

Trauma Care Systems 2003

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“Trauma Care Systems 2003”

In recent years, traumatic injury has begun to receive long overdue recognition as a major public health problem. With the emerging awareness of injury treatment, trauma care systems have been evolving in the United States over the past three decades. Trauma care systems represent an integrated structure to provide optimal care to injured patients and are one of many components of the overall emergency medical service (EMS) system. Today’s trauma care systems encompass a continuum of care. This involves injury prevention and control, timely public access via rapid activation of the EMS system, emergency medical care in the out-of-hospital setting, transport to the nearest appropriate trauma care facility, stabilization and treatment in the emergency department, surgical intervention when needed, acute hospital care, and rehabilitation. (Figure 1)

The role of emergency physicians is essential to assure the initial stages of trauma care are managed with an integrated team of out-of-hospital and hospital health care providers and resources. This includes the broad responsibilities to be involved prospectively with planning on local, regional, state, and national levels. The emergency physician must concurrently manage the acute care of the injured patient and the counseling of patients on injury prevention; and retrospectively with Continuous Quality Improvement to assure effective functioning of the overall system.

Epidemiology of Injury

The number of injuries leading to death and disability in this country each year is staggering. Trauma is the most important public health problem in every country in the world. Unintentional injury in the US is the leading cause of death between the ages of one and 44.¹ These injuries annually rob the nation of approximately four million years of potential life.² In 1995, there were 148,000 trauma deaths in the United States and direct and indirect health care costs for trauma injuries estimated at \$260 billion dollars. Over 40,000 die in motor vehicle accidents and 5 million more are injured yearly in non-fatal motor vehicle accidents.³ But that is only the tip of the injury pyramid as nearly sixty million Americans are injured annually, accounting for one in six hospital admissions.⁴

The most reported injuries in this country are the result of motor vehicle crashes (MVCs), followed closely by gunshot wounds. Driving while impaired by alcohol is the most frequent cause of MVCs. About one in 123 drivers were cited for driving under the influence in 1995 and alcohol continues to account for approximately 40% of traffic fatalities.⁵

Firearm injuries represent a problem that is unique to the United States. Our country annually has four times as many homicides than any other country.⁶ About \$21 billion dollars is spent per year on firearm injuries and nearly 40,000 people die each year from these injuries.⁷ The majority of deaths are a result of suicide, closely followed by homicide and unintentional injuries. Mortality statistics are widely available for both MVCs and firearm deaths. Far less accurate data is maintained for the far greater number of disabling injuries.

Timeline of Trauma Systems in the US

The essential characteristics of a trauma care system were first developed by the military during the past century. Field triage of the wounded from the battlefield and evacuation through echelons of care were established by protocol. The military experience with casualties established the public impression that seriously injured people should be expected to survive if a system enables experts to work smoothly together. The following timeline of events in the United States summarizes progress during the past half century.

- (1966) Society begins to look at “injury” as a health problem subsequent to publication of the 1966 document *Accidental Death and Disability: The Neglected Disease of Modern Society*.⁸ This document encouraged government involvement to address injury, and introduced the concept of trauma systems.
- (1970s) Throughout the 1970s professional organizations began to exercise leadership by advocating standards for hospital categorization. Three states (Illinois, Maryland, and Florida) utilized federal funding programs to pioneer the development of regional EMS systems including trauma care. In 1979 Boyd introduced the concept of providing optimal care to the trauma victim through an organized “systems approach” to the complex nature of the health problem of traumatic injury.⁹
- (1983) A National Research Council study, authorized by Congress, was done in follow-up to the 1966 report. Regionalization of trauma care had previously been proposed by Trunkey in 1981.¹⁰ The document *Injury in America*¹¹ was published in 1985, and concluded that very little progress had been made to address traumatic injury, and called for stronger federal efforts. It also recommended involvement of the Center of Disease Control (CDC) to research the epidemiology of traumatic injury and use the results to develop injury prevention programs.
- (1990) The 1990 Federal Trauma Care Systems Planning and Development Act (PL. 101-590) created Title XII of the Public Health Service Act and provided health care planning support by developing a model trauma care plan. States received funding to develop state-wide plans consistent with the federal model.
- (1991) The CDC led a consensus conference involving a multidisciplinary group that prepared the document, *Position Paper on Trauma Care Systems*¹². This document expanded the scope of trauma systems to include all injured patients, not just those critically injured. More specifically, inclusive trauma care systems should ensure optimal care for injured patients in rural areas where unique challenges exist for assuring access to care. Development of coalitions involving public-private partnerships was encouraged to sustain trauma care systems.
- (1995) Trauma Care Systems Planning and Development Act is not reauthorized by Congress.
- (1998) The Academic Symposium to Evaluate Evidence Regarding the Efficacy of Trauma Systems was held at Skamania Lodge in Stevenson, Washington to bring together trauma care experts interested in the investigation of formal systems to optimize the delivery of timely and appropriate trauma care. The symposium systematically reviewed the published literature to quantify the current understanding of trauma system effectiveness and to chart a course for future research endeavors. A number of recommendations were made to chart the course for future trauma system development and evaluation in the

