data on defined patients as outlined in CCR, Title 22, Division 9, Chapter 7. This minimum data set is expanded locally to meet the needs of the Trauma Center and trauma system. This data is integrated into both LEMSA and EMSA State's data management systems. CEMSIS-Trauma is inclusive of Trauma Center data with data standards in compliance with the National Trauma Data Standards (NTDS).

While regulations require all hospitals that receive trauma patients to participate in the local EMS agency data collection efforts, compliance with this requirement is variable as non-trauma facilities have no contractual obligation to comply. All hospitals are required to provide emergency department, and hospital discharge data to the State Office of Health Planning and Development (OSHPD) with specific data standards outlined in regulations.

Other data systems that support CEMSIS-Trauma

- Crash/law enforcement data is collected through the California Statewide Information Traffic Records System (SWITRS) by law enforcement personnel.
- California Highway Patrol at the scene of a crash on state highways; other law enforcement agencies have the option of participating in SWITRS.
- Coroner data: California has a mixed system of county coroners and medical examiners with no central data repository of data apart from the reporting of data for death certificates to the state Department of Public Health. Coroners and medical examiners report data for death certificates via an electronic (web-based) system. The California Department of Public Health edits and verifies the information and creates several files.

The most commonly used is the Deaths Statistical Master file which contains all the information found in comparable files for other states and territories.

Planned Development

State EMS Authority/State Trauma Advisory Committee/CEMSIS Data Committee

1. Explore feasibility of linking databases to create a complete longitudinal patient record.[27] This would include:
   1.1. Develop a mechanism for deterministic/probabilistic matching of data.
   1.2. CEMSIS-Trauma and CEMSIS-EMS linkage.
   1.3. CEMSIS-EMS and Hospital Data (OSHPD) linkage.
   1.4. CEMSIS and SWITRS linkage.
2. Evaluate data validity by developing a plan to monitor data completeness and accuracy including utilization of the state-defined inclusion criteria.
3. Improve data compliance by:
   3.1. Development of standard reports provided to local EMS agencies itemizing Trauma Center data compliance.
   3.2. Development of a subset of CEMSIS-Trauma to include data on pre-defined injured patients seen at non-trauma facilities.
      3.2.1. Develop a special recognition program for non-designated acute care facilities that submit trauma data as trauma participating hospitals.
   3.3. Promotion of CEMSIS participation by all local EMS agencies through submission of a minimal data set from non-trauma facilities (e.g. OSHPD data).
4. Improve data sharing through:
   4.1. Development of standard aggregate reports and dashboards to be publically shared on the EMSA website and the California Health and Human Services Open Data Portal, as applicable.
   4.2. Development of a procedure for all requests for data including a data request form.
   4.3. Development of a policy for data sharing in compliance, with applicable patient confidentiality laws and California Health and Human Services De-Identification Policy Standards.
   4.4. Development of a comprehensive report of injuries for the state with comparisons of injury in rural, suburban, and urban counties.
      4.4.1. Obtain a template for a comprehensive state injury report from a state with a CDC Core Injury Grant.
      4.4.2. Prepare an executive summary of the injury report including key information and graphics for use in educating the public.
5. Create an injury report template for the LEMSAs, and provide a list of EpiCenter queries to use to complete the injury report.
   5.1. Include a list of queries from the EMS and trauma registries.
   5.2. Consider using an injury epidemiology graduate student from a School of Public Health to support development of additional injury data reports and report templates.

[27] 2016 ACS Recommendation from State Trauma System Consultation report

Local EMS Agency

1. Develop a plan to monitor data completeness and accuracy including utilization of the state-defined inclusion criteria prior to submission to CEMSIS.
2. *Assure all EMS patient data are included in hospital electronic health records (Trauma Centers and non-trauma centers), as well as trauma registries.*
3. *Develop a process to track the movement of patients through the continuum of trauma care.*[28]

[28] EMS and Hospitals Join Together to Track Trauma Patients, 2011 http://www.healthy.arkansas.gov/programsservices/hslicensingregulation/emsandtraumasystems/documents/training/trainingmaterials/traumaband.pdf

Component 11—System Evaluation and Performance Improvement

Background and Current Status

The purpose of a state Performance Improvement and Patient Safety (PIPS) Program ensures that injured patients receive quality care throughout the continuum. This requires monitoring care processes, structures and outcomes, identifying areas for improvement, developing and carrying out corrective action plans, and verifying that these corrective action plans result in desired improvements. The ideal PIPS Program requires accurate local, regional, and state prehospital and hospital clinical databases. Other components include identification of risk factors and best practices, accurate, standardized measurement of complications, risk-adjusted outcomes measurement, benchmarking, and appropriate feedback of benchmarking results.

EMSA may develop and implement a state-wide EMS Quality Improvement (QI) Plan with the LEMSA Trauma System Coordinators in collaboration with EMS Medical Directors. For the purposes of this plan, the terms QI and PIPS are synonymous. RTCCs may assist in case review if it crosses jurisdictional lines within the region. Trauma Centers are required to have a PIPS Program for improving care. In most cases, the PIPS program is linked to the hospital PI department and overall hospital PI Plan. Performance Improvement standards are developed to assist with monitoring care relative to standards of care.

California Code of Regulations, Title 22, Division 9, Chapter 12: EMS System Quality Improvement, requires that EMS provider agencies and Base Hospitals develop a PIPS Program with an associated Plan to be approved by the LEMSA. The LEMSA PIPS Plan is approved by EMSA. The regulations do not itemize trauma-specific components of the LEMSA PIPS Plan.

Planned Development

In order to evaluate the State Trauma System, the continuum of care from dispatch to pre-hospital to hospital disposition must be connected through a data system. Only in this way, can we begin to understand how care provided translates to improved outcomes and system effectiveness.

State EMS Authority

A program should be developed by the EMS Authority in collaboration with the LEMSAs and RTCCs to evaluate statewide trauma system performance. This should include:

1. Develop a statewide comprehensive Trauma PIPS Plan consistent with the elements of these Statewide Trauma Planning recommendations[29].
   - *1.1. 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.*
   - *1.2. Utilize existing educational forums to provide information on the state PIPS plan, with an emphasis on the PIPS structure, process and metrics.*

[29] Recommendation from ACS State Trauma System Consultation report, 2016

2. Create a *multidisciplinary* State Trauma PIPS committee as a subcommittee of the STAC *taking into consideration the urban, suburban and rural clusters of Trauma Centers, regions, hospital network affiliations, and Committee on Trauma representation.*
   2.1. Solidify the state core trauma performance improvement measures within the State PIPS plan to include structure, process, outcome and patient safety metrics.
   2.2 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.
   2.3 Query the databases to help answer specific performance improvement questions of interest, such as rates of over- and under-triage, and timeliness of re-triage and address trends in deviation of care through the PIPS plan process.
   2.4 ***Consider incorporating the best practices, processes and metrics identified from LEMSAs with well-established PIPS plans.***
3. Perform a statewide assessment of the Trauma System based on national standards and California-specific resources.
4. Evaluate state data and identify regional opportunities for improvement, determining if similar opportunities are occurring in other regions and explore mechanisms for shared resolution:
   4.1. Develop specific database queries.
   4.2. Create definition for system sentinel event and monitor such events.
   4.3. Facilitate issue resolution by assisting other system performance improvement committees.
   4.4. Develop and implement standards for system-wide performance improvement.
5. Create a recommended minimal data set of information to be submitted to LEMSA system trauma registries from non-trauma facilities to track and trend outcomes of traumatically injured patients retained in non-trauma receiving facilities.
6. Direct cross-regional issues to specific PIPS Work Groups for study and recommended resolution.
7. Develop and institute a mechanism for providing data and feedback to LEMSAs to assist in optimizing local PIPS processes.
8. Explore participation in the American College of Surgeons National Trauma Performance Improvement Project (TQIP) as a state, including a cost-benefit analysis.
   8.1. Seek funding partners to support a California State Collaborative to provide risk-adjusted benchmarking outcomes.
9. Create a policy regarding the sharing of data for the PI process, recognizing hospital confidentiality and HIPPA regulations.
10. Explore the development of a HIPPA compliant universal identifier (e.g. PCR# from prehospital patient care report) that allows individual patient data to be tracked throughout the entire spectrum of care including post care outcomes.
11. Ensure recommended minimum data that set allows for risk adjustment of individual patients so that benchmarking can be carried out.
12. Develop a process to periodically collect data elements designed to focus on specific patient populations and processes that are deemed to be the most important at any given time; these focused projects may be directed from the State, Region or LEMSA.

13. Periodically benchmark individual systems, hospitals, LEMSAs and RTCCs to the group as a whole and to an outside standard such as the HRSA "Benchmarks, Indicators, Scoring" (BIS) tool[30].
    13.1. Encourage utilization of the BIS by the LEMSAs.
    13.2. Train facilitators to conduct the BIS for LEMSAs.

Local EMS Agency

1. Develop risk-adjusted standardized reports and based on nationally recognized formula.
2. Show overall progress in achieving goals for significant injury and patient categories.
3. *Ensure that all LEMSA medical directors report their clinical performance improvement initiatives to the EMS Authority.*
4. Create a local/regional Performance Improvement Program (may be integrated into EMS PI Program for small systems) to:
    4.1. Develop specific database queries.
    4.2. Create definition and monitor system sentinel events.
    4.3. Work with local Medical Examiner on guidelines for trauma post-mortem exams.
    4.4. Facilitate issue resolution by individual performance improvement committees.
    4.5. Incorporate the state PIPS trauma performance measures as a minimum into their trauma plans.
5. Represent LEMSA at regional and state Performance Improvement Committees

Regional Trauma Coordinating Committee

1. Identify regional system issues and work with member LEMSAs on resolution of these issues.
2. *Support regional collaboration to enhance system integration and performance improvement.*
3. Recommend audit filters based on the region's population traits, available resources and geography.
4. Explore tools to identify variations in care and outcomes across respective regions and determine possible ways to reduce detrimental variations in regional structures and care processes that may result in negative outcomes.
5. Prioritize system issues identified for resolution.
6. Work collaboratively with each member LEMSA to ensure standardized and accurate data collection and CEMSIS participation[31].

[30] 2016 ACS Recommendation from State Trauma System Consultation report
[31] 2016 ACS Recommendation from State Trauma System Consultation report

Component 12—Education & Training

Background and Current Status

Education consists of two categories: education of the public regarding trauma systems and education and training of trauma care professionals across the continuum of care.

Education of the Public
No formal public education process exists for trauma systems. Private and public surveys indicate that the general public regards all hospitals as Trauma Centers and few can indicate where their closest Trauma Center is located; furthermore, many citizens are not aware that the EMS system is the best avenue to receive trauma care. Direct first aid is another aspect of public education. Interventions utilizing new equipment and medications formerly available only to medical professionals are now being taught to the public, including use of tourniquets for severe limb hemorrhage.

Education and Training for Trauma Care Professionals
Education and training of trauma care professionals is compartmentalized into prehospital, nursing, and physician education with very limited trauma systems education. The EMS Authority in conjunction with statewide partners has sponsored seven State Trauma Summits providing updates on national trauma system development and clinical care along with an opportunity for local systems to present on best practices.

RTCCs also offer regional Trauma Summits with a mix of systems and clinical topics. RTCCs, partnering with the Trauma Managers Association of California (TMAC), sponsor the ACS Rural Trauma Team Development Course. Standard certification courses such as International Trauma Life Support (ITLS), Prehospital Trauma Life Support (PHTLS) and Transport Nurse Advanced Trauma Course (TNATC) are available and encouraged but not required in most of areas of the State.

While there are national continuing education standards in place for Trauma Centers, they are silent in California regulations. Some education requirements are addressed through the Trauma Center designation process and monitored by the LEMSA. Various national certification programs such as Advanced Trauma Life Support (ATLS), Trauma Nurse Coordinator Course (TNCC), Advanced Trauma Care for Nurses (ATCN), Advanced Cardiac Life Support (ACLS), and Pediatric Advanced Life Support (PALS) are available; however, there is no consistent standard for training throughout the State.

Regulations specify Trauma Center physician qualifications related to specialty board certification and Advanced Trauma Life Support certification. It is also a requirement that the Trauma Center participate in continuing education in trauma care. Education standards also exist within the Trauma Center, which are met if the Trauma Center either chooses or is required to be verified by the ACS.

Planned Development

State, regional and local education needs should be identified, and resources identified to meet those needs. Standard education competencies should apply statewide, and each region's individual educational offerings should address local needs.

EMS Authority

1. Identify statewide educational needs through the Performance Improvement and Patient Safety Program in consultation with hospitals, LEMSAs and RTCCs.
2. Develop, through its State Trauma Advisory Committee, a plan for providing information to the public regarding the structure and function of the State Trauma System.
3. *Expand the state EMS annual recognition program to include a category specific to the trauma system.*
4. ***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.***
    - *4.1. Consider engaging graduate student(s) from a communications or marketing program to support this effort.*
    - *4.2. Develop a one page fact sheet to summarize the updated goals in these Statewide Trauma System Planning recommendations and publish it on the EMS Authority website.*
    - *4.3. Integrate the executive summary from the comprehensive trauma injury report.*

Local EMS Agency

1. Provide public education regarding trauma systems and injury prevention.
2. Perform a needs assessment prior to developing new or additional trauma-related educational programs.

Regional Trauma Advisory Committee

1. Promote regional efforts to educate the public on trauma systems and the role and effectiveness of Trauma Centers.
2. Develop trauma clinical care education for regional trauma professionals.

Trauma Centers

1. Work with non-trauma facilities and level IV Trauma Centers in providing for the Rural Trauma Team Development Course.
    - *1.1. Seek funding for continued provision of the course for rural acute care facilities to assist them in becoming participating trauma facilities.*
2. Provide educational opportunities based on PIPS Program findings.

Component 13—Trauma Systems Research

Background and Current Status

Academic research centers perform the majority of trauma research done in California (Level I Trauma Center) and is required by regulation for Level I designation. Important contributions are also being made in the areas of public health, pediatrics, and prehospital. Most of these projects are being conducted by single institutions or agencies and are not utilizing the opportunities of collaborative, multidisciplinary research. Currently, funding is sought by investigators and facilitated by the research institution. To date, statewide systems research has been limited and has included isolated reports from single institutions on issues such as access to care and pediatrics.

The state trauma registry (CEMSIS-Trauma) is an important source of information and data for research. Institutional and regional databases may be used for comparative and outcomes research, and large statewide databases should be used to demonstrate the effectiveness of the system. The CEMSIS-Trauma Registry was started in 2009 and currently does not have a mechanism to request data for the purposes of research. The EMS Authority is responsible for maintaining data integrity and reliability of the state trauma registry, which is compatible with the National Trauma Data Standards (NTDS).

Research using trauma registries may provide information about resource utilization, outcomes, and system performance. Comparative benchmarking using local, regional or statewide trauma registries can be performed by comparing local data with the National Trauma Data Bank (NTDB).

Planned Development

Local EMS agencies and Trauma Centers should be the basis for collaborative systems research utilizing the statewide CEMSIS database. Trauma system research involving both local and state agencies should be part of local/regional trauma systems.

EMS Authority

1. *Develop a research agenda with priority topics identified.*
2. *Encourage continued investigation of issues that may help inform trauma system evaluation and planning in California and the nation.*
3. Facilitate access to data for individual or groups of investigators through the use of the CHHS Open Data Portal and CEMSIS[32]
4. Establish internal policies for the request for data from CEMSIS for research purposes.
5. Identify the research expertise in the system and work collaboratively with experts in the field (e.g. Schools of Public Health, Finance and Economics).

State Trauma Advisory Committee

1. Facilitate multidisciplinary collaboration for research.

[32] 2016 ACS Recommendation from State Trauma System Consultation Report

2. Develop research agenda (possibly through a research committee) and collaborate with established investigators to conduct research projects.
3. Periodically review trauma system data derived from CEMSIS, OSHPD and other sources, and make recommendation to various system stakeholders regarding potential areas of research.

Component 14—Injury Prevention

Background and Current Status

A number of collaborative efforts between Trauma Centers, LEMSAs and public health departments have successfully been developed at the regional level and can be used as models for injury prevention. In keeping with the public health model, statewide injury control in California has been established primarily under the direction of the Department of Public Health; however, an assessment of the state trauma system in 2006 by EMSA recognized a lack of interface between these efforts and state trauma leadership.

