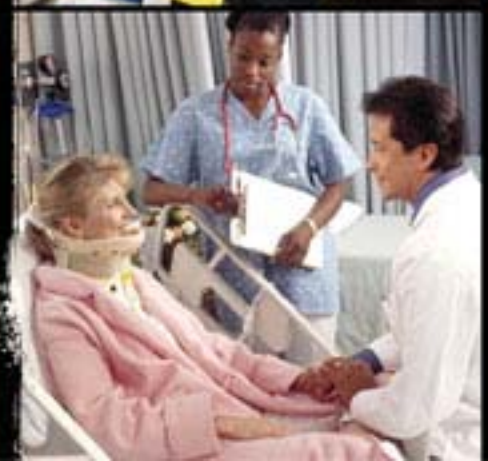

TRAUMA SYSTEM

Agenda for the Future

What Is Trauma

For the purposes of this report, the trauma patient is an 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. Injuries occur across a broad spectrum and a trauma system must determine the appropriate level of care for each type of injury.

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 public health system. The true value of a trauma system is derived from the seamless transition between each phase of care, integrating existing resources to achieve improved patient outcomes. Success of a trauma system is largely determined by the degree to which it is supported by public policy.

Trauma systems are regionalized, making efficient use of 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. Trauma systems must emphasize the prevention of injuries in the context of community health. Ultimately, nationwide development of trauma systems would allow for seamless and effective care across the United States with the ability to expand to meet the medical needs of the community from a man-made or natural disaster.

The Vision

Trauma systems, when fully implemented throughout the U.S., will enhance community health through an organized system of injury prevention, acute care and rehabilitation that is fully integrated with the public health system in a community. Trauma systems will possess the distinct ability to identify risk factors and related interventions to prevent injuries in a community, and will maximize the integrated delivery of optimal resources for patients who ultimately need acute trauma care. Trauma systems will address the daily demands of trauma care and form the basis for disaster preparedness. The resources required for each component of a trauma system will 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.

EXECUTIVE SUMMARY

Trauma kills. Trauma maims. Trauma is a disease; it is not an accident. Like heart disease and cancer, trauma has identifiable causes with established methods of treatment and defined methods of prevention. Much can and should be done to reduce the incidence of trauma and to improve trauma treatment in this country.

Most commonly, injury happens to one or two individuals at a time. Less frequently, disasters strike tens or hundreds of people at once. Injury results from motor vehicle collisions, falls, stabbings and gunshot wounds, or other blunt or penetrating forces. Injuries also may be caused by an act of terrorism utilizing explosives and/or chemical, biological or nuclear agents.

In 1995, in the United States, nearly 148,000 lives were cut short due to trauma.[4] To add to the tragedy, most of those lost were young. Ten times that number of Americans survive traumatic events, only to face the future with life-long disability that takes its toll not only on the injured themselves but also on their families and the community.[4] The total cost of injury in the United States in 1995 was estimated at $260 billion and injury and its consequences accounted for 12 percent of all medical spending. [4]

Consider the experience of hundreds of thousands of injured people each year, whether the injury occurs as a single incident or as part of a national disaster, such as the Oklahoma City bombing or the attacks on September 11, 2001. The emotional and financial impact is devastating. Prevention activities could keep many from experiencing trauma. For others, improved systems of care for the injured can increase the chances of optimal recovery. Regardless of the number of injured or the source of injury, advanced planning, preparation, and coordination are essential for optimal response and care.

Responding to a growing trauma problem and ever increasing trauma care challenges, stakeholders including the American Trauma Society, the National Highway Traffic Safety Administration, Health Resources and Services Administration, the American College of Surgeons, the American College of Emergency Physicians, Society of Trauma Nurses, the National Association of State EMS Directors, the National Association of EMS Physicians, among others, developed an action plan for the nation and all persons and organizations involved in trauma care. The plan addresses the prevention of trauma and improvement of care of injuries resulting from both day-to-day emergencies and disasters.

This report presents a Trauma System Agenda for the Future, reflecting the synergism of ideas generated from literally hundreds of professionals and based on decades of experience. These professionals believe this is the appropriate time to launch a new initiative, attacking trauma on all fronts to make a difference to our country and to each victim or potential victim.

Trauma systems, when fully implemented throughout the U.S., will enhance community health through an organized system of injury prevention, acute care and rehabilitation that is fully integrated with the public health system in a community. Trauma systems will possess the distinct ability to identify risk factors and related interventions to prevent injuries in a community, and will maximize the integrated delivery of optimal resources for patients who ultimately need acute trauma care. Trauma systems will address the daily demands of trauma care and form the basis for disaster preparedness. The resources required for each component of a trauma system will 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.

To realize this vision, the Trauma System Agenda for the Future identifies key issues in addressing four fundamental components of the trauma care system and eight key infrastructure elements that are critical to trauma system success. The four Fundamental Components of the Trauma Care System addressed in this document are:

- Injury Prevention
- Prehospital Care
- Acute Care Facilities
- Post-hospital Care

In addition to the fundamental operational components of the trauma system, the following key infrastructure elements must be in place to support any comprehensive trauma care system:

- Leadership
- Professional Resources
- Education and Advocacy
- Information Management
- Finances
- Research
- Technology
- Disaster Preparedness and Response – Conventional & Unconventional

The current status and a set of vision statements or recommendations are included for each of the above areas. A summary of the recommendations can be found in the appendices.