United States, including recommendation #9: “Using a national consensus process involving a spectrum of national organizations and committees interested in trauma care and prevention, construct a ‘Trauma System for the Future’ document including current status, a future vision, and an implementation strategy based on valid and reliable data.”¹³ A model format is the “EMS Agenda for the Future” document, which is targeted at improving EMS systems.¹⁴

- (2001) Trauma Care Systems Planning and Development Act is funded for FY2001 and 2002 in the amounts of \$ 3m and \$ 6m respectively.
- (2002) The National Highway Transportation Safety Administration (NHTSA), in conjunction with the American Trauma Society (ATS) completed a paper entitled “Trauma System Agenda for the Future” that is now available on NHTSA’s website. The paper outlines a comprehensive approach to the trauma system continuum, from injury prevention strategies to post acute care. It includes the necessary components of infrastructure needed to bring a nationally linked system to fruition.
- (2002) Legislation introduced in the Senate to reauthorize the Trauma Care Systems Planning and Development Act.

Paradigm Shift

A number of definitions are emerging in the literature that now reflect the changing focus of the trauma system from the concept of the isolated “Trauma Center” as being the solution to the problem to that of the “Trauma Care System.” Given the mixed medical and geopolitical nature of a mature trauma care system, it might be most appropriately defined as “*a regional / statewide injury control system supported by public policy.*”¹⁵

As the concept of a trauma care system matures, there are several new ways of thinking that have emerged to support the goal of a trauma care system to reduce suffering, disability, death, and costs from traumatic injury. The following table contrasts the old versus new concept.

Paradigm Shift in Trauma Care

Old Thinking	New Thinking
Trauma is a “surgical disease”	Trauma is a “team” disease
Exclusive: trauma care must focus on a subset of the most seriously injured patients that are threatened by death	Inclusive: trauma care must focus on all injured patients to reduce not only death but also disability and costs to society
“Trauma Centers” save lives	“Trauma Care Systems” save lives, reduce disability, and costs
Competition among hospitals for “designation”	Cooperation among hospitals to assure broad system safety net access and effective stabilization and transfer when appropriate
Input: resources consumed	Output: improved health status of the population served

Financing of Trauma Systems

Funding for trauma system development at both the state and federal levels has frequently competed with other governmental priorities and objectives. In 1990 the Federal government stepped away from its previous model of concentrating its funding and efforts at prehospital EMS care.

With the passage of the Federal Trauma Care Systems Planning and Development Act in 1990 (P.L. 101-590) the government authorized the financing necessary to develop a broader approach to trauma systems. This legislation was to allow states to develop an inclusive trauma system that would organize statewide prehospital care, acute care, and rehabilitation care. This work was to be coordinated and assistance provided to the states by the newly developed Division of Trauma and EMS (DTEMS). In 1995, Congress, while attempting to reduce federal budget deficits, did not reauthorize DTEMS budget and the agency vanished. With the loss of this central coordinating federal structure, states have essentially been left to secure funding for trauma system development on their own.