EMSA participates in the Strategic Highway Safety Plan (SHSP) that has 17 Challenge Areas focused on many injury prevention topics. EMSA is the lead agency for Challenge Area 15 that has the goal of "Improving Post Crash Survivability". EMSA is actively forging relationships between EMS partners (LEMSAs, Trauma Centers, and providers) and SHSP committees to increase statewide injury prevention participation.

The Trauma Managers Association of California (TMAC) utilizes the expertise of many trauma program leaders to develop statewide coalitions for prevention. Some of the Regional Trauma Coordinating Committees (RTCC) are developing organized approaches for injury prevention.

Planned Development

The incorporation of an integrated injury prevention system into the Trauma System is a critical step in reducing the burden of injury morbidity and mortality in California. In recent years, trauma care has shifted from the medical model of treating injuries to a public health approach that defines trauma as a preventable disease. Rather than focusing on the acute care of traumatic injuries, the public health framework allows for the prevention and mitigation of injury by addressing the causes of trauma and subsequent injury.

State EMS Authority/State Trauma Advisory Committee

1. *Create a needs-based, integrated, statewide injury prevention injury prevention plan, in collaboration with the California Department of Public Health that identifies priorities for intervention.*
   - *1.1. Share the injury prevention plan and its priorities with LEMSAs and Trauma Centers.*
   - *1.2. Encourage LEMSAs and Trauma Centers to develop strategies to address state priority injury prevention issues.*
2. Partner with existing agencies focusing on statewide injury prevention (e.g. EpiCenter at the California Department of Public Health) for the purpose of:
   - 2.1. Establishing best practice recommendations for prevention programs and evaluation based on scientifically evaluated injury prevention strategies.
   - 2.2. Improving coordination and utilization of public health and trauma systems injury prevention resources at the state, regional and local levels.
   - 2.3. Coordinating a statewide strategy to promote injury awareness with the public, media, and elected officials.

Local EMS Agency/Regional Trauma Coordinating Committee

1. Develop a compendium of regional injury prevention programs with links provided to EMSA for posting on the website.
2. Implement new and support existing scientifically proven prevention programs in response to regionally specific injury data.
3. Ensure ongoing program evaluation to determine the effectiveness in reducing intentional and unintentional injuries.
4. Collaborate with injury prevention programs to collect the necessary data for program evaluation and needs assessment.
5. Create a public information and education program with consistent messaging on the preventability of injury.

Component 15—Emergency/Disaster Preparedness

Background and Current Status

The role of trauma systems is a key component of the overall response system for disasters/multiple casualty events. Each LEMSA and Operational Area (county) has a defined means of communication and coordination of patient movement. A local jurisdiction engaged in a multi-casualty incident (MCI) commands and organizes a given incident using their local MCI Plan. Triage, using LEMSA protocols and procedures, is conducted under a Triage Unit and patient treatment and staging prior to transport are conducted under a Treatment Unit. Using local procedures, Radio communication from the Transportation Leader relays the number and acuity of victims to the healthcare system, including Trauma Centers, which in turn communicate their capacity for receiving patients. Designated trauma and burn patients, using LEMSA criteria, are directed to trauma/burn centers. If the magnitude of the MCI begins to exceed the capacity of the local or Operational Area trauma system, patient movement may be directed to contiguous trauma systems.

The State Operations Center (SOC), operated by CalOES, coordinates State resources to a disaster. The Public Health and Medical Emergency Function (EF8) support the Medical Mutual Aid system and supports affected trauma systems or to coordinate state-wide patient movement through the EMS Authority and California Department of Public Health. The SOC, with approval of the Governor, can also make requests for federal medical and health resources through the FEMA Region IX and Department of Health and Human Services Region IX.

All-hazards multi-casualty events typically include situations involving natural (earthquake), unintentional (school bus crash), and intentional (terrorist explosion) trauma-producing events that test the expanded response capabilities and surge capacity of the trauma system. Funding from HRSA and FEMA is inadequate for the task of preparing Trauma Centers for the next inevitable event when they are already under economic duress.

Planned Development

EMS Authority/State Trauma Advisory Committee

1. Perform an assessment gap analysis of the state trauma system's emergency preparedness including Trauma Center surge capacity
2. *Explore the use of Hospital Preparedness Program funding to assist the trauma system with disaster planning and exercises.*
3. Integrate Statewide Trauma System Planning with the California Department of Public Health and Medical Emergency Operations Manual Plan for natural and manmade incidents.
    3.1. *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.*
4. *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.*

5. Explore the use of existing resource monitoring systems to provide real-time trauma capacity and resources assessment.
    5.1. Utilize disaster management systems to assess hospital capacity and capability for specialized care.
6. Incorporate the role of the trauma system in the Public Health and Medical Emergency Operations Manual[33] .
7. Develop a standardized inventory for trauma caches that could be located at strategic locations in the event of a disaster.
8. Develop the capacity via the EMSA website for the dissemination of guidelines, protocols, programs, etc. relevant to the State Trauma System.
9. Encourage collaboration, communication, and involvement between LEMSAs, RTCCs, MHOAC/RDMHS, and local Trauma Center staff.
10. Coordinate and plan with LEMSAs, RTCCs, MHOAC/RDMHS, and local Trauma Center staff for rapid decompression of healthcare facilities during regional mass casualty events.

Local EMS Agency/Regional Trauma Coordinating Committee

1. Explore trauma system surge capacity, and best practices to improve disaster response.
2. Provide leadership and active participation in the state and regional trauma care system with lead functions for system and disaster planning.
3. Promote training to Trauma Centers and non-trauma facilities on the medical health disaster system in the region.
4. Develop template language for MOU's between Trauma Centers to ensure a quick process for sharing resources (personnel, equipment and medical supplies) to enhance surge capacity during disasters.
5. Incorporate applicable LEMSA disaster planning with the LEMSA trauma plans along with annual disaster updates.
    5.1. 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.
6. Consider using a patient tracking system that could be implemented on a regular basis as well as in the event of a disaster.

[33] 2016 ACS Recommendation from State Trauma System Consultation report

Appendix C

State Trauma Advisory Committee Membership

State of California
EMS Authority
State Trauma Advisory Committee

	Name	Representation	Nominating Organization	Employment	Term Appoint.	Term Expires
	Committee Chair					
1	Robert Mackersie, MD, FACS	EMS Authority	EMS Authority	San Francisco General Hospital & Trauma Center	02/01/14	02/01/17
	Regional Representatives					
2	David Shatz, MD, FACS	Region 1 - North RTCC	North RTCC	UC Davis Medical Center	08/01/16	08/01/19
3	Adella Garland, MD, FACS	Region 2 - Bay RTCC	Bay RTCC	Santa Clara Valley Medical Center	05/01/16	05/01/19
4	James Davis, MD, FACS	Region 3 - Central RTCC	Central RTCC	Community Regional Medical Center - Fresno	08/01/16	08/01/19
5	Katy Hadduck, RN	Region 4 - SW RTCC	SW RTCC	Ventura County EMS Agency	01/01/15	08/01/18
6	John Steele, MD, FACS	Region 5 - SE RTCC	SE RTCC	Palomar Medical Center	08/01/16	08/01/19
	Constituent Representatives					
7	Cathy Chidester, RN	LEMSA Admin - Urban	EMSAAC	Los Angeles County EMS Agency	08/01/13	08/01/16
8	Dan Lynch	LEMSA Admin - Rural	EMSAAC	Central California EMS Agency	09/18/13	09/18/16
9	Jay Goldman, MD	LEMSA Medical Director	EMDAC	Kaiser Permanente Foundation Health Plan & Hospit	07/20/13	07/31/16
10	BJ Bartleson, RN	California Hospital Assn	CHA	California Hospital Association	08/01/16	08/01/19
11	H. Gill Cryer, MD, PhD	Trauma Surgeon	ACS	Ronald Reagan UCLA Medical Center	05/07/10	05/08/13
12	Vacant	Emergency Physician	CAL ACEP	Emergency Medicine Associates		
13	Christy Preston	Trauma Coordinator	TMAC	Los Angeles County EMS Agency		
14	Robert Dimand, MD	Pediatric Representative	EMSC TAC	State of California - California Children's Services	12/20/13	12/31/15
15	David Shatz	Trauma Surgeon	Cal-Chiefs	UC Davis Medical Center	09/01/16	09/01/19
16	Myron Smith,MBA, EMT-P	Private Provider	CAA	Hall Ambulance Service,INC	11/22/13	11/22/16
	At-Large Representatives					
17	Joe Barger, MD, FACEP	At Large	EMS Authority	Contra Costa EMS Agency	04/02/14	04/02/17
18	Christopher Newton, MD, FACS, FAAP	At Large	EMS Authority	Oakland Children's Hospital	03/14/14	03/14/17

Appendix D

Designated Trauma Centers

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center	Level I Trauma Center	Level II Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
ALAMEDA COUNTY EMS (Bay Area RTCC)	**Alameda**		**1**						**2**				
	Alameda County	Children's Hospital Medical Center - Oakland 747 52nd Street Oakland, CA 94609 Hospital: (510) 450-7600 (Private) Trauma: (510) 428-3045										06/01/1985	**04/26/2005** Designation as Level I Pediatric Trauma Center
	Alameda County	Eden Hospital Medical Center 20103 Lake Chabot Road Castro Valley, CA 94546 Hospital: (510) 537-1234 (Private) Trauma: (510) 727-2717										06/01/1985	
	Alameda County	Highland Alameda County Medical Center Campus 1411 East 31st Street Oakland, CA 94602 Hospital: (510) 534-8055 (Public) Trauma: (510) 437-4754										06/01/1985	
CENTRAL CALIFORNIA EMS (Central RTCC)	**Fresno, Kings, Madera, & Tulare**			**1**				**1**		**1**			
	Fresno County	Community Regional Medical Center - Fresno 2823 Fresno Street Fresno, CA 93721 Hospital: (559) 459-6000 (Private) Trauma: (559) 459-5130										04/07/2007	
	Madera	Valley Children's Hospital 9300 Valley Children's Place Madera, CA 93636 Hospital: (559) 353-3000 (Private)										02/03/2015	
	Tulare County	Kaweah Delta Medical Center 400 West Mineral King Visalia, CA 93291-6263 Hospital: (559) 624-2000 (Private) Trauma: (559) 624-2867										01/26/2010	
	Fresno County	University Medical Center											**04/17/2007** De-Designated as Level I Trauma Center (Hospital closed)
	Fresno County	Children's Hospital Central California											**10/04/2002** De-Designated as Level II Pediatric Trauma Center
COASTAL VALLEY EMS (North RTCC)	**Sonoma, & Mendocino**								**1**		**2**		
	Mendocino County	Ukiah Valley Medical Center 275 Hospital Drive Ukiah, CA 95482 Hospital: (707) 462-3111 (Private)										07/01/2010	
	Sonoma County	Santa Rosa Memorial Hospital 1165 Montgomery Drive Santa Rosa, CA 95405-4897 Hospital: (707) 546-3210 (Private) Trauma: (707) 547-4608										05/01/2000	
	Sonoma County	Frank Howard Memorial Hospital 1 Marcela Drive Willits, CA 95490 Hospital: (707) 4596801										12/01/2016	**12/1/2016** Designated as Level IV Trauma Center

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center	Level I Trauma Center	Level II Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
CONTRA COSTA COUNTY EMS (Bay Area RTCC)	**Contra Costa**								1				
	Contra Costa County	John Muir Medical Center 1601 Ygnacio Valley Road Walnut Creek, CA 94598 Hospital: (925) 939-3000 (Private) Trauma: (925) 947-5224										06/01/1986	
EL DORADO COUNTY EMS (North RTCC)	**El Dorado**									2			
	El Dorado County	Barton Healthcare System 2170 South Avenue South Lake Tahoe, CA 96158 Hospital: (Private) Trauma:										01/27/2015	
	El Dorado County	Marshall Medical Center 1100 Mashall Way Placerville, CA 95667 Hospital: (530) 622-1441 (Private) Trauma: (530) 626-2784										08/09/2009	
IMPERIAL COUNTY EMS (South East RTCC)	**Imperial**										2		
	Imperial County	El Centro Regional Medical Center 1415 Ross Avenue El Centro, CA 92243 Admin - (760) 339-7111 (Private) Trauma Office - (760) 339-7323										03/24/2004	
	Imperial County	Pioneers Memorial Healthcare District 207 W Legion Road Brawley, CA 92227 Admin - (760) 344-2120 (Private) Trauma Office - (760) 351-3888										03/22/2004	
INLAND COUNTIES EMS (South East RTCC)	**San Bernardino, Inyo, & Mono**				1				1				
	San Bernardino County	Arrowhead Regional Medical Center 400 North Pepper Avenue Colton, CA 92324 Hospital: (909) 580-1001 (Public) Trauma: (909) 580-6116										10/01/1981	**03/30/1999** Name change (formally San Bernardino County Medical Center)
	San Bernardino County	Loma Linda University Medical Center 11234 Anderson Loma Linda, CA 92354 Hospital: (909) 824-0800 (University) Trauma: (909) 558-4000, ext 87270										10/01/1981	**07/27/2004** Added Designation as Level I Pediatric Trauma Center
KERN COUNTY EMS (Central RTCC)	**Kern**								1		1		
	Kern County	Kern Medical Center 1830 Flower Street Bakersfield, CA 93305 Hospital: (661) 326-2161 (Public) Trauma: (661) 326-5658										11/01/2001	

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center	Level I Trauma Center	Level II Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
	Kern County	Ridgecrest Regional Hospital 1081 N. China Lake Blvd. Ridgecrest, CA 93555 Hospital: (760) 446-3551 (Public)										05/01/2016	
LOS ANGELES COUNTY EMS (South West RTCC)	**Los Angeles**		**1**		**1**	**3**	**2**		**8**				
	Los Angeles County	Antelope Valley Hospital 1600 W. Avenue J Lancaster, CA 93534 Hospital: (661) 949-5505 (Private) Trauma: (661) 949-5298										05/03/2010	**12/01/1987** De-Designated as Level II Trauma Center; **05/03/2010** Designation as Level II Trauma Center
	Los Angeles County	California Hospital Medical Center 1401 S. Grand Avenue Los Angeles, CA 90015 Hospital: (213) 748-2411 (Private) Trauma: (213) 742-5451										12/01/2004	**07/01/1984** Designation as Level II Trauma Center; **02/01/1985** De-Designated as Level II Trauma Center; **12/01/2004** Designation as Level II Trauma Center
	Los Angeles County	Cedars-Sinai Medical Center 8700 Beverly Boulevard Los Angeles, CA 90048-1865 Hospital: (310) 423-3277 (Private) Trauma: (310) 423-8732										04/01/1984	**04/01/2002** Added Designation as Level II Pediatric Trauma Center
	Los Angeles County	Children's Hospital of Los Angeles 4650 Sunset Boulevard Los Angeles, CA 90027-6062 Hospital: (323) 660-2450 (Private) Trauma: (323) 669-4526										12/01/1983	
	Los Angeles County	Harbor UCLA Medical Center 1000 West Carson Street Torrance, CA 90502-2004 Hospital: (310) 222-2345 (Public) Trauma: (310) 222-1912										12/01/1983	**04/01/2002** Added Designation as Level II Pediatric Trauma Center
	Los Angeles County	Henry Mayo Newhall Memorial Hospital Memorial Hospital 23845 W. McBean Parkway Valencia, CA 91355-2083 Hospital: (661) 253-8000 (Private) Trauma: (661) 253-8118										10/01/1984	**01/01/1992** Changed from Level III Trauma Center to Designation as Level II Trauma Center
	Los Angeles County	Huntington Memorial Hospital 100 West California Blvd. Pasadena, CA 91105-3097 Hospital: (626) 397-5000 (Private) Trauma: (626) 397-5900										12/01/1983	**06/30/1992** Changed from Level I Trauma Center to Designation as Level II Trauma Center
	Los Angeles County	LAC + USC Medical Center 1200 North State Street Los Angeles, CA 90033-1083 Hospital: (323) 226-2622 Trauma: (323) 226-7780 (Public)										12/01/1983	**04/01/2002** Added Designation as Level II Pediatric Trauma Center
	Los Angeles County	Long Beach Memorial + Miller Children's Medical Center 2801 Atlantic Avenue Long Beach, CA 90806-1737 Hospital: (562) 933-2000 (Private) Trauma: (562) 933-1315										12/01/1983	**01/01/1992** Changed from Level I Trauma Center to Designation as Level II Trauma Center; **04/01/2002** Added Designation as Level II Pediatric Trauma Center
	Los Angeles County	Northridge Hospital Medical Center 18300 Roscoe Blvd. Northridge, CA 91325-4105 Hospital: (818) 885-8500 (Private) Trauma: (818) 885-8500, xtn 2758										06/01/1984	**10/04/2010** Added Designation as Level II Pediatric Trauma Center