The benefits of successful implementation of this plan include: (1) a reduction in deaths caused by trauma; (2) a reduction in the number and severity of disabilities caused by trauma; (3) an increase in the number of productive working years seen in America through reduction of death and disability; (4) a decrease in the costs associated with initial treatment and continued rehabilitation of trauma victims; (5) a reduced burden on local communities as well as the Federal government in support of disabled trauma victims; and (6) a decrease in the impact of the disease on "second trauma" victims – families.

Trauma is predictable. It happened yesterday, it is happening today, and it will happen tomorrow. Fortunately some answers already exist. There is tremendous consensus among trauma stakeholders. Multidisciplinary teams of professionals have outlined a plan to reduce death and disability from the disease of trauma. What they need now is support—support from policy makers, support from other health providers, and support from the community. Achieving this vision will not only serve thousands of Americans who are injured in single incidents across the nation on a daily basis, but will also add greatly to the readiness of the nation for future disasters. This is an urgent call for action. When it comes to trauma, time is truly a life and death matter.

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Trauma System Agenda for the Future

TRAUMA SYSTEM AGENDA FOR THE FUTURE

I. INTRODUCTION

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Key Issues in Developing Inclusive Trauma Systems

A number of issues must be considered in planning an inclusive trauma care system for the future. These include the following:

Regionalization of Trauma Care

The concept of inclusive trauma care systems promotes regionalization of trauma care, so that all areas of the country receive the best possible care. Equally important, an inclusive trauma care system must identify high-risk behaviors in each community and the population groups at risk for injury so that the system can provide an integrated approach to care that is responsive and appropriate to local needs.

Disaster Preparedness

Historically, the overwhelming majority of all manmade disasters or incidents of terrorism have involved explosives and have resulted in large numbers of people with life and/or limb threatening injuries. Though future acts of terrorism may include the use of other less conventional weapons of mass destruction (chemical, biological or radiological), they will most likely continue to involve use of explosives. In light of this experience, disaster medical response is best provided through an extension of existing resources within a trauma system. The best strategy for a community to prepare for disasters is to create a strong EMS and trauma system infrastructure that will deal with daily injuries and have the capacity to efficiently expand to respond to the demands of an unconventional or natural disaster of greater magnitude.

Trauma as a Disease Process

Trauma must be recognized as a disease process. Trauma has seasonal variations and trends, and characteristic demographic distribution. It is also age dependent. Like heart disease and cancer, trauma has identifiable causes, established means of treatment, and defined means of prevention. But unlike heart disease, trauma is communicable. People injure other people. Attitudes toward risk-taking behavior—such as running red lights or driving while under the influence—can spread throughout a community. Injury is not an accident; it is a predictable and preventable disease.

Continuum of Care

Designated trauma centers (Level I and Level II) are only one component of a trauma care system. Appropriate care must be provided along a continuum that includes prevention, pre-hospital care, care at all acute care facilities and trauma centers, and rehabilitation.

Trauma Requires a Multidisciplinary Approach

Trauma is a disease requiring a multidisciplinary team response. There is no question that committed and skilled surgeons interested in trauma care are essential to any properly organized trauma system. These specialized providers must be immediately available for definitive surgical intervention. However, many health care professionals along the continuum of care take part in providing care to the traumatically injured patient, including prehospital EMS providers, EMS medical directors and hospital physicians of all specialties, nurses, and allied health

professionals. The appropriate use of all members of the trauma team must be planned to provide quality care in a timely and cost effective manner.

Improving Cost Effectiveness

The current cost of delivering trauma care is overwhelming. Many emergency departments and hospitals - both trauma centers and non-trauma centers that are important to trauma care - are closing or refusing to care for trauma patients due to health care industry issues, including high cost, inadequate reimbursement and malpractice.[12] Because of the lack of Federal and state funds, development of comprehensive trauma systems is taking place in only a few states. A coalition of health professionals, elected officials, and other special interest groups is essential to correct the problem. With the total cost from trauma in the U.S. approaching $260 billion each year, combined with changes in health care financing, any system unable to decrease costs is certain to fail.[4] An inclusive trauma system with an emphasis on optimal resource utilization and prevention offers the best chance for success.

Enhanced public awareness and increased individual responsibility are essential. Injury surveillance to identify high-risk groups and the development of prevention countermeasures are also important parts of an inclusive trauma care system.

Appropriate care for the major trauma patient will continue to be expensive. The charge for the average trauma admission is two to four times greater than for the average general admission. However, trauma centers remain cost effective because they significantly improve survival and reduce disability. The amount paid in Federal, state, and local taxes by a rehabilitated trauma patient returning to work far exceeds the cost of trauma care.

Coordination of Resources, Services and Special Populations

An effective trauma care system will be part of, and interrelate with, many other components of the health care system. Duplication must be avoided and existing resources integrated. The capabilities of current EMS systems should be taken into consideration when developing a trauma system. An integrated EMS and trauma system should, through a coordinated effort, provide a continuum of care while addressing specialized patient needs such as pediatrics, burns, and spinal cord injuries. The system must also continue to coordinate trauma care within regions and, when needed, adjoining states, especially in rural and frontier regions.

Reimbursement, Funding and Legislation

Funding issues require a perspective that looks beyond the “costs” of development to consider the societal benefits of reducing the incidence of trauma and improving outcomes. Adequate funding is required to complete the creation of a national trauma care system where hospitals’ capabilities to treat trauma is matched with the severity of trauma patients’ injuries.

Funding for trauma is needed on several levels. National planning and development, leadership and research must be funded at a Federal level. These critical components have received partial and intermittent Federal financial support in the past. In fact, the goal today is to complete the job begun in