Presently states receive block and categorical grants from institutions including NHSTA, HRSA, and the CDC. It is difficult to estimate exactly how much funding goes directly to trauma system development from these or other federal programs. States spend their own funds as well, from either legislative appropriations or fees from activities frequently associated with trauma system usage, motor vehicle registration or licensing fees. Some localities also have specific tax mechanisms to pay for prehospital care. Third party “fee for service billing” also shares in payment of these services. Managed care has had some effect on trauma care financing through its use of contracting between managed care organizations (MCOs) and prehospital care providers. But as MCOs look at their expenses related to trauma it will hopefully be seen that funding trauma system development can lead to cost savings for their organization. This can include injury prevention programs and education, prehospital care, acute care (where they have traditionally focused), and rehabilitation. All of these will hopefully be viewed by MCOs and all third party payers as acceptable investments not only in their patients’ health but also economically for their organizations.

Emergency Medicine’s Leadership in Trauma Care Systems

The American College of Emergency Physicians (ACEP) has long maintained a commitment to the comprehensive care of traumatically injured persons, including education, treatment, quality improvement, and research. As trauma care facilities and systems have developed, ACEP has proactively promoted the need to respond appropriately to the needs of the injured which requires the skills of the entire health care team.

Guidelines for Trauma Care Systems (1986)

The “Guidelines for Trauma Care Systems” were developed by the American College of Emergency Physicians Trauma Committee and published in 1986.¹⁶ These guidelines complemented those of the American College of Surgeons (ACS) by defining the components and providers that are essential to urban and rural trauma care systems and have become a foundation for the “all-inclusive” design of trauma systems proposed by the CDC in 1991. An example of a statewide all-inclusive trauma system is Iowa where all 117 hospitals throughout the state have been categorized according to criteria consistent with ACEP and ACS guidelines, verified by a process established by Iowa Code, and certified by the state at their level of care capability as of January 1, 2001*.

The ACEP “Guidelines for Trauma Care Systems” was the first clearly defined approach to an integrated EMS system recognizing the need for special provisions for trauma victims. The trauma care continuum was recognized to represent care extending from prevention through rehabilitation and requiring close cooperation among specialists in each phase of care. These guidelines recognized that optimal treatment for trauma care in a system must encompass all aspects of care and called for emergency physician leadership in developing and managing systems, directing out-of-hospital care, providing emergency department resuscitation and stabilization, and facilitating a smooth transition to inpatient care.

Trauma Care System Quality Improvement Guidelines (1990)

The “Trauma Care Systems Quality Improvement Guidelines” were developed by the ACEP Trauma Committee in 1990 and were published in *Annals of Emergency Medicine* in 1992.¹⁷ These guidelines called for both facility and system QI programs and for close cooperation between the facility and system programs in order to deliver the best possible care for trauma patients. Previous to this publication, existing quality improvement (QI) programs focused almost exclusively on specific trauma hospitals. This document defined the importance of a combined approach of both individual institutions and system-based QI as essential to examine the overall functioning of the system, including management and financial impact of trauma systems, out-of-hospital care, hospital care, and rehabilitation. Facility QI was recognized to evaluate individual patients cared for by specific practitioners within a given institution, and system QI was recognized to evaluate components of the trauma care system and their interaction with each other.

Trauma Care Systems Development, Evaluation and Funding (1999)

The ACEP Trauma Care and Injury Control Committee developed the “Trauma Care System Development & Evaluation” policy statement in 1998 and amended it in 1999 to include “Funding.”¹⁸ This policy combines concepts from previous ACEP documents and further calls for trauma care systems to be inclusive of all patients and for collaborative efforts between the ACS and ACEP. Enabling legislation and funding at the national and state levels is called for to support unrestricted access of injured patients to trauma care irrespective of payment methods, and the needs of the trauma care system including ongoing funding for infrastructure, research, and evaluation of outcomes. Emergency physicians are recognized as providing a critical role in the access and treatment of injured patients, and in the management and evaluation of trauma care systems to assure patient care effectiveness and cost efficiency.