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center	Level I Trauma Center	Level II Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
					Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level II Pediatric Trauma Center						
	Los Angeles County	Pomona Valley Hospital Medical Center 1798 N. Garey Avenue Pomona, CA 91767 Hospital: (909) 865-9500 (Private)										04/01/2017	**10/01/1986** De-Designated as Level II Trauma Center **04/01/2017** Re-designated as Level II
	Los Angeles County	Providence Holy Cross Medical Center 15031 Rinaldi Street Mission Hills, CA 91345-1207 Hospital: (818) 365-8051 (Private) Trauma: (818) 898-4312										05/01/1984	
	Los Angeles County	Ronald Regan UCLA Medical Center 757 Westwood Plaza Los Angeles, CA 90095-3075 Hospital: (310) 825-9111 (Private) Trauma: (310) 825-5215										12/01/1983	**04/01/2002** Added Designation as Level I Pediatric Trauma Center
	Los Angeles County	St. Francis Medical Center 3630 E. Imperial Hwy. Lynwood, CA 90262-2678 Hospital: (310) 900-8900 (Private) Trauma: (310) 900-8675										01/01/1996	
	Los Angeles County	St. Mary Medical Center 1050 Linden Avenue Long Beach, CA 90813-3393 Hospital: (562) 491-9000 (Private) Trauma: (562) 491-9174										12/01/1983	**01/01/1992** Changed from Level I Trauma Center to Designation as Level II Trauma Center
	Los Angeles County	Daniel Freeman Memorial Hospital											**06/01/1987** De-Designated as Level II Trauma Center
	Los Angeles County	Martin Luther King Jr./Drew Medical Center											**07//01/2004** Changed from Level I Trauma Center to Designation as Level II Trauma Center, **03/01/2005** De-Designated as Level II Trauma Center
	Los Angeles County	Methodist Hospital of Southern California											**01/01/1989** De-Designated as Level II Trauma Center
	Los Angeles County	Presbyterian Intercommunity Hospital											**08/01/1989** De-Designated as Level II Trauma Center
	Los Angeles County	Queen of Angels Medical Center											**02/01/1987** De-Designated as Level II Trauma Center
	Los Angeles County	Queen of the Valley Hospital											**12/01/1987** De-Designated as Level II Trauma Center
	Los Angeles County	Santa Monica UCLA Hospital											**08/01/1987** De-Designated as Level II Trauma Center
	Los Angeles County	St. Joseph Medical Center											**06/01/1989** De-Designated as Level II Trauma Center
	Los Angeles County	Westlake Community											**06/01/1994** De-Designated as Level III Trauma Center

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center	Level I Trauma Center	Level II Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
MARIN COUNTY EMS (Bay Area RTCC)	**Marin**									**1**			
	Marin County	Marin General Hospital 250 Bonair Road Greenbrae, CA 94912-8010 Hospital: (415) 925-7000 (Private) Trauma: (415) 925-7251										01/01/2001	
MERCED COUNTY COUNTY EMS (Central RTCC)	**Merced**												**Approved Trauma Plan & No Designated Trauma Centers**
MONTEREY COUNTY EMS (Bay Area RTCC)	**Monterey**								**1**				
	Monterey County	Natividad Medical Center 1441 Constitution Blvd Salinas, CA 93906 Hospital: (831) 755-4111										01/06/2015	
MOUNTAIN VALLEY EMS (Central RTCC)	**Alpine, Amador, Calaveras, Mariposa, & Stanislaus**								**2**				
	Stanislaus County	Doctor's Medical Center - Modesto 1441 Florida Avenue Modesto, CA 95350 Hospital: (209) 578-1211 (Private) Trauma: (209) 576-3776										02/02/2004	
	Stanislaus County	Memorial Medical Center - Modesto 1700 Coffee Road Modesto, CA 95355 Hospital: (209) 526-4500 (Private) Trauma: (209) 572-7147										02/02/2004	
NAPA COUNTY EMS (North RTCC)	**Napa**									**1**			
	Napa County	Queen of the Valley Hospital - Napa 1000 Trancas Street Napa, CA 94558 Hospital: (707) 252-4411 (Private) Trauma: (707) 252-4422, ext 2399										12/01/1988	
NORTH COAST EMS (North RTCC)	**Del Norte, Humboldt, & Lake**										**2**		
	Del Norte County	Sutter Coast Hospital 800 E. Washington Street Cresent City CA 95443 Hospital: (707) 464-8511 (Private) Trauma: (707) 263-5640										05/09/2009	

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center	Level I Trauma Center	Level II Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
	Lake County	Sutter Lakeside Hospital 5176 Hill Road Lakeport, CA 95443 Hospital: (707) 263-5641 (Private) Trauma: (707) 263-5641										04/04/2006	
NORTHERN CALIFORNIA EMS (North RTCC)	**Lassen, Modoc, Trinity, Plumas, Glenn, & Sierra**										**3**		
	Glenn County	Glenn Medical Center 1133 W. Sycamore Street Willows, CA 95988 Hospital: (530) 934-1800 (Public) Trauma: (530) 934-1800 *Ask for ED*										07/30/2002	
	Lassen County	Banner Lassen Hospital 1800 Spring Ridge Drive Susanville, CA (530) 252-2238 (Private)										01/01/2015	
	Plumas County	Seneca Healthcare District 130 Brentwood Drive Chester, CA 96080 Hospital: (530) 258-2151 (Private) Trauma: (530) 258-3673										12/01/2002	
NORTHERN CALIFORNIA EMS	Plumas County	Indian Valley Healthcare District											**01/03/2005** De-Designated as Level IV Trauma Center (ED closed)
ORANGE COUNTY EMS (South West RTCC)	**Orange**			**1**				**1**	**2**				
	Orange County	Mission Hospital Regional Medical Center 27700 Medical Center Road Mission Viejo, CA 92691 Hospital: (949) 364-1400 (Private) Trauma: (949) 364-7754										06/01/1980	
	Orange County	UC Irvine Medical Center 101 The City Drive South Orange, CA 92868 Hospital: (714) 456-7890 (University) Trauma: (714) 456-5637										06/01/1980	
	Orange County	Orange County Global Medical Center 1001 North Tustin Santa Ana, CA 92705 Hospital: (714) 835-3555 (Private) Trauma: (714) 953-3422										06/01/1980	**6/12/2015** Name Change from Western Medical Center-Santa Ana
	Orange County	Children's Hospital Orange County 1201 West La Veta Avenue Orange CA 92868 Hospital: (714) 997-3000										1/15/2015	
	Orange County	Anaheim Memorial Hospital											**04/01/1983** De-Designated as Level II Trauma Center

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center / Level I Pediatric Trauma Center	Level I Trauma Center / Level II Pediatric Trauma Center	Level II Trauma Center / Level II Pediatric Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
	Orange County	Fountain Valley Regional Hospital											**12/01/1989** De-Designated as Level II Trauma Center
	Orange County	St. Jude Medical Center											**09/01/1983** De-Designated as Level II Trauma Center
RIVERSIDE COUNTY EMS (South East RTCC)	**Riverside**						1		3				
	Riverside County	Desert Regional Medical Center 1150 North Indian Canyon Drive Palm Springs, CA 92262 Hospital: (760) 323-6511 (Private) Trauma: (760) 323-6524										09/01/1994	
	Riverside County	Inland Valley Medical Center 36485 Inland Valley Drive Wildomar, CA 92595 Hospital: (951) 677-1111 (Private) Trauma: (951) 696-6210										01/01/1996	**10/1/2013** upgraded from Level III to Level II designation.
	Riverside County	Riverside Community Hospital 4445 Magnolia Riverside, CA 92501 Hospital: (951) 788-3000 (Private) Trauma: (951) 788-3369										09/01/1994	
	Riverside County	Riverside County Regional Medical Center 26520 Cactus Avenue Moreno Valley, CA 92555 Hospital: (951) 486-4000 (Public) Trauma: (951) 486-4557										09/01/1994	**12/16/2009** Added Designation as Level II Pediatric Trauma Center
SACRAMENTO COUNTY EMS (North RTCC)	**Sacramento**				1				2				
	Sacramento County	Kaiser - South Sacramento 6600 Bruceville Road Sacramento, CA 95823 Hospital: (916) (Private) Trauma: (916)										08/09/2009	Christy Frecceri
	Sacramento County	Mercy San Juan Medical Center 6501 Coyle Avenue Carmichael, CA 95608 Hospital: (916) 537-5000 (Private) Trauma: (916) 864-5692										08/01/1999	
	Sacramento County	UC Davis Medical Center 2315 Stockton Boulevard Sacramento, CA 95817 Hospital: (916) 734-2011 (University) Trauma: (916) 734-7122										06/01/1984	
SAN BENITO COUNTY EMS (Bay Area RTCC)	**San Benito**												**Approved Trauma Plan & No Designated Trauma Centers**

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center	Level I Trauma Center	Level II Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
			Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level II Pediatric Trauma Center						
SAN DIEGO COUNTY EMS (South East RTCC)	**San Diego**			**1**				**2**	**3**				
	San Diego County	Palomar Medical Center 555 East Valley Parkway Escondido, CA 92025 Hospital: (760) 739-3000 (Private) Trauma: (760) 739-3692										10/01/1984	
	San Diego County	Rady Children's Hospital San Diego 3020 Children's Way San Diego, CA 92123 Hospital: (858) 966-1700 (Private) Trauma: (858) 966-4010										08/01/1984	
	San Diego County	Scripps Memorial Hospital 9888 Genesee Avenue La Jolla, CA 92037 Hospital: (858) 626-4123 (Private) Trauma: (858) 626-6350										08/01/1984	
	San Diego County	Scripps Mercy Hospital and Health Center 4077 Fifth Avenue San Diego, CA 92103 Hospital: (619) 294-8111 (Private) Trauma: (619) 260-7285										08/01/1984	**08/12/2003** Changed from Level II Trauma Center to Designation as Level I Trauma Center
	San Diego County	Sharp Memorial Hospital 7901 Frost Street San Diego, CA 92123 Hospital: (858) 541-3400 (Private) Trauma: (858) 541-3200										08/01/1984	
	San Diego County	UC San Diego Medical Center 200 West Arbor Drive San Diego, CA 92103 Hospital: (619) 543-6222 (Public) Trauma: (619) 543-7200										08/01/1984	
	San Diego County	Grossmont Hospital											**08/01/1985** De-Designated as Level II Trauma Center
SAN FRANCISCO COUNTY EMS (Bay Area RTCC)	**San Francisco**							**1**					
	San Francisco County	San Francisco General Hospital & Medical Center 1001 Potrero Avenue San Francisco, CA 94110 Hospital: (415) 206-8000 (Public) Trauma: (415) 206-4639										02/01/1991	
SAN JOAQUIN COUNTY EMS (North RTCC)	**San Joaquin County**									**1**			
	San Joaquin County	San Joaquin General Hospital 500 W Hospital Rd French Camp, CA 95231 Hospital: (209) 468-6000 (Public)										08/01/2013	

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center / Level I Pediatric Trauma Center	Level I Trauma Center / Level II Pediatric Trauma Center	Level II Trauma Center / Level II Pediatric Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
SAN LUIS OBISPO EMS (South West RTCC)	**San Luis Obispo**									**1**			
	San Luis Obispo	Sierra Vista Regional Medical Center 1010 Murray Avenue San Luis Obispo CA 93405 Hospital: (805) 546-7600 (Private) Transfer: (877) 903-0003										03/01/2012	
SAN MATEO COUNTY EMS (Bay Area RTCC)	**San Mateo**												**Approved Trauma Plan & No Designated Trauma Centers**
SANTA BARBARA COUNTY EMS (South West RTCC)	**Santa Barbara**						**1**			**1**			
	Santa Barbara County	Marian Regional Medical Center 1400 East Church St Santa Maria, CA 93454 Hospital (805) 739-3000 (Private)										04/01/2013	
	Santa Barbara County	Santa Barbara Cottage Hospital P. O. Box 689 Santa Barbara, CA 93102 Hospital: (805) 682-7111 (Private) Trauma: (805) 569-7451										06/01/2001	Pediatric Level II Designation
	Santa Barbara County	Goleta Valley Cottage Hospital											**07/01/2008** De-Designated as Level III Trauma Center
SANTA CLARA COUNTY EMS (Bay Area RTCC)	**Santa Clara**				**2**				**1**				
	Santa Clara County	Regional Medical Center of San Jose 225 N. Jackson Avenue San Jose, CA 95116 Hospital: (408) 259-5000 (Private) Trauma: (408) 272-6466										05/24/2005	
	Santa Clara County	Santa Clara Valley Medical Center 751 South Bascom Avenue San Jose, CA 95128 Hospital: (408) 885-5000 (Public) Trauma: (408) 885-5220										08/01/1986	**10/09/2009** Added Designation as Level II Pediatric Trauma Center; upgraded to Level I Pediatric Trauma Center
	Santa Clara County	Stanford University Medical Center 300 Pasteur Drive Stanford, CA 94305 Hospital: (650) 723-7570 (University) Trauma: (650) 723-7570										08/01/1986	**10/09/2009** Added Designation as Level II Pediatric Trauma Center; April 2014 upgraded to Level I Pediatric Trauma Center
	Santa Clara County	San Jose Medical Columbia Center											**12-09-2004** De-Designated as Level II Trauma Center (facility closed)

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center	Level I Trauma Center	Level II Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
SANTA CRUZ COUNTY EMS (Bay Area RTCC)	**Santa Cruz**												**Approved Trauma Plan & No Designated Trauma Centers**
SIERRA-SACRAMENTO VALLEY EMS (North RTCC)	**Butte, Colusa, Nevada, Placer, Shasta, Siskiyou, Sutter, Tehema, & Yuba**								**3**	**4**	**1**		
	Butte County	Enloe Medical Center 1531 Esplanade Chico, CA 95926 Hospital: (530) 332-7300 (Private) Trauma: (530) 332-5433										07/01/1988	
	Placer County	Sutter Roseville Medical Center One Medical Plaza Roseville, CA 95661 Hospital: (916) 781-1000 (Private) Trauma: (916) 781-1381										01/01/1995	
	Shasta County	Mercy Medical Center Redding 2175 Rosaline Avenue Redding, CA 96001 Hospital: (530) 225-6000 (Private) Trauma: (530) 225-7242										08/01/1990	
	Shasta County	Shasta Regional Medical Center 1100 Butte Street Redding, CA 96001 Hospital: (530) 244-5400 (Private) Trauma: (530) 244-5170										12/26/2001	
	Siskiyou County	Fairchild Medical Center 444 Bruce Street Yreka, CA 96097 Hospital: (530) 842-4121 (Private) Trauma: (530) 842-4121										12/18/2001	**2007** Changed designation from Level III to designation as Level IV Trauma Center
	Siskiyou County	Mercy Medical Center Mt. Shasta 914 Pine Street Mt. Shasta, CA 96067 Hospital: (530) 926-6111 (Private) Trauma: (530) 926-9367										12/01/2001	**06/27/2002** Changed from Level IV to Designation as Level III Trauma Center
	Tehema County	St. Elizabeth Community Hospital 2550 Sister Mary Columba Drive Red Bluff, CA 96080 Hospital: (530) 529-8000 (Private) Trauma: (530) 529-8305										12/13/2001	
	Yuba County	Rideout Memorial Hospital 726 4th Street Marysville, CA 95901-5656 Hospital: (530) 749-4300 (Private) Trauma: (530) 749-4580										12/01/2001	
	Butte County	Orchard Hospital 240 Spruce Street Gridley, CA 95948 Hospital: (530) 846-9068 (Private) Trauma: (530) 846-9068 *ask for ED*										06/21/2004	**5/20/2015** Withdrew its designation