American College of Surgeons - Committee on Trauma Initiatives

Since 1976 ACS has periodically published guidelines describing resources for trauma care hospitals. In 1999 the American College of Surgeons Committee on Trauma issued its latest *Resources for Optimal Care of the Injured Patient*. Included in this document are general descriptors, a field triage decision scheme, and trauma facilities criteria for the categorization of levels of trauma care for individual hospitals.

Trauma Center Categorization

Level I Trauma Center typically serves a large city or a population dense area and is expected to manage large numbers of injured patients. These centers would be expected to admit at least 1,200 trauma patients yearly. Of those, 20 percent will have an Injury Severity Score (ISS) of 15 or greater *or* there will be 35 patients per surgeon with an ISS of 15 or greater. Institutional dedication to trauma is essential including having a dedicated trauma program, trauma service, trauma team, and medical director. There must be departments or divisions of surgery, neurosurgery, orthopedic surgery, emergency medicine, and anesthesia. General surgeons,

anesthesiologists, and emergency medicine specialists must be immediately available 24 hours a day. Essentially every surgical subspecialty as well as obstetrics/gynecology, critical care medicine, and radiology must be on call and promptly available 24 hours a day. Board certification is expected for general surgeons, emergency physicians, neurosurgeons, and orthopedic surgeons. Completion of ATLS is expected for the general surgeons and emergency physicians and is desirable for the sub specialists. Level I trauma centers are expected to maintain specific emergency department personnel as well as equipment pertinent to trauma in all age groups. Twenty-four hour a day immediate operative capability, a staffed recovery room, intensive care units for the critically injured, respiratory therapy services, radiological services (including angiography, sonography, computed tomography with an in house technician, and MRI), clinical laboratory services, hemodialysis, burn care, and acute spinal cord management are all essential. Rehabilitation services must be available. Performance improvement including chart audits, care reviews, and a trauma registry are essential. Finally level I trauma centers are expected to be leaders in continuing education, trauma prevention programs, and research.

Level II Trauma Center provides care either in a population dense area to supplement the activity of a level I center or in a less populated dense area where a level I center is not immediately available. In the second case, there should be transfer agreements prearranged with a distant level I facility. Level II centers are expected to have similar institutional organization, hospital departments/divisions, and clinical capabilities as level I facilities. However, cardiac surgery, microvascular/replant surgery, and acute in-house hemodialysis are not required. A surgeon is expected to be on call 24 hours a day and present at resuscitations and operative procedures. The operating room must be adequately staffed and available when needed in a timely fashion. Emergency department personnel and equipment, recovery room and intensive care unit availability mirror that of a level I institution. Many of the radiological services expected for the level I center are expected for the level II center. However, it is acceptable to not have an in-house CT technician or an MRI unit. There are fewer requirements for continuing education/outreach programs, prevention programs, and research.

Level III Trauma Center must have the capability to manage the initial care of the majority of injured patients and have 24 hour general surgical coverage. It should have transfer agreements in place for patients that exceed resources. The only specialties considered essential are emergency medicine, anesthesia, orthopedics, plastic surgery, and radiology. Twenty-four hour availability of an operating room and on call personnel are desirable. In house radiological services are desirable but not expected; computed tomography availability is expected. A trauma registry and CME availability for physician and nursing staff are expected. Prevention programs and research are desirable, but not required.

Level IV Trauma Center should be able to provide the initial evaluation, assessment and resuscitation of injured patients. However, patients with known or potentially serious injuries will require transfer to a larger facility with more resources. The facility should have 24 hour coverage by a physician; surgical coverage may not be available. These facilities would be located in rural areas. Continuing education and prevention programs are desirable.

Oregon is an example of a state with these levels of facilities available. In 1985 the Oregon legislature passed a bill that provided the authority for the creation of a statewide trauma system. The Oregon Health Services' Trauma Program adopted the American College of Surgeons' standards with few changes as their minimal acceptable standards. They have a competitive application and designation process assuring that hospitals meet these standards. A contrasting example is New York where trauma center designation and standards are not regulated by code. There is an application process and two levels of care:

“Regional” and “Area” likened to level I and level II ACS COT criteria. The Department of Health is able to withdraw designation of noncompliant facilities..

Other American College of Surgeons Trauma System Resources:

- *Advanced Trauma Life Support Course*, new 7th edition, tentative release date Spring 2003 developed the by American College of Surgeons - Committee on Trauma (ACS-COT).
- *National Trauma Data Bank (NTDB)* - a national repository of data data on trauma patients from trauma center registries.
- *TRACS* - national software for the collection, storage, analysis and reporting of trauma patient information on an individual regional and state level.
- *Trauma Verification and Consultation Service* to assist facilities plan and evaluate their compliance with ACSCOT guidelines. This is done through voluntary review of potential and existing trauma centers to ensure that they provide an organized and systematic approach to the care of the injured patient.

Partnering Between the Leaders in Trauma Systems

ACEP, through the Trauma Care and Injury Control (TCIC) committee, has had a productive relationship with the American College of Surgeons - Committee on Trauma (ACS-COT) to improve trauma care in the United States. Notable collaborations between the two groups include:

- *Equipment for Ambulances*, a consensus document listing appropriate supplies and equipment for pre-hospital delivery of medical and trauma care
- *Advanced Trauma Life Support Course*, new 7th edition, includes several ACEP members in the editorial process. This edition recognizes that "the doctor who first attends to the injured patient has the greatest opportunity to impact outcome",¹⁹ is "designed for doctors who care for injured patients" and recognizes the benefit of " a foundation of common knowledge for all members of the trauma team".¹⁹

Disaster Preparedness

Although trauma systems are frequently thought of as caring for the individual victim of an injury, their development must incorporate the possibility of a mass causality disaster. Recent national events have further reinforced the need for disaster preparedness activities to include the involvement of trauma systems and emergency medicine. Trauma system preparedness must include the the capabilities to care for victims of weapons of mass destruction including but not limited to nuclear, chemical and biological weapons. Several different federal agencies (e.g. CDC, HRSA, FEMA) have interests and authority in this arena and their input into trauma system development and maintenance is essential. Emergency medicine has contributed by participating with these organizations in disaster preparedness.

Trauma Care Systems within Emergency Medical Services (EMS)

A Trauma Care Systems is an integral part of EMS systems that help to guide and regulate trauma care. Locally, EMS system trauma committees have members consisting of emergency physicians, trauma physicians and coordinators, and paramedical personnel, among others. These committees meet to update

trauma guidelines, make recommendations to the state agencies regarding trauma care regulations and oversight of local trauma care issues.

EMS systems have physicians providing medical oversight of the activities of the system. Emergency physicians have been involved with EMS and trauma care since the inception of trauma system development.

Trauma care facilities have many personnel actively involved in the trauma program: emergency physicians, a trauma coordinator, trauma surgeons, other medical specialties and various other personnel from educators to administrators. Trauma centers are more likely to have significant representation at the regional and state levels EMS agencies and as a result to have a greater impact on the trauma care regulations, including trauma center triage.

Using Outcome Measurements for Trauma System Evaluation

Increasingly, trauma researchers are using outcome measures to evaluate the effectiveness of trauma interventions and trauma systems innovations. These measures of outcomes are becoming increasingly sophisticated as well. The following represents partial listing of some of the more commonly used measures, and their strengths and limitations.

Mortality Outcomes

Crude mortality rates - both the numbers of deaths from a particular injury mode and the incidence of injury deaths per inhabitant are used as simple and available outcomes measures. A limitation of this measurement is that both hospital and out-of-hospital deaths must be included if the statistics are to be valid.

Case fatality rate - this is the number of deaths occurring among all cases and yields an overall index of the trauma care system effectiveness. Again, both hospital and out-of-hospital deaths should be included in the numerator; additionally, the "total cases" should also include those cases not admitted to hospital- ED "treat-and-discharge" cases should be included.

Preventable death rates - usually dependent upon the collective opinion of a panel of experts. Preventable death definition varies from study to study limiting external validity.