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center	Level I Trauma Center	Level II Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
	Butte County	Oroville Hospital 2767 Olive Highway Oroville, CA 95966 Hospital: (530) 533-8500 (Private) Trauma: (530) 532-8349										12/01/2001	**05/27/2002** Changed from Level IV Trauma Center to Designation as Level III Trauma Center; **1/1/2015** Withdrew its designation
	Colusa County	Colusa Regional Medical Center 199 East Webster Street Colusa, CA 95932 Hospital: (530) 458-5821 (Private) Trauma: (530) 458-5821 *Ask for ED*										12/19/2001	**8/5/2015** Withdrew its designation
	Shasta County	Mayers Memorial Hospital District P.O. Box 459 Fall River Mills, CA 96028 Hospital: (530) 336-5511 (Private) Trauma: (530) 336-5511 *ask for ED*										12/18/2001	**7/1/2015** Withdrew its designation
SOLANO COUNTY EMS (Bay Area RTCC)	**Solano**								**1**	**1**			
	Solano	Kaiser Foundation Hospital 1 Quality Drive Vacaville, CA 95688 Hospital: (707) 624-4000 (Private) Trauma: (707) 624-2275										11/01/2011	**Level II designation 11/20/2013**
	Solano	NorthBay Medical Center 1200 B. Gale Wilson Blvd. Fairfield, CA 94533 Hospital: (707) 646-5000 (Private) Trauma: (707) 646-4019										11/01/2011	
TUOLUMNE COUNTY EMS (Central RTCC)	**Tuolumne**												**Approved Trauma Plan & No Designated Trauma Centers**
VENTURA COUNTY EMS (South West RTCC)	**Ventura**								**2**				
	Ventura County	Los Robles Hospital & Medical Center 215 West Janss Road Thousand Oaks, CA 91360 Hospital: (805) 497-2727 (Private) Trauma: (805) 370-4424										07/01/2010	
	Ventura County	Ventura County Medical Center 3291 Loma Vista Road Ventura, CA 93003 Hospital: (805) 652-6075 (Public) Trauma: (805) 652-5993										07/12/2010	
YOLO COUNTY EMS (North RTCC)	Yolo County												**Approved Trauma Plan & No Designated Trauma Centers**

	County	HOSPITAL	Level I Pediatric Trauma Center	Level II Pediatric Trauma Center	Level I Trauma Center	Level I Trauma Center	Level II Trauma Center	Level I Trauma Center	Level II Trauma Center	Level III Trauma Center	Level IV Trauma Center	Designation Date	Status Change
TOTAL TRAUMA CENTERS BY DESIGNATION													
Level I Pediatric Trauma Center Only			**2**										
Level II Pediatric Trauma Center Only			**3**										
Level I Trauma Center & Level I Pediatric Trauma Center			**5**										
Level I Trauma Center & Level II Pediatric Trauma Center			**3**										
Level II Trauma Center & Level II Pediatric Trauma Center			**4**										
Level I Trauma Center			**5**										
Level II Trauma Center			**34**			**Designated Pediatric Trauma Centers 17**							
Level III Trauma Center			**13**										
Level IV Trauma Center			**11**										
TOTAL:			**80**										

Appendix E

Trauma System Research

APPENDIX E: Research Articles

The following journal abstracts reflect National and California specific research on trauma system development.

Arch Surg. 1979;114(4):455-460
Systems of Trauma Care, A Study of Two Counties
John G. West, MD; Donald D. Trunkey, MD; Robert C. Lim, MD
Summary
Cases of motor vehicle trauma victims who died after arrival at a hospital were evaluated in both Orange County (90 cases) and in San Francisco County (92 cases), Calif. All victims in San Francisco County were brought to a single trauma center, while in Orange County they were transported to the closest receiving hospital. Approximately two thirds of the non-CNS-related deaths and one third of the CNS-related deaths in Orange County were judged by the authors as potentially preventable; only one death in San Francisco County was so judged. Trauma victims in Orange County were younger on the average, and the magnitude of their injuries was less than for victims in the San Francisco County. These data suggest that survival rates for major trauma can be improved by an organized system of trauma care that includes the resources of a trauma center.

J Trauma. 1999 Apr;46(4):565-79; discussion 579-81.
Trauma care regionalization: a process-outcome evaluation.
Sampalis JS, Denis R, Lavoie A, Fréchette P, Boukas S, Nikolis A, Benoit D, Fleiszer D, Brown R, Churchill-Smith M, Mulder D.
Summary
Regionalization of trauma care services was initiated in 1993 with the designation of four tertiary trauma centers. The process continued in 1995 with the implementation of patient triage and transfer protocols. Since 1995, the network of trauma care has been expanded with the designation of 33 secondary, 30 primary, and 32 stabilization trauma centers. In addition, during this period emergency medical personnel have been trained to assess and triage trauma victims within minimal prehospital time. The objective of the present study was to evaluate the impact of trauma care regionalization on the mortality of major trauma patients.
This study produced empirical evidence that the integration of trauma care services into a regionalized system reduces mortality. The results showed that tertiary trauma centers and reduced prehospital times are the essential components of an efficient trauma care system.

Crit Care Med. 2004 Jul;32(7):1477-83.

Impact of between-hospital volume and within-hospital volume on mortality and readmission rates for trauma patients in California.

Marcin JP, Romano PS.

Summary:

Previous research assessing the impact of between-hospital trauma volume (high volume centers vs. low volume centers) and outcomes has been inconsistent. Furthermore, previous research has not considered temporal variations in within-hospital volume (a center having higher than average volume vs. lower than average volume) as a covariate. The objective of this study was to determine the relationship of between-hospital and within-hospital trauma volume and two measures of hospital quality of care. The study analyses a population-based non-concurrent cohort included in the California Patient Discharge Data Set from 1995 to 1999 on thirty-nine nonfederal California hospitals designated as adult trauma centers .

The findings of this study suggest that relationships between trauma volume and outcomes exist but depend on which patient populations are studied and how the data are analyzed. Furthermore, trauma centers may be subject to the detrimental effects of high temporal volume overextending existing services and capacity. Since this study found that both between-hospital volume and within-hospital volume measures are associated with outcomes, we recommend that both measures be included in future volume-outcome investigations.

J Trauma. 2005 Jan;58(1):136-47

Trauma system structure and viability in the current healthcare environment: a state-by-state assessment.

Mann NC, Mackenzie E, Teitelbaum SD, Wright D, Anderson C.

Summary:

Anecdotal reports suggest that some state trauma systems are struggling to remain solvent while others appear stable in the current health care environment. The purpose of this research is to characterize the current structure and viability of state trauma systems in the U.S. Expert panels were convened in all 50 states to characterize the current structure of trauma care and to identify strengths, weakness, opportunities and threats facing trauma care delivery in each state. States continue to value the formalization of trauma systems. System operations, evaluation/research methods and trauma leadership are highly valued by states with mature systems. However, all states consider their trauma system severely threatened by inadequate funding and difficulty recruiting and retaining physicians and nurses. Trauma care systems are valued and demonstrate potential for future expansion. However, economic shortfalls and retention of medical personnel threaten the viability of current systems across the U.S.

J Trauma Nurs. 2010 Jul-Sep;17(3):126-34
Trauma systems origins in the United States.
Boyd DR.
Summary
A historical narrative is presented. The US Civilian Trauma and Emergency Medical Services Systems (EMSS) started in the 1970s. The conceptual basis, strategic, and tactical implementation approaches used to establish the national program are described. The trauma and other clinical systems were extensions of proven clinical methods initially from cardiac and trauma units and deployed in new settings. The overall systems design was regionalization. Professionals, governmental agents, the public, and politicians all worked together to establish local, regional, state, and a nationwide comprehensive trauma/EMSS program that touch every state, territory, and community.

J Trauma. 2010 Apr;68(4):783-9
Improved trauma system multicasualty incident response: comparison of two train crash disasters.
Cryer HG[1], Hiatt JR, Eckstein M, Chidester C, Raby S, Ernst TG, Margulies D, Putnam B, Demetriades D, Gaspard D, Singh R, Saad S, Samuel C, Upperman JS.
Summary:
Two train crash multi-casualty incidents (MCI) occurred in 2005 and 2008 in Los Angeles. A post-crash analysis of the first MCI determined that most victims went to local community hospitals (CHs) with underutilization of trauma centers (TCs), resulting in changes to our disaster plan. To determine whether our trauma system MCI response improved, we analyzed the distribution of patients from the scene to TCs and CHs in the two MCIs.
This study, showing a trauma system performance improvement program, allowed us to significantly improve our response to MCIs with improved utilization of TCs and improved distribution of victims according to injury severity and needs.

J Trauma. 2011 Jun;70(6):1345-53.
Out-of-hospital decision making and factors influencing the regional distribution of injured patients in a trauma system.
Newgard CD[1], Nelson MJ, Kampp M, Saha S, Zive D, Schmidt T, Daya M, Jui J, Wittwer L, Warden C, Sahni R, Stevens M, Gorman K, Koenig K, Gubler D, Rosteck P, Lee J, Hedges JR.
Summary
The decision-making processes used for out-of-hospital trauma triage and hospital selection in regionalized trauma systems remain poorly understood. The objective of this study was to assess the process of field triage decision making in an established trauma system. A total of 64,190 injured patients were evaluated by EMS in this study, which showed that the provider cognitive reasoning for field trauma triage is driven primarily by provider judgment, rather than specific triage criteria

J Trauma Acute Care Surg. 2012 Sep;73(3):716-20.

The mortality risk from motor vehicle injuries in California has increased during the last decade.

Waxman K[1], Izfar S, Grotts J.

Summary:

Organized trauma systems and trauma centers are thought to improve trauma outcomes. It is clear that injured patients who receive care in trauma centers have survival advantages. However, large regions of California still do not have access to trauma centers. Many injured patients in California continue to receive their care in non-trauma center hospitals. The purpose of this study was to compare outcomes in California counties with and without trauma centers and to query the efficacy of the current statewide trauma system by asking whether mortality after motor vehicle trauma in California has improved during the last decade. The mortality was significantly lower in counties with trauma centers in this retrospective outcome study using California Highway Patrol data from all motor vehicle crashes (MVCs) and mortality during the years 1999 to 2008 for the 58 counties in California. Low population and hospital density independently correlated with increased mortality. Injury mortality rates after MVCs increased during the decade, both in counties with and without trauma centers. Overall, the presence of a trauma center improved the chances of survival after an MVC in California counties. However, mortality rates after injuries increased during the decade both in counties with and without trauma centers. Future efforts to improve outcomes for injured patients in California will require new approaches, which must include improving both access to trauma centers and the care provided in non-trauma center hospitals.

Ann Emerg Med. 2013 Feb;61(2):167-74.

Emergency medical services out-of-hospital scene and transport times and their association with mortality in trauma patients presenting to an urban Level I trauma center.

McCoy CE, Menchine M, Sampson S, Anderson C, Kahn C.

Summary:

This study determines the association between emergency medical services (EMS) out-of-hospital times and mortality in trauma patients presenting to an urban Level I trauma center. In this analysis of patients presenting to an urban Level I trauma center during a 14-year period (1996 to 2009), we observed increased odds of mortality among patients with penetrating trauma if scene time was greater than 20 minutes. We did not observe associations between increased odds of mortality and out-of-hospital times in blunt trauma victims. These findings should be validated in an external data set.

J Am Coll Surg. 2013 Apr;216(4):687-95; discussion 695-8

Fifteen-year trauma system performance analysis demonstrates optimal coverage for most severely injured patients and identifies a vulnerable population.

Ciesla DJ[1], Tepas JJ 3rd, Pracht EE, Langland-Orban B, Cha JY, Flint LM.

Summary:

Trauma systems are designed to deliver timely and appropriate care. Prehospital triage regulations and interfacility transfer guidelines are the primary determinants of system efficacy. This study analyzed the effectiveness of the Florida trauma system in delivering trauma patients to trauma centers over time. Severe injury discharges increased at designated trauma centers (DTCs) and decreased at non-trauma centers (NTCs). The proportion of patients with severe injuries discharged from DTCs increased for all age groups, capturing nearly all severely injured children and adults. Access to DTCs was dependent on proximity for severely injured elderly but not for severely injured children and adults. Triage improved over time, enabling near complete capture of at-risk children and adults independent of DTC proximity. Because distance from a DTC does not limit access for children and adults, existing trauma system resources are sufficient to meet the current demands. Efforts are needed to determine the trauma resource and triage needs of the severely injured elderly.

J Trauma Acute Care Surg. 2013 Oct;75(4):704-16

The effect of trauma center care on pediatric injury mortality in California, 1999 to 2011.

Wang NE[1], Saynina O, Vogel LD, Newgard CD, Bhattacharya J, Phibbs CS.

Summary:

Trauma centers (TCs) have been shown to decrease mortality in adults, but this has not been demonstrated at a population level in all children. We hypothesized that seriously injured children would have increased survival in a TC versus non-trauma center (nTC), but there would be no increased benefit from pediatric-designated versus adult TC care. This was a retrospective study of the unmasked California Office of Statewide Health and Planning Department patient discharge database (1999-2011).

The TC outcome models use improved injury severity and case mix adjustment to demonstrate decreased mortality for seriously injured California children treated in TCs. These results can be used to take evidence-based steps to decrease disparities in pediatric access to, and subsequent outcomes for, trauma care.

Health Aff (Millwood). 2013 Dec;32(12):2091-8.
Sustaining a coordinated, regional approach to trauma and emergency care is critical to patient health care needs.
Eastman AB, Mackenzie EJ, Nathens AB.
Summary:
Trauma systems provide an organized approach to the care of injured patients within a defined geographic region. When fully operational, the systems ensure a continuum of care involving public access through 911 calls, emergency medical services, timely triage and transport to acute care, and transfer to rehabilitation services. Substantial progress has been made in establishing statewide trauma systems, which are seen as the prototype for regionalized care for other time-sensitive, emergency conditions such as stroke. Trauma systems provide a model of care that is consistent with the goals of the Affordable Care Act, which authorizes $100 million in annual grants to ensure the continued availability of trauma services. Full funding of these provisions is needed to stabilize statewide systems that are struggling to survive. We describe the components of a regionalized trauma system, review the evidence in support of this approach, and discuss the challenges to sustaining systems that are accountable and affordable.

J Emerg Trauma Shock. 2014 Jan;7(1):41-6.
A comparison of rural versus urban trauma care.
Lipsky AM, Karsteadt LL, Gausche-Hill M, Hartmans S, Bongard FS, Cryer HG, Ekhardt PB, Loffredo AJ, Farmer PD, Whitney SC, Lewis RJ.
Summary:
This study compared the survival of trauma patients in urban versus rural settings after the implementation of a novel rural non-trauma center alternative care model called the Model Rural Trauma Project (MRTP). Authors conducted an observational cohort study of all trauma patients brought to eight rural northern California hospitals and two southern California urban trauma centers over a one-year period (1995-1996). This study demonstrates that rural and urban trauma patients are inherently different. The rural system utilized in this study, with low volume and high blunt trauma rates can effectively care for its population of trauma patients with an enhanced, committed trauma system, which allows for expeditious movement of patients toward definitive care.

Characteristics of Pediatric Trauma Transfers to a Level I Trauma Center: Implications for Developing a Regionalized Pediatric Trauma System in California

Colleen D. Acosta, MPH, M. Kit Delgado, MD, Michael A. Gisondi, MD, Amritha Raghunathan, MD, Peter A. D'Souza, MD, Gregory Gilbert, MD, David A. Spain, MD, Patrice
Christensen, RN, and N. Ewen Wang, MD

Summary:
Since California lacks a statewide trauma system, there are no uniform interfacility pediatric trauma transfer guidelines across local emergency medical services (EMS) agencies in California. This may result in delays in obtaining optimal care for injured children. This study sought to understand pattern of pediatric trauma patient transfers to the study trauma center as a first step in assessing the quality and efficiency of pediatric transfer within the current trauma system model. The hypothesis was that transferred patients would be more severely injured than directly admitted patients, primary catchment transfers would be few, and out-of-catchment transfers would come from hospitals in close geographic proximity to the study center. Trauma patients brought directly to the emergency department (ED) and patients transferred from other facilities to the center were compared. From the perspective an adult Level I trauma center with a certified pediatric intensive care unit (PICU), delays in definitive pediatric trauma care appear to be present secondary to initial transport to non-trauma community hospitals within close proximity of a trauma hospital, long transfer distances to accepting facilities, and lack of capacity at the study center. Given the absence of uniform trauma triage and transfer guidelines across state EMS systems, there appears to be a role for quality monitoring and improvement of the current interfacility pediatric trauma transfer system, including defined triage, transfer, and data collection protocols.