YPLL - Years of Potential Life Lost. This simple calculation incorporates the difference between the age at death and the life expectancy summed over a population. It gives a powerful index of the burden of illness represented by injury, particularly in different jurisdictions or as a measure of trends in a population.

Trauma Score Measurements

TRISS analysis - Trauma and Injury Severity Score combines the anatomical severity measure of the Injury Severity Score with a physiological measure, the Revised Trauma Score, along with age and a constant for injury mechanism that is analyzed by a regression model. A score (the z statistic) is calculated which gives a measure of the proportion of unexpected deaths in the sample, when compared to national norms. This score is used by a number of trauma registries to evaluate the effectiveness of a particular hospital or group of hospitals in the management of severely injured cases. In some jurisdictions, regional norms have been derived to improve case mix comparability.

ASCOT – (A Severity Characterization of Trauma) - a more recent measure introduced to overcome some of the limitations of TRISS. It uses the anatomical profile as an injury severity descriptor.

Functional Outcomes

FIM, wee FIM and F AM - the Functional Independence Measure, its pediatric variant and the Functional Assessment Measure all assess how the patient is coping as a result of their injuries. The domains evaluated give a combination of impairment and disability measures, and are used extensively by the rehabilitation community to evaluate outcomes.

DALY s - Disability Adjusted Life Years - used to include the burden represented by both deaths and disabilities caused by injuries in a population. In addition to the YPLL measure outlined above, 'relative weighting' is included for each disability caused by injury. This weighting reflects the years of fully productive life free of disability lost due to injury.

ADLs -Activities of Daily Living - a measure of patients' abilities to perform the simple tasks of life, such as feeding, dressing, bathing, etc.

IADLs -Instrumental ADLs - somewhat more extensive. They include measures of more functional outcomes related to independent living such as shopping, housework, preparing meals, managing money, and using a phone.

The Role of Emergency Physicians in Trauma System

- **Pre Trauma Event**

Leadership and Planning for regional, statewide, and national coordinated efforts

The problem of injury control and trauma systems development is too large and too complex for any single group, specialty or entity to solve. Because emergency physicians routinely interface with and provide leadership for many of the clinical providers in the out-of-hospital and emergency department continuum of care, emergency medicine has a unique perspective regarding the operational and clinical aspects of the trauma care event. Emergency medicine therefore is a key stakeholder to be involved at all levels of planning and implementation of trauma care.

Injury Prevention and Control

Emergency physicians have become leaders in the injury prevention field. Their clinical experience allows them to speak authoritatively about injury patterns. Emergency physicians are working nationally, statewide, and locally in advocating for injury prevention and control. They are able to provide powerful testimony to state or federal officials about injuries and the need for more resources for injury control. In the last decade, emergency physicians have successfully advocated on state or federal levels for more regulations for motor vehicle safety, including child safety seats and primary or secondary seat belt regulations, lowering the permissible alcohol level while driving laws, helmet laws for bicycles, scooters, and motorcycles, and reducing intentional injuries. Emergency physicians have conducted important research for a variety of injury patterns including helmet use, firearm injuries, motor vehicle trauma, interpersonal violence, and poisonings. This research has also contributed in addressing the important causative factor of alcohol with injury.

ACEP has outlined a comprehensive role for emergency physicians in injury prevention and control in policy statements adopted in 1998 and 1999.²⁰ These policy statements promote concepts for integrating primary injury prevention education into the routine clinical practice of emergency physicians to identify patients at risk for injury, and develop or promote the use of injury prevention interventions. They also support teaching the fundamental concepts of injury prevention to medical students, emergency medicine residents, and in continuing medical education programs. Emergency physicians have become champions within their institutions in educational efforts to teach injury control.²¹ Emergency medicine should continue to advocate for primary injury prevention for our patients and contribute to the field with injury surveillance and research initiatives.