N Engl J Med. 2006 Jan 26;354(4):366-78.

A national evaluation of the effect of trauma- center care on mortality.

MacKenzie EJ1, Rivara FP, Jurkovich GJ, Nathens AB, Frey KP, Egleston BL, Salkever DS, Scharfstein DO

Summary:
Hospitals have difficulty justifying the expense of maintaining trauma centers without strong evidence of their effectiveness. To address this gap, we examined differences in mortality between level 1 trauma centers and hospitals without a trauma center (non-trauma centers). Mortality outcomes for patients 18 to 84 years old with a moderate-to-severe injury were compared among 18 hospitals with a level 1 trauma center and 51 hospitals non-trauma centers located in 14 states. After adjustment for differences in the case mix, the in-hospital mortality rate was significantly lower at trauma centers than at non-trauma centers. The effects of treatment at a trauma center varied according to the severity of injury, with evidence to suggest that differences in mortality rates were primarily confined to patients with more severe injuries. These findings show that the risk of death is significantly lower when care is provided in a trauma center than in a non-trauma center and argue for continued efforts at regionalization.

Appendix F

Scudder Oration

Wherever the Dart Lands: Toward the Ideal Trauma System

A Brent Eastman, MD, FACS

I can't express strongly enough how honored I am to be standing before you, my peers and friends and patients, to speak about an issue that has absorbed my professional life: the development of trauma systems in North America and beyond. I accept the responsibility of giving the Scudder Oration recognizing it is meant to be a seminal address on the care of the injured patient, meant to carry a message to the people in this room and to trauma surgeons and trauma teams in the United States, Canada and around the world.

This 77th Scudder Oration will be built around surgeons, patients, and maps. I'll begin with my mantra, which some have said may be engraved on my tombstone. My wife, Tica, who is my editor and a master of brevity, says it's too long for a mantra, or a tombstone, for that matter, but here it is: my concept of an inclusive trauma system is one that is designed to ensure expeditious transfer to the appropriate level of care commensurate with the patient's injuries wherever the geographic location. Let me emphasize *appropriate* level of care because trauma systems have been misconstrued as dealing with only the most critically injured, the patients who must be triaged to a Level I or II trauma center, but that is not correct. An inclusive trauma system is meant to encompass all injuries: minor, moderate, and major. If you're a patient with a relatively minor injury, you don't need to go to a Level I or II trauma center, but you do deserve access to a facility that is committed and equipped to give you optimal care for your injury. If the facility you reach is not prepared to provide the care you need, you must be expeditiously transferred to a level of care commensurate with your injury. Hence my title, "Wherever the Dart Lands."

I've chosen to bracket this lecture in a time frame that mirrors my own career in trauma and my own life. It's tempting, when speaking about trauma, to begin with ancient history, and others have done that extremely well. In reading nearly all of the 76 previous Scudder Orations, however, I found no one who started in Evanston, WY, so I thought, if nothing else, there's original material here. Evanston was my hometown, population 3,000. I was inspired by you, Anna Ledgerwood, when you began your Scudder Oration talking about your beginnings in rural America, and I wish to emulate your approach.

Evanston and southwest Wyoming, when I was growing up, had a trauma system that was mostly my uncle Gilbert. Gilbert was county coroner and owned the funeral home, but he also taught first aid, and whenever there were injuries on the roads or ranches, he and his mortuary helper could slip out the coffin rollers in his 1951 Cadillac combination hearse and ambulance, slip in a gurney, stick on the flashing red light, and be on their way. His son and sometime assistant told me they occasionally had to interrupt a funeral for a trauma call. It was a somewhat delicate maneuver to offload the casket and take off for the scene of the trauma, not to mention disconcerting to bystanders, when the hearse arrived. No doubt some of them wondered about a conflict of interest; would they turn left to the mortuary or right to the hospital?

Evanston also had a disaster plan, born out of civil defense in World War II, and Gilbert organized the town's response to The Great Train Wreck of November 1951, in which one passenger train slammed into the back of another during what would turn out to be the worst blizzard of the winter. That year the Annual Clinical Congress of the American College of Surgeons (ACS) met in San Francisco, November 5 to 9, at the Fairmont Hotel. On Sunday, November 11 at 5 PM, several of the attending surgeons and their wives boarded the streamliner *City of San Francisco* bound for Chicago. Eighteen hours later at Evanston, WY, the *City of San Francisco* ran a red light covered over by new snow and hit the back of the halted *City of Los Angeles* with such force that the mangled cars took out a freight train on the sideline. Some of the surgeons died; others acted quickly to help the wounded, including one orthopaedist who made his way into the kitchen car and carried out smashed orange crates to serve as splints for broken limbs—perhaps inspired by the Annual Oration on Fractures, at that year's Clinical Congress, which would be renamed The Scudder Oration, the next year. Figure 1 shows pictures from the local newspaper about the worst rail accident in many years. As an 11-year-old boy, I was taken by my father, a locomotive engineer running the great steam engines, and my hero, to see this crash because

Disclosure information: Nothing to disclose.

Presented at the American College of Surgeons 95th Annual Clinical Congress, Chicago, IL, October 2009.

Received May 7, 2010; Accepted May 7, 2010.
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ISSN 1072-7515/10/$36.00
doi:10.1016/j.jamcollsurg.2010.05.004

Figure 1. Train wreck, Evanston, WY, November 1951. From the *Unita County Herald*, Evanston, WY, November 16, 1951.

the engineer was a next-door neighbor and friend. This was my first exposure to mass casualty, and it awakened my interest in trauma.

Thanks to Rollo Hanlon, MD, FACS, I was able to go further in my research and find the program of the 1951 Clinical Congress of the American College of Surgeons (Fig. 2). You can see the names of some stellar surgeons leading us at that time: Blalock and Wangenstein and Frank Glenn, among others. Figure 3 shows the Oration on Fractures, given that year by the British Sir Reginald Watson Jones.

Now, if I might fast forward in time 11 years, again using my own experience in the world of trauma to bracket this lecture, I started my internship in 1966 under Dr J Englebert Dunphy, as did several others in this room as you'll see, and under Dr William Blaisdell. I would point out that before 1966 there were no formal trauma centers and certainly no trauma systems in the United States. However, as my good friend J David Richardson points out, there may not have been formal trauma centers in those years, but there were hospitals with surgeons dedicated to the care of injured patients, including his own in Louisville. I think that's an important point because one of the central themes of this lecture is the importance of surgical volunteerism. Trauma centers and trauma systems here and around the world are successful only because of the volunteerism, commitment, and passion of trauma surgeons such as those sitting in this room. The year 1966 was an important one; the monograph, *Accidental Death and Disability: The Neglected Disease of Modern Society* was written.[1] Today, I worry that we may not have come far enough, fast enough, that we will fail to recognize trauma as the neglected disease of the 21st century; this recognition will be part of my call to action.

I had the opportunity to interview Dr Blaisdell at the 2009 Pacific Coast Surgical Association Meeting (Fig. 4) at the Fairmont Hotel in San Francisco, the same hotel that hosted the 1951 Clinical Congress, and I asked him about 1966. He had told us many times, "Everything changed then." It was the advent of Medicaid and Medicare, and psychiatry units closed and emptied their disturbed patients onto the streets. There were drugs and violence. At the time of the Vietnam protests, crimes of violence doubled, which Dr Blaisdell said was the impetus to create a more formal trauma center at the San Francisco General Hospital. If you haven't read it, I would highly recommend Dr. Blaisdell's 1991 Presidential address at the American Association for the Surgery of Trauma on the pre-Medicare role of the city and county hospitals in education and health care.[2] There were 12 great public hospitals; almost all of the first hospitals in the United States developed as a result of the need for indigent care. These were the primary institu-

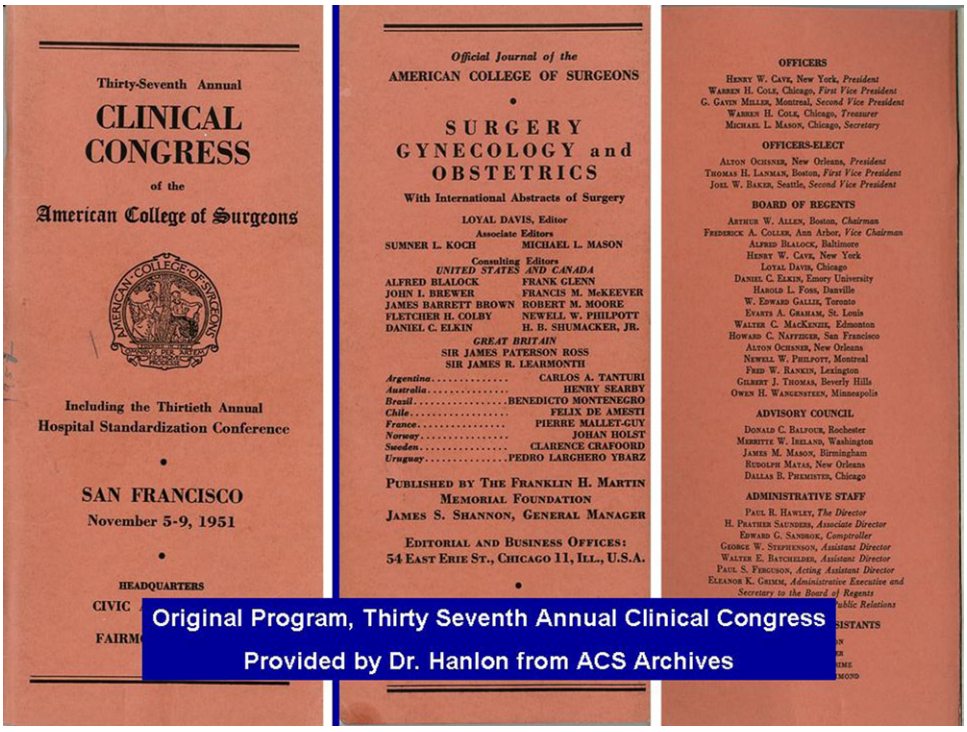

Figure 2. Original program, 37th Annual Regional Clinical Congress. (Courtesy of Dr C Rollins Hanlon, American College of Surgeons Archives).

tions for the care of the injured during most of our country's history, and the vast majority of advances in trauma care arose from these great public hospitals (Fig. 5). I'm sure there are surgeons in this audience who may see their own beginnings in trauma in one of these hospitals. But the two that are considered to be the first two trauma centers, San Francisco General with Dr Blaisdell, who, was the Scudder orator in 1982, and Cook County, in Chicago with Dr Robert Freeark, who was the orator in 1985. Dr Freeark talked about an "accident hospital," but he proposed a different kind of hospital: one that would be the focal point of a *system* of care.

I can't resist commenting on being a boy from Wyoming, going to San Francisco in the 1960s. It was culture shock, with the Grateful Dead, the peace marches, LBJ as President; we were embroiled in the Vietnam War, drugs were rampant, and, as somebody said, "If you remember San Francisco in the 60s, you weren't there." I'm using this opportunity to tell you that I do remember San Francisco and I was there. It's just that I was spending most of my time, like all the other surgical residents with no work hour restrictions, at the San Francisco General Hospital. Our trauma team during the period 1966 to 1972 consisted of George Sheldon and Don Trunkey, Frank Lewis and myself (Fig. 6). Don Trunkey and George Sheldon, being ahead of Frank and me, were chief residents when we were junior residents, but we too evolved to the position of chief residents at UCSF.

Time doesn't allow me to talk about all the people who have made seminal contributions to trauma system development in this country but I would be remiss not to mention Dr David Boyd, who made the first effort toward founding trauma systems at a federal level, when he was appointed by the Secretary of Health Education and Welfare to head up the Emergency Medical Services (EMS). There was funding in the 1970s, we had momentum, and David Boyd took advantage of that and had us on our way until the 1980s, when all of that funding and that enabling legislation were eliminated and we went into a slump from which we're still trying to recover. Dr R Adams Cowley trained some of you at Maryland Shock Trauma, which we acknowledge as the first statewide trauma *system*.

In "Systems of Trauma Care: A Study of Two Counties,"[3] by Drs Donald Trunkey and John West, they compared San Francisco and Orange counties after we all had finished our surgical training in San Francisco. This is a foundational paper because they did the first preventable death study. They showed that the preventable death rate in Orange County was significantly greater than in San Francisco, which had a *de facto* trauma system because all trauma patients in the city and county were taken to the San Francisco General Hospital. It was that paper and the influence

Figure 3. The 37th American College of Surgeons Clinical Congress Oration on Fractures, Sir Reginald Watson-Jones.

of Drs Trunkey and West that led us in San Diego to do our own preventable death study, called "The Amherst Study," which, incidentally, was funded by the County Board of Supervisors to determine whether we needed a trauma system in San Diego County. When we did our study, we found we had the same unacceptably high preventable death rate, 22%. But guess what? It wasn't because of one or two bad hospitals. Every one of our hospitals was striving to do the best it could but shared this 22% preventable death rate because we had no trauma system. We did not always have surgeons available; we didn't always have blood available, or experienced triage nurses, or specialists. However, once the system was instituted, the preventable death rate fell to 1% to 2% and remains there through today. Evidence of the efficacy of a trauma system.

Fortunately, we had surgical champions because no trauma center, let alone system, can ever be created without them. In a slightly biblical reference, let me say that in the beginning there were trauma surgeons. In San Diego those were Richard Virgilio, David Hoyt, and Steve Shackford, and I had the honor of working with them at that time. We were followed by a legion of others who created the San Diego trauma system. Dr Richard Virgilio had come back from Vietnam and made a statement before the Board of Supervisors that a soldier wounded in the rice field in Vietnam has a better chance of survival than a trauma patient in San Diego, and that launched us. From the beginning, our Medical Audit Committee (MAC) had delegates from the entire system—the 5 designated adult centers, the 1 pediatric center, as well as the medical examiner, surgical specialties, anesthesia, nontrauma hospitals, and county officials—and all gathered on a monthly basis. This has continued uninterrupted for 25 years and is now chaired by Dr Raul Coimbra; it continues to do the work of peer review and quality improvement that I believe holds our system together.

Some of us had the opportunity to participate in creating "The Model Trauma Care System Plan" in 1992.[4] Drs Ronald Maier and Bill Schwab were two of the key people, and in that document the term *inclusive trauma system* was first used. Emergency room physician Dr Ricardo Martinez was on that committee and later became director of the National Highway Traffic Safety Administration. I give Ricardo credit for coming to one of our breakfast meetings with a napkin on which he had drawn a curve depicting the relationship of the volume of trauma patients stratified by their severity of injury. He said, "You know what we've done is focused only on the severely injured patients and only the Level I and II trauma centers." We had neglected those patients with moderate and minor injuries. An inclusive system must encompass the entire continuum of care including all injured patients. It must go beyond the hos-

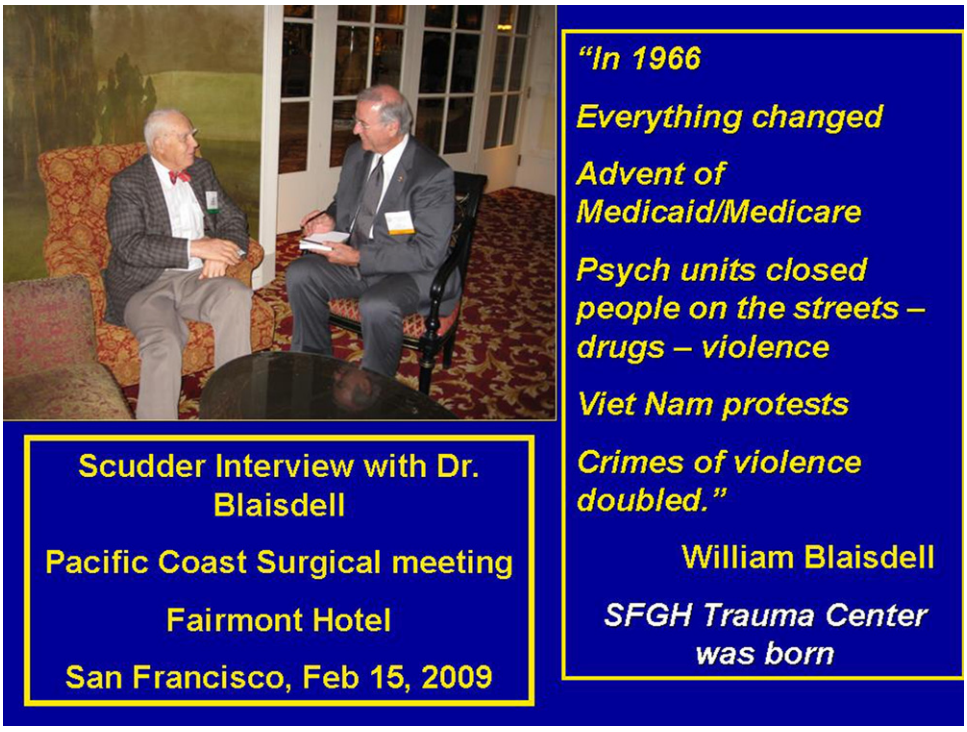

Figure 4. Scudder interview with Dr William Blaisdell, February 15, 2009.

pital, must include prevention, prevention, prevention, and it must address the critical element of rehabilitation and even end of life care.

In 1998, the Skamania Symposium in Washington was organized by Dr Trunkey and his colleagues. This was a search for evidence supporting trauma system development, which led to the writing, in 2006, of the "Model Trauma System Planning and Evaluation."[5] Many of the

Figure 5. The great public hospitals.

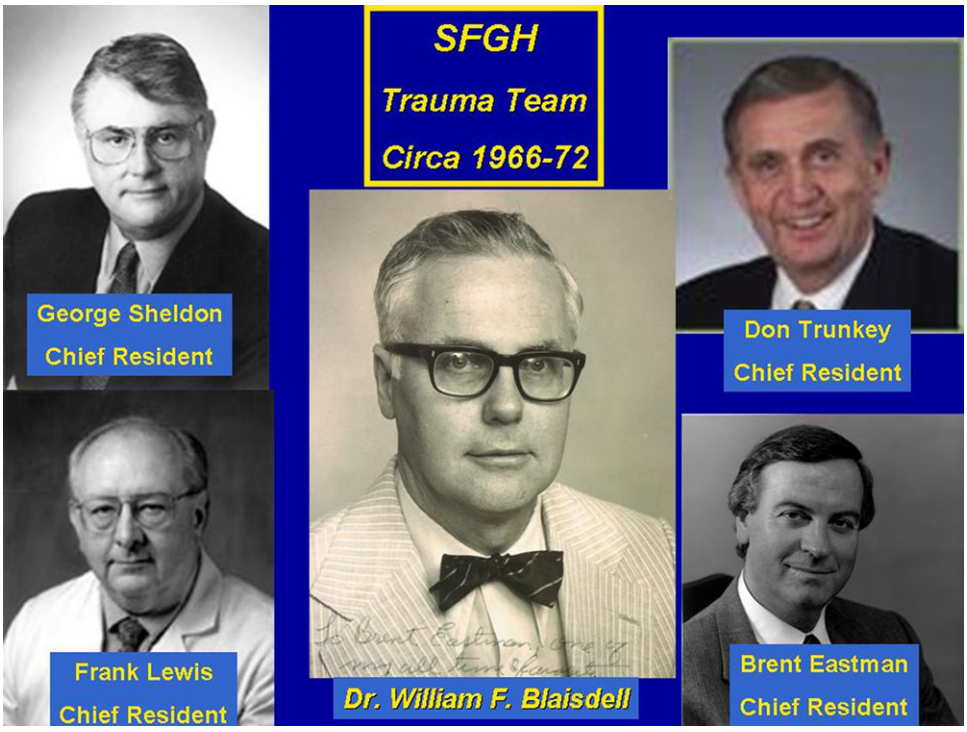

Figure 6. San Francisco General Hospital trauma team circa 1966 to 1972.

people in this room participated in this, which was an extension of the 1992 document. The important thing for you to know about this paper is that it is fundamental to the development of trauma systems today because it incorporates the concept that *injury is a public health problem.* In fact, it may be our worst public health program; it may be our worst global public health problem. So this helps us design systems to take that into account.

What is the current status of trauma systems in the United States? The map in Figure 7 is an update on trauma *center* status, courtesy of Anthony Carlini from the American Trauma Society, Trauma Information Exchange Program. It shows the distribution of trauma centers and was updated within the last few months, and Anthony was willing to share this. He also provided data to show the progress we've made: a big jump, for example, in Level I and II trauma centers between 1991 and 1992 and then a leveling off.

I realized that we had not had an update on which states in the US had a trauma *system* so I embarked on a survey with the aid of Dr Peggy Knudson, vice-chair of the Committee on Trauma (COT), who assisted me in asking all 50 state chairs of the COT 3 questions:

1. Does your state have a **state-wide trauma system**?
2. If not, does your state have any **regional systems** or any verified or designated centers?
3. Does your state **collaborate with any other state** in a system of care?

Figure 8 shows the results. This, I believe, is the most current look at this country in terms of states with trauma systems and those who are in the progress of trying to develop trauma systems. Dr Sheldon and his colleagues at the ACS Sheps Health Policy Institute put this into a pie graph, which shows that about two-thirds of the states today have some type of trauma system, which, I would hasten to add, could be a trauma system at the most basic level. All the respondents had to show for a "yes" answer was that their state had a trauma plan and existence of the imperative enabling legislation. On the other hand, they almost all lacked adequate funding for sustainable trauma systems. However, this survey has provided a valuable database because the answers to those 3 questions provide important and useful material from trauma surgeons about their challenges in building systems in their respective states. These data will be shared with the Committee on Trauma for their continued efforts in trauma system development.

Among all of the responses, over 90% said inadequate funding is a major problem because of a lack of support both at state and federal levels. This was particularly emphasized in some of our western states, where, as one state chairman said, "Personal freedom is cherished above all."

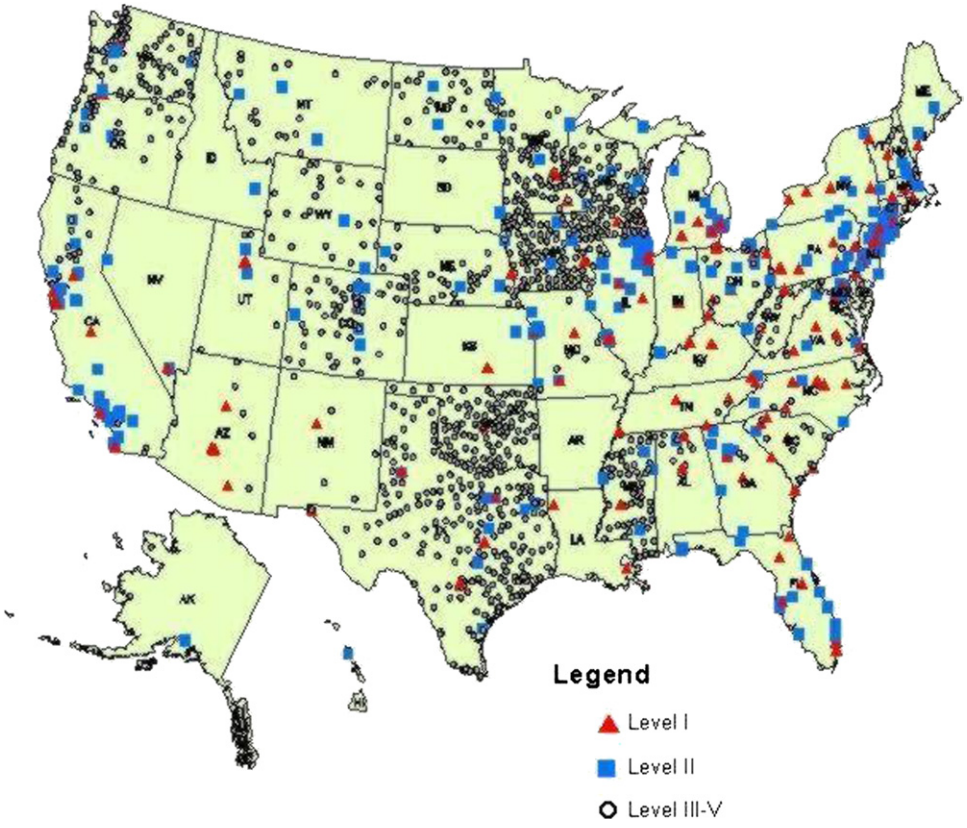

Figure 7. Updated trauma center status, July 2009. (Courtesy of Anthony Carlini, American Trauma Society, Trauma Information Exchange Program).

He said, "We have no trauma system, we have no seatbelt laws, we have no helmet laws." So there are still tremendous barriers to overcome to accomplish what we need to do in establishing trauma systems everywhere in the country—wherever the dart lands.

The other important thing these data speak to is the need for surgical leadership in the development of any trauma system. We also found that states vary greatly in what they are doing with the development of trauma systems. Some states have only a few verified trauma centers and, by contrast, a state like California has several regions with functioning systems and a plan to merge these regional systems into a state plan. Figure 9 shows the regions — it's a big state. I acknowledge Jonathan Jones for providing this map, which was meant to represent these 5 regions working together. Dr Coimbra is the leader in our southernmost region, including San Diego; Dr Hoyt is the leader in his region just to the north, and is the person who has led the development of the state-wide plan for California, which will, in the near future, bring these 5 systems together for a truly state wide system (a "system of systems") comprehensive statewide system or a "system of systems".

The map in Figure 10 is the centerpiece of this lecture. It is based on unpublished data provided to me by Lee Annest, PhD National Center for Injury Prevention and Control, CDC. I am a member of the CDC's Scientific Advisory Board and was there a few months ago, saw this map, and asked Dr. Annest if I could use it for this lecture. I would ask you to look carefully and see that this is, first of all, not the returns from the last Presidential election, although the red and blue distribution is similar. This is the death rate per 100,000, which is smoothed, meaning that they took into account the disparity and the discrepancy between counties with varying populations. It's age adjusted, and this particular map is looking at the death rate per 100,000 for people who die on our roads—not just occupants of cars, but pedestrians and bicyclists as well. I believed that we could do something with these data, and I spoke to Charlie Branas and his colleague, Dr. William Schwab at the University of Pennsylvania, who had done some remarkable work in which they mapped the time to a Level I or II trauma center. I asked if they had ever thought about overlaying their map on death rates to see if there's any correlation. So they did that, and we have this map, courtesy of the cartographers at the University of Pennsyl-

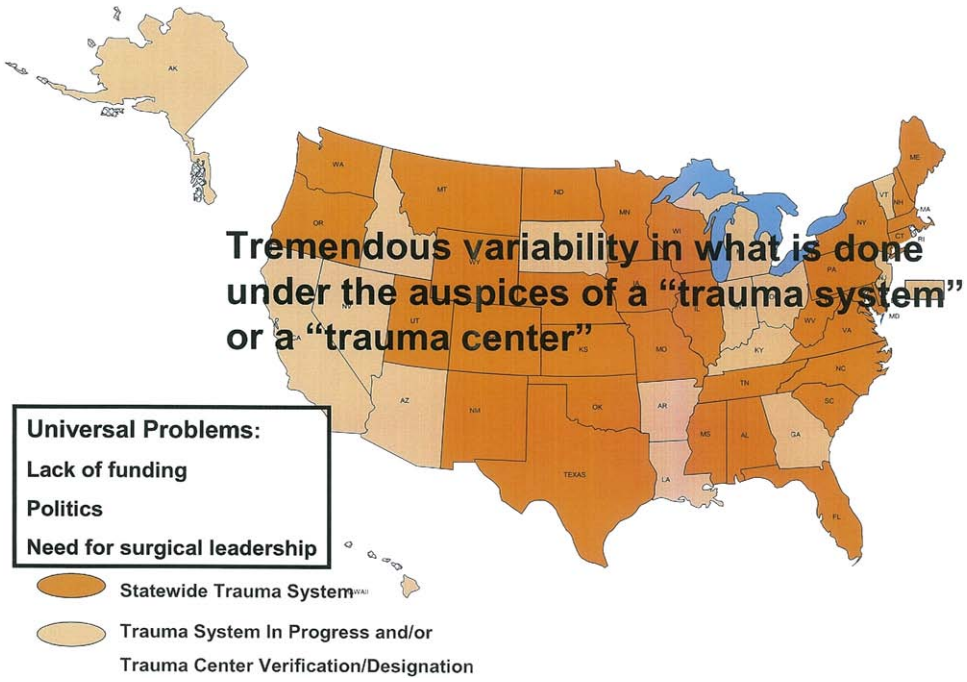

Figure 8. Status of trauma systems in the US, 2009. Based on the American College of Surgeons (ACS) State Chair Survey. (Courtesy of Tom Ricketts, PhD, George Sheldon, MD, FACS, and ACS Sheps Health Policy Institute).

vania (Fig. 11), showing us what we intuitively know: that long travel times equal high death rates. Lack of proximity to a trauma center or the appropriate level of care results in high death rates.

I thought we would take the next step and look at the issue that George Sheldon has made us so aware of: that we have a shortage of surgeons in this country. Some of you remember that Richard Cooper gave the opening address, the American Urological Association Lecture, "The Coming Era of Too Few Physicians," at the ACS Clinical Congress in 2007 in New Orleans, and he talked about the physician shortage. The striking thing is that we are going to be short 200,000 physicians by the year 2020 and, contrary to much of what is being said in discussions today about health care reform, which is that "we're only going to be short of primary care physicians," I submit we're going to be short of specialists, we're going to be short of surgeons of every specialty, and we'd better do something about that. One thing I propose we do about it is take the work of George Sheldon and Tom Ricketts demonstrating where we have surgeons and where we don't (Fig. 12). Big circles are good, little circles are bad. At my request they did the same thing, they took the data from Lee Annest at the CDC; he allowed them to take his map and superimpose the distribution of surgeons in the United States on death rate. Look carefully, there is a lot of dark brown in the center of the country and that means the highest death rates. These death rates tell us that it is not good to be hurt in rural America. This is added impetus for us to support our surgeons who work diligently in the less populated regions of our country, often without the support and resources of those working in urban and suburban regions. Conversely, we have a concentration of surgeons on both coasts. In Washington D.C. today, some argue that this is just a maldistribution problem, but we disagree. There is going to be an absolute shortage of surgeons in this country, and yes, we must be part of the solution for this surgical problem. For example, we must determine how to provide neurosurgical coverage when there are only 3,000 or 4,000 neurosurgeons in the entire country. I believe this is our responsibility as surgeons. I submit that trauma care in the United States needs a surgeon. We must never let this message die.

We must strongly bring this message to the health care reform debate. One of the central things we have to convey is what we tried to do on the Institute of Medicine Committee on the Future of Emergency Systems. That message is that we have the model for much of what is being debated in the halls of Congress today regarding access, quality, and evidence based medicine-that solution is called an Inclusive Trauma System.

We are the American College of Surgeons of the United States and Canada and, although I haven't focused on Canada, with the help of Drs Richard Simmons and Sandro

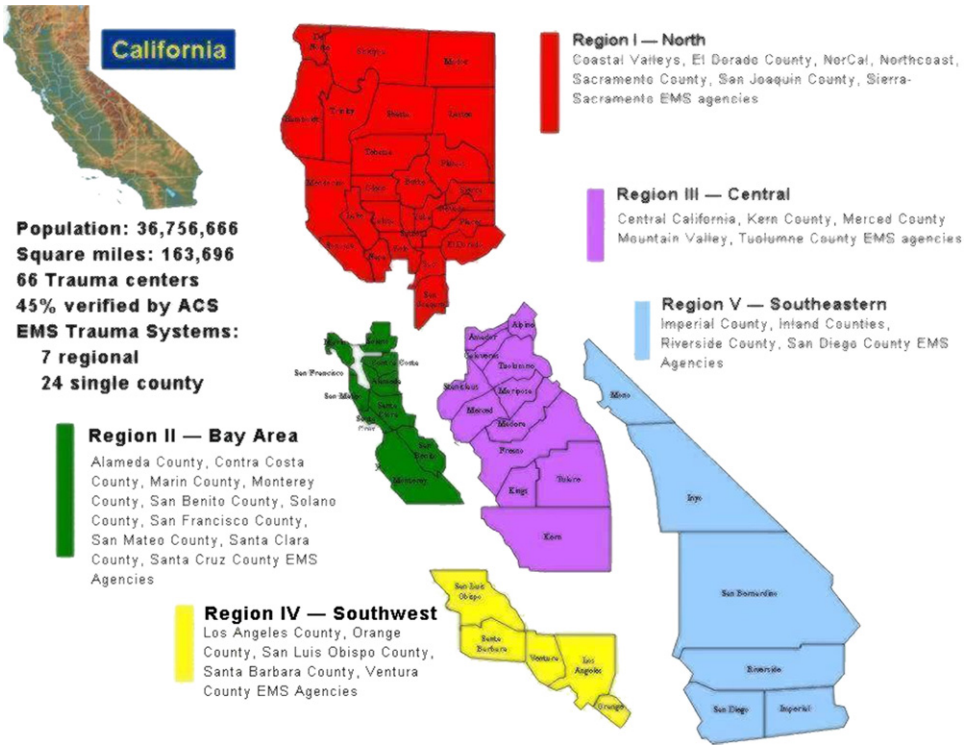

Figure 9. California regional traumas systems. (Courtesy of Jonathan Jones, California Emergency Medical Services (EMS) Agency).