- **Trauma Event**

- **Coordinate aspects of out-of-hospital and initial hospital care**

- The practice of emergency medicine involves not only providing care for acute injury and illness but also matching resources to needs. This expertise is essential to assure timely intervention along the continuum of care. As resources are more limited in rural and remote areas, the role of a well-trained and qualified emergency physician becomes even more critical to assure the safety net of clinical care is present in an all-inclusive trauma care system. In that setting, the emergency physician is often the sole physician provider in the initial management and resuscitation of the trauma patient until appropriate transfer can occur. It is therefore critical that all emergency physicians (in urban, suburban and rural settings) remain skilled in the evaluation and management of the trauma patient.

- **Post Trauma Event**

- **Evaluation and improvement of system**

- Emergency medicine and its organizations should continue to support efforts to develop population based data systems that describe the injury problem and the trauma systems performance to address them. Emergency medicine and its partners at the state and federal levels should use the data to develop practical and effective “best practice guidelines” for ongoing trauma system development.

Future Challenges for Trauma Care Systems

The challenge for emergency physicians, other health care professionals, and the public at large remains to more clearly define the burden of injury on society and the most effective solutions. Greater efforts at successful prevention initiatives are essential, combined with outcome-based interventions for acute care and rehabilitation. The concept of a mature “trauma care system” must include the key components of the injury control model involving prevention, acute care, and rehabilitation. Professional organizations and policy makers must recognize the need for an injury control system supported by strong public policy. Emergency physicians have much expertise to offer in planning, implementation, evaluation, and enhancement of trauma care systems. The expertise of a diverse group of stakeholders, private and public, clinical and non-clinical, will be essential as the science of injury control and the implementation of trauma systems matures into an integrated continuum of care within existing EMS systems.

Conclusions

Trauma care systems have evolved over the last thirty-five years and will continue to mature to provide for improved care of the population. Emergency medicine continues to be at the front of these

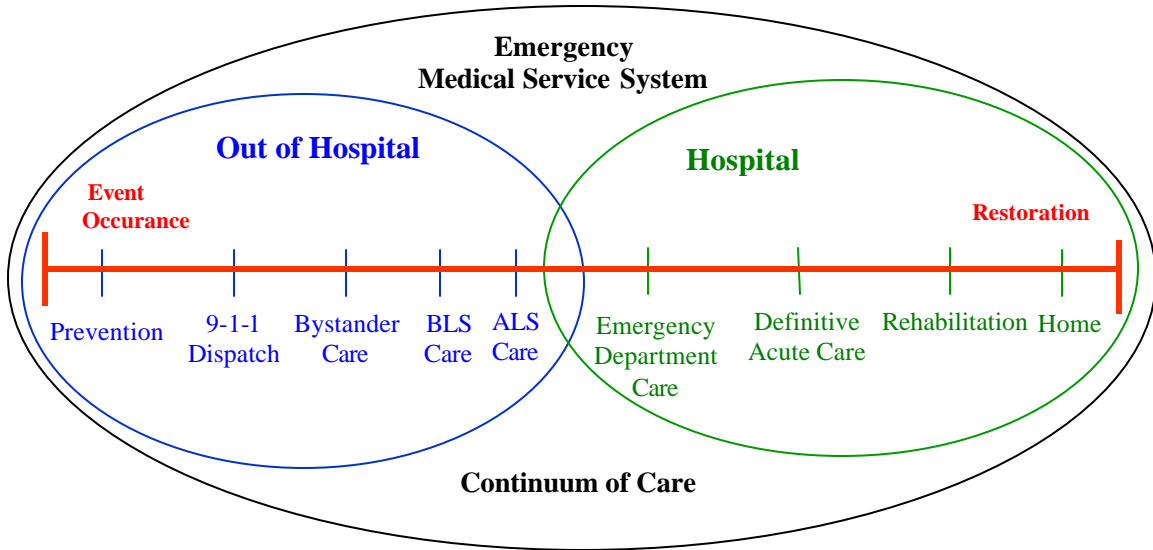
developments and is an essential component of future trauma system development initiatives. Emergency physicians and their specialty organizations must continue to provide direction in trauma system development that will best serve patients and communities.

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Figure 1



Developed during discussion between Jeff Runge, MD and Tim Peterson, MD in October 2000; and presented to the American Trauma Society May 2001.