Rizoli, the Canadian regions chiefs of Regions 11 and 12, I was able to get current information on the status of trauma systems and centers in Canada. Those in the audience who are from Canada, and many of us traveling in Canada, should know they, too, have a skew in the distribution of their trauma centers, which tend to mainly lie along the United States border. Dr Simmons was able to give me this information and I won't go into detail except to say that most of the provinces in Canada do have province-wide regionalization or a trauma system. Most of them also have designated and certified trauma centers. The exceptions are the provinces of Saskatchewan and Manitoba. There they have 3 university centers that are *de facto* trauma centers, where seriously injured patients are transported, however they do not have organized provincial trauma systems. Canada has done a superb job with trauma care and has very strong leadership with people like Drs Richard Simmons and Sandro Rizoli as the Canadian region chiefs. Thank you both for providing these data to me. Invoking my metaphor, *wherever the dart lands*, we see the same problems that we have in the US. If that dart happens to land in rural Canada or the Territories, the death rate is unacceptably high and the only solution to that is establishment of a Canadian trauma system(s).

The Trauma System Consultation Committee of the ACS is critical to the solution of this problem. We formed this committee in 1994, with Dr Wayne Meredith as a founding member. Dr Robert Mackersie took over the chair from me and Dr Michael Rotondo leads it today. The document we put together was fairly basic and was based on the Health Resources and Services Administration (HRSA) document, the 1992 "Model Care Trauma Plan." More recently the Committee on Trauma, led by Avery Nathan and his team, have done an excellent job of creating a more sophisticated document to help our teams when they do state trauma system consultation visits. The goal is to help move any systems, whatever their stage of development, to the next level. In Figure 13, you see the states that have had an ACS Trauma System consultation, those that are lacking, and those that were recently done. This is a significant accomplishment, but it is very labor intensive. We must find a way to do it more efficiently because it's something that the United States desperately needs. We must be available to states like Idaho, if they request our help, to aid them in establishing a trauma system. Dr Winchell did an analysis of this process and concluded that consultations had not managed to solve the funding problem, one of our major challenges, but they have been very helpful in many other areas of trauma system development. I'll not dwell on the many lessons learned from the consul-

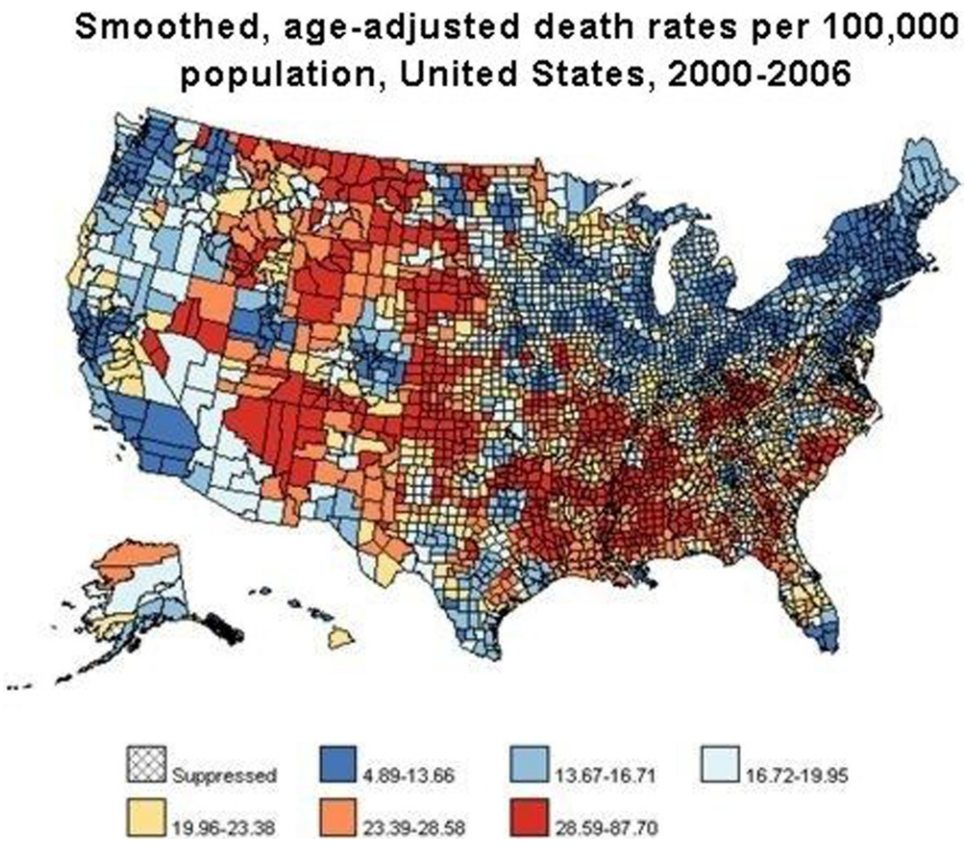

Figure 10. Motor vehicle traffic deaths per 100,000; 2000 to 2006. Smoothed, age-adjusted death rates per 100,000 population (motor vehicle, traffic, unintentional, all races, all ethnicity, both genders, all ages). Age-adjusted rate for United States: 15.31 per 100,000 population. (Unpublished data reproduced with permission of Lee Annest, PhD, Office of Statistics and Programming; National Center for Injury Prevention and Control, Centers for Disease Control).

tation visits except to say that there is important information gleaned, catalogued, and then shared during other consultation visits.

Do trauma systems make a difference? To ask this question would, with this audience, be preaching to the choir, as would my answer when I say, they do and they must make a difference. If we are to decrease the unacceptably high death rates that you have seen in Figure 10, we must establish trauma systems. If we don't do this we run the risk of trauma being "the neglected disease of the 21st century." Ellen McKenzie and colleagues[6] published an elegant paper in the *New England Journal of Medicine* showing that the risk of death is 25% lower if you have a system that gets you to a trauma center.

So now, with maps and tables and data, I would like to depart from the format of many other Scudder Orations and tell a patient story. According to Carlos Pellegrini, MD, FACS, Chair Department Surgery, University of Washington, the WWAMI system—Washington, Wyoming, Alaska, Montana, and Idaho—started out as an educational system in 1972, but it evolved into a trauma system under the leadership of Drs. Carrico, Maier, Jurkovich, and others. I posed the question, "What if the dart landed in this system that's been in place for 25 years? Would the trauma system make any difference to the injured people?" I'll answer my own question and tell you it did make a difference for Johan and Jenna Otter. Johan is an employee at our Scripps Health system in San Diego. He is one of our most valued and beloved managers. Johan came to me a couple of years ago and said that his daughter Jenna, for her high school graduation trip, wanted to take a hike with him and asked where they should go. I suggested my home state and specifically, Jackson Hole, WY. He took my advice partially and they went to Jackson Hole, WY, but they also went on to Glacier National Park, MT. This is going to be the story of the Kalispell Regional Medical Center, a small and excellent hospital in Montana, and the Harborview Medical Center, the WWAMI regional Level I trauma center in Seattle.

Johan and Jenna, hiking alone on a cold morning with

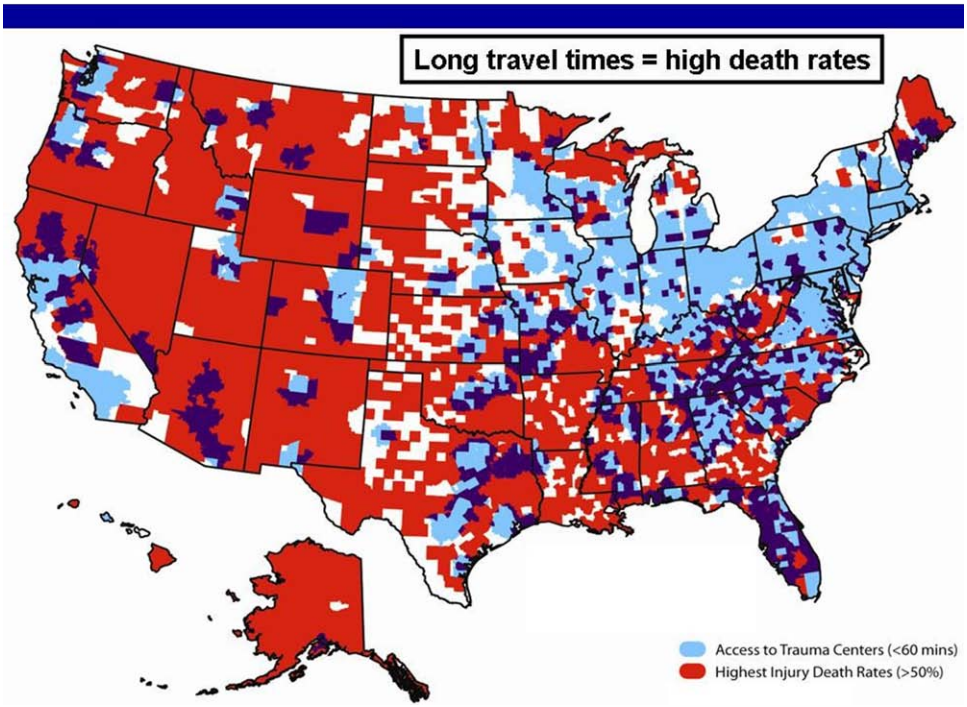

Figure 11. Access to trauma centers. (Courtesy of Charles Branas, PhD, Cartographic Modeling Laboratory, University of Pennsylvania, 2009).

fresh snow, encountered a sow grizzly bear with 2 cubs. Jenna, who is very fit and was bound for a career as a classical/modern dancer, was leading when the mother grizzly came around a bend in the trail. Johan heroically got himself between the bear and his daughter and took the brunt of the attack. Although Jenna was also badly mauled. In trying to escape Jenna fell 50 feet to a ledge below. Johan, fighting with the bear, fell, with the bear, to the same ledge. The bear continued to maul him then moved to Jenna, mauled her, and then returned to the trail and to her cubs.

This trauma scenario demonstrates an inclusive trauma system at its finest. First there was the prehospital component, including a 6-hour heroic helicopter rescue to get both victims off the ledge. Johan and Jenna couldn't see one another, but were talking after they finally established that the bear had left and they were both alive. Johan had a 60% scalp avulsion, an unstable C-spine fracture, multiple vertebral fractures, bites, a claw injury to his right eye with the rectus muscle lacerated, fractured orbit, and some psychological trauma. Jenna had a severe laceration to the right side of her face, fortunately missing the facial nerve, a deep bite in her shoulder, and on and on. They were resuscitated and stabilized at the Kalispell Regional Medical Center. I had a call from Dr Iwerson, the trauma surgeon there, who told me that one of our employees, Johan Otter, was in his emergency room, and was one of the most badly injured survivors of a grizzly bear attack he had ever treated. He said Johan was awake and told him to call his trauma surgeon, Dr Eastman. I have to tell you Dr Iwerson didn't sound too pleased to call me and in fact, allowed that he thought perhaps he, in Kalispell, MT, had taken care of more grizzly bear attacks than I had in San Diego. I, of course, agreed with that. We also agreed on the next course of action, which was that Jenna could stay in Kalispell, but Johan had to get to the Harborview Level I trauma center. This story has a happy ending and demonstrates the triumph of an inclusive trauma system from rescue to recovery and rehabilitation. Today, we can celebrate one of our exemplary inclusive trauma systems. There are other great trauma systems, but what they've done in the Northwest with leadership from the trauma surgeons at Harborview is a model, especially in the area of rural trauma care. By the way, Johan and Jenna returned to Glacier to finish their hike in August of 2007 with their rescuer, Gary Mosley, who was named Ranger of the Year for his team's heroic effort. Also, far from being defeated by this tragic event, Jenna has now decided to pursue a career in medicine as well as dance. Johan and Jenna Otter are here today as a tribute to all of you who are dedicating your lives, your volunteerism to creating and staffing trauma systems. I'd like to ask Johan and Jenna to please stand, lest anyone still questions whether trauma systems make a difference.

I will not have the time to go into any detail about the global epidemic of trauma, but at that same Pacific Coast

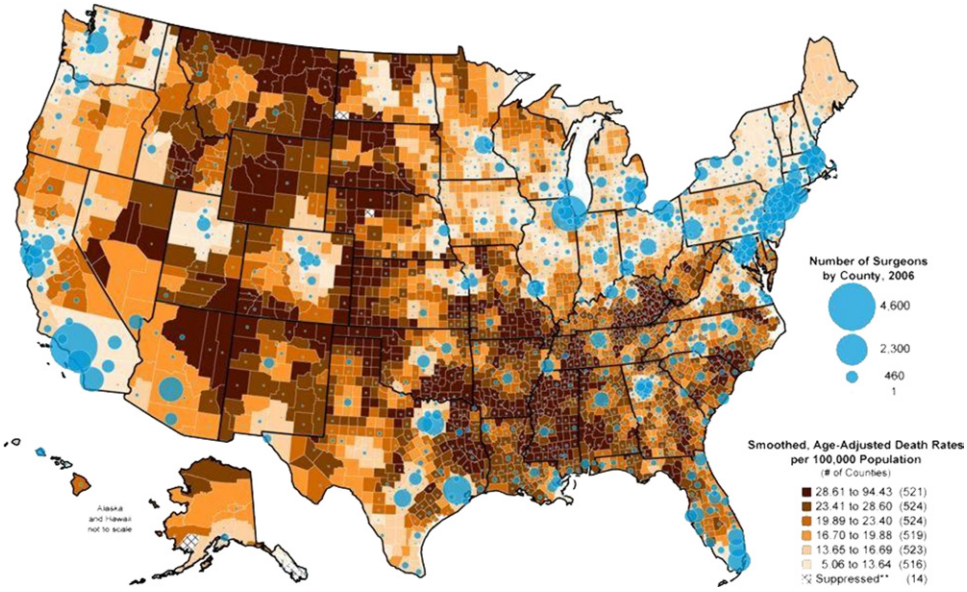

Figure 12. Number of surgeons by county in 2006 combined with smoothed, age-adjusted death rates per 100,000 population (motor vehicle, traffic, unintentional, all races, all ethnicity, both genders, all ages). American College of Surgeons Sheps Health Policy Research Institute – Chapel Hill. (Courtesy of Thomas Ricketts, MD and George Sheldon, MD, 2006).

Surgical Association meeting in San Francisco in February 2009, where I interviewed Dr William Blaisdell, I also had the opportunity to interview Dr Haile Debas, Executive Director, UCSF Global Health Sciences (Fig. 14). He said that "we do have a global endemic of trauma, greater than AIDS or malaria. Trauma care is rudimentary in sub-Saharan Africa." "We need trauma systems," he said, with no prompting from me. "We need to use cell phones, wireless networks, new technology. Global health should be the pillar of our US foreign policy and we should have a *diplo-*

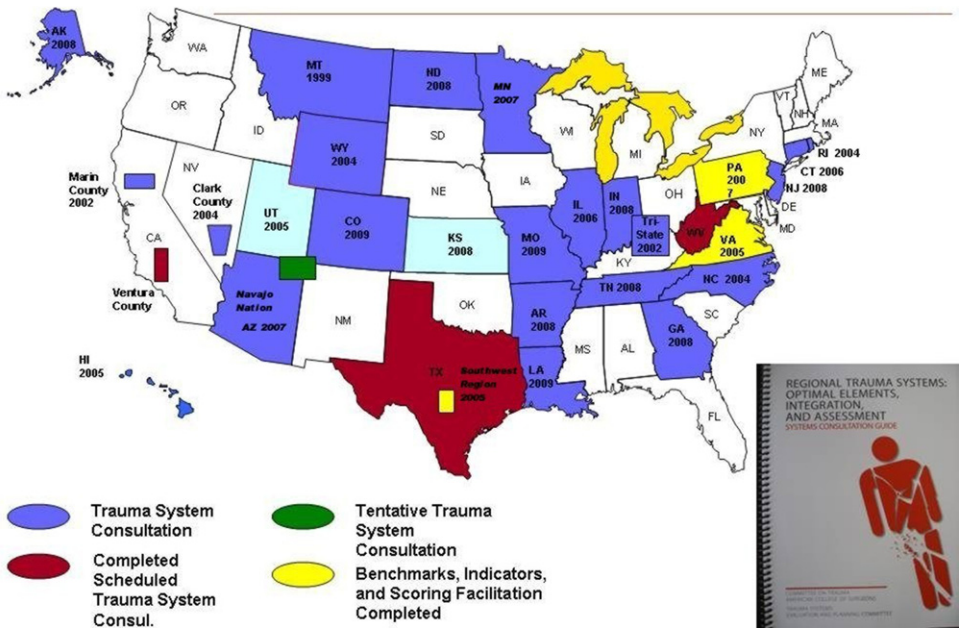

Figure 13. Trauma Systems Evaluation and Planning Committee consultations and facilitations. (Courtesy of Holly Michaels, American College of Surgeons, September 2009).

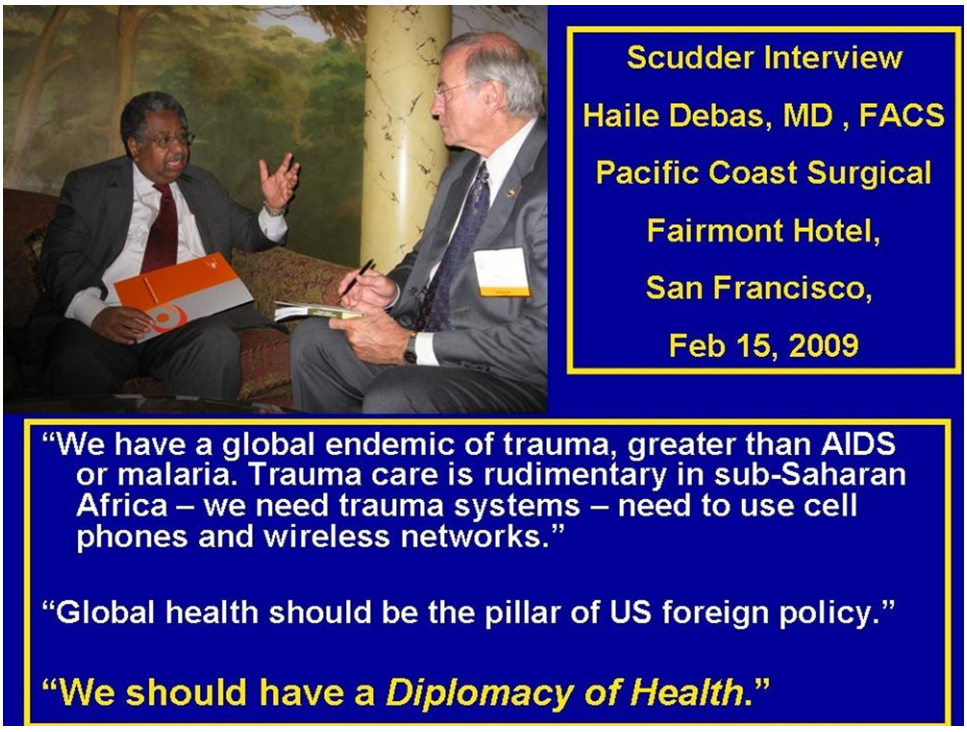

Figure 14. Interview with Dr Haile Debase, MD, FACS, February 15, 2009, regarding the global epidemic of trauma.

macy of health." I think that our ACS Advanced Trauma Life Support program embodies that principle beautifully.

I had the opportunity, thanks to Dr Richard Hunt, who is here today, to join the team from the CDC to travel twice to the subcontinent of India. India is establishing a trauma system for their vast population. They have extraordinary issues with their roads, such as sharing them with camels, cows, and elephants, which result in the highest road traffic mortality rate in the world: more than 200,000 road deaths per year. India intends to build a new road system the entire length of the subcontinent and, with help from the CDC and the World Health Organization, according to Richard Hunt, CDC, Center for Injury Prevention and Control, National Highways Development Project, (December 31, 2006). In addition to the new road system, they are also building a trauma system. Their communications will be based principally on cell phones because they are not encumbered by landlines; they've skipped that whole technology. More than half the people in India and in Pakistan have cell phones along with the other four billion cell phones in the world today. We met with a Pakistani neurosurgeon, Dr Juma, when we went to India last time. We actually had to meet in Dubai because our state department would not allow us to travel into Pakistan. One of the things Dr Juma told us is that Pakistan, too, is depending on new technology in order to have a trauma system. Dr Juma runs a 3,000-bed hospital in Karachi that sees 2,000 patients a day, including 500 bombing victims a week. So they have a trauma problem of a different magnitude than most of us do.

I will conclude by speaking to what we have learned from our military operations throughout history. We have had surgical leaders and surgical lessons from the Civil War to World War I, World War II, Korea, and Vietnam, but it is important to note what we are relearning in the war in Iraq and Afghanistan today, which is that survival is dependent on the time to definitive care. I, like some of you, have had the opportunity to participate in the Senior Visiting Surgeon Combat Care Program of the ACS and American Association for the Surgery of Trauma (AAST) at the Landstuhl Regional Medical Center in Germany, where I had the privilege of attending in July 2007. Landstuhl Regional Medical Center is an integral part of the Joint Theater Trauma System and we have some surgeons in the audience today who are absolutely central to the development of that system.

This military trauma system provides a model for our civilian systems in this country, particularly in rural America. Remember the map, remember where it's red (Fig. 10); there are important lessons to learn from this war. In the Joint Theater Trauma System they have critical air

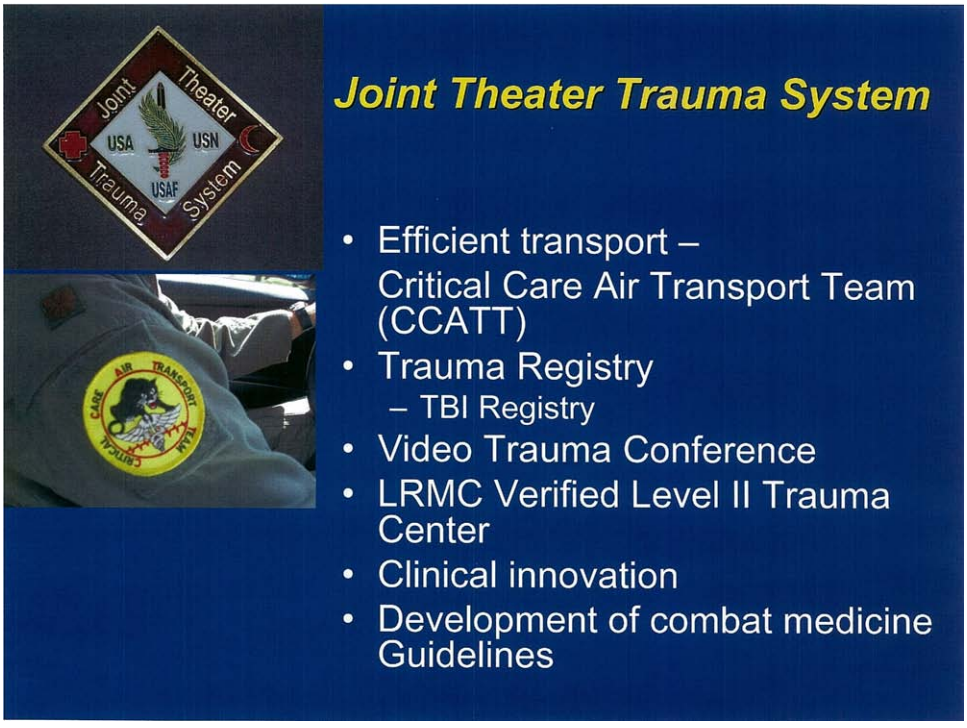

Figure 15. Joint Theater Trauma System.

transport—the Critical Care Air Transport Teams—and they also use video conferencing (Fig. 15), which is technology that must be embraced in our civilian trauma systems. This is one of those technologies that can link us, who are privileged to work in a trauma center, with resources and help us extend ourselves out to others. Every week they have a video trauma conference at the Landstuhl Regional Medical Center, and they review every patient from the previous week: what happened in Iraq? What happened in Afghanistan? What happened in Africa? What was done during the soldier's brief length of stay, usually only 3 to 4 days in Landstuhl, Germany and then on to CONUS (the continental United States), to Bethesda if they're Marines, or to Walter Reed for the Army, or Brooke Air Force Base in San Antonio for the severely burned. Two of the many impressive components of the Joint Theater Trauma System are transport and video conferencing.

So let me conclude with another patient story. I hesitated whether to tell this because I was involved in the care of Corporal William Gadsby only because I happened to be in Landstuhl the night he came in. It was my first night. He came in on a C-17 and was reported to have some serious vascular injuries. Because of my interest in vascular trauma I was asked to help care for this patient. Let me point out that by the time I saw this Marine, his life had already been saved by a Navy Corpsman named Kyle who under fire put on tourniquets while Corporal Gadsby was down and bleeding to death in the kill zone. Then he was quickly taken to a forward surgical unit, where an immediate, life-saving, right above-knee amputation was performed and a shunt placed in his left superficial femoral artery. Within an hour the patient was moved on to Balad, a combat support hospital where a very good vascular surgeon (I know he was good because I had the opportunity to close the wounds over his graft) did a reverse saphenous vein interposition graft that would have gratified the vascular surgeons in the audience, including Prof Averil Mansfield from England. It was pointed out to me when I saw Corporal Gatsby in Landstuhl, 23 hours postinjury, that he had already had 2 operations and I was strongly advised to reoperate on the patient that night, and not the next morning, because I would be the first surgeon operating on this Marine who was not under fire. We did operate that night, the patient did very well, was transferred back to Bethesda and then on to the San Diego Naval Medical Center for rehabilitation. There I met Corporal Gadsby again, as you'll see, and met his mother, Cheryl Huffman, who later sent me an article in *Reader's Digest* showing her son with his devastating injuries, receiving the last rites in Iraq. However, when I saw him in San Diego he was in so much better shape than he had been in Landstuhl, Germany the first night on the operating table, when he was shaking violently and I asked him if he was cold. One of the more senior surgeons said, "Dr. Eastman the man's not

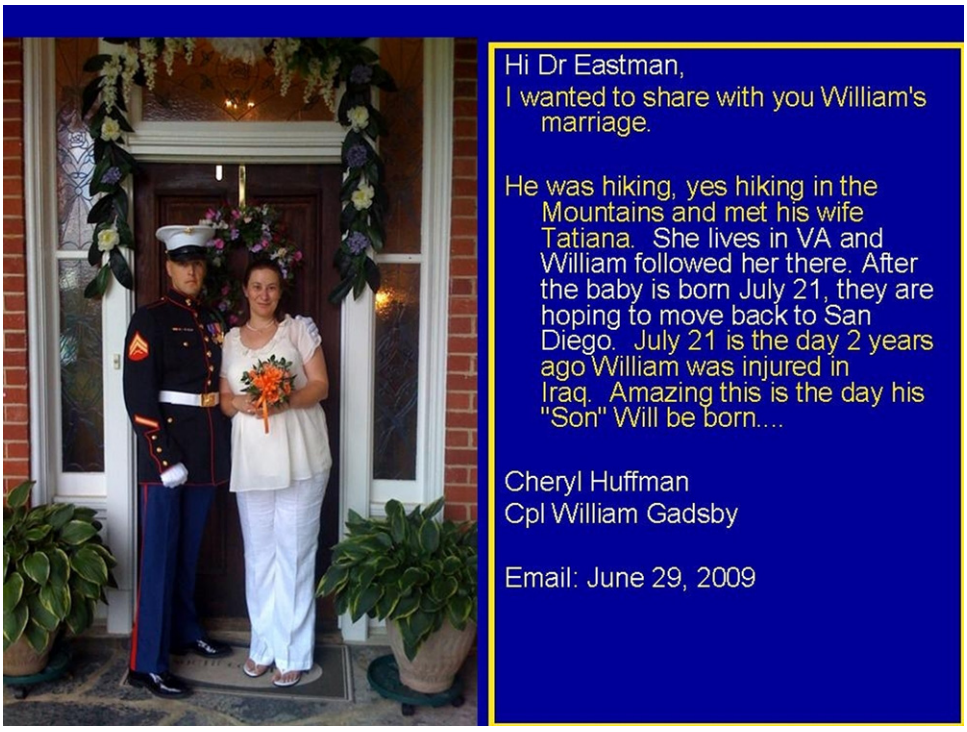

Figure 16. Corporal William Gadsby's marriage. (Courtesy of his mother, Cheryl Huffman).

Figure 17. Our challenge: develop inclusive trauma systems in the US, Canada, and around the globe.

cold, he's frightened." But when I asked, "Corporal Gadsby, are you frightened?" he said, "No sir, I haven't been frightened since I was bleeding to death in the kill zone. I'm cold, could you get me a blanket please?" I knew that I was always going to admire and want to stay in touch with Corporal Gadsby. His mother sent me another email last June, saying, "Dr Eastman, I wanted to share with you William's marriage. He was hiking, yes, hiking, in the mountains and met his wife-to-be Tatiana, who lived in Virginia; and William followed her there and they fell in love (Fig. 16). They're expecting a baby and are hoping to move back to San Diego." And here was the most striking part of the message. "William's baby will be born July 21, 2 years to the day after William was injured in Iraq."

To end this lecture on trauma on a happy note, baby Kyle Gadsby, named for the Navy Corpsman who had saved his father's life, was born on July 21, 2009, exactly 2 years to the day his father nearly died in Iraq. I would submit that Kyle looks like a Marine-to-be. I would also say that the Joint Theater Trauma System has components that we should embrace, that we should study, and we should bring into play in the civilian population, just as we're bringing in clinical lessons such as the use of tourniquets, factor VII and the treatment of traumatic brain injury. Equally important are the systems lessons, such as C-CAT and video conferencing.

While I was at Landstuhl, Brigadier General David Rubenstein came over and met with me, and I'd like to share this final quote, which Dr Rubenstein told me is kept in his office. It is a quote from the Mayo brothers, which says, "The only victor in war is medicine." I would certainly concur that most of what we know as trauma surgeons today has been learned from military conflicts. If we must have war, let us continue to learn.

And now I would like to pay tribute to Corporal William Gadsby, a brave Marine and a brave patient. At the same time I wish to recognize all the military surgeons in the audience who continue to care for and save our wounded warriors in Iraq and Afghanistan every single day. So first I would like to ask Corporal William Gadsby, who came today; he had a heck of a time trying to find this room, but I'll tell you he ambulates so well on his above-knee prosthesis that he got here right on time. I asked him if he would come and be a tribute to the military trauma surgeons, and to all trauma surgeons in this audience, who care for grievously injured patients every day. So it's really my great, great pleasure to ask William to stand and be recognized.

I now ask all the surgeons who have helped take care of our troops in this war, thousands of William Gadsbys, to also stand, and William, please turn around, because you'll see the people that you most dmire. Would all the surgeons here who are the regular military surgeons or who have served in Iraq through the visiting surgeon program please stand?

I'll conclude by saying that our challenge as trauma surgeons of the United States and Canada is to persuade the powers that be to support the development of inclusive trauma systems for every citizen and traveler, in every state and province, wherever the dart lands, and, when asked, to share our knowledge around the globe (Fig. 17), as the American College of Surgeons is doing so well in such areas as Advanced Trauma Life Support. Thank you for allowing me the privilege of presenting this Scudder Oration.

Acknowledgment: I thank Samantha Saunders for her invaluable assistance in preparing this manuscript. I also want to acknowledge my sister, Carol Lamb, of Rock Springs, WY, for her historical research in the archives of Evanston, WY.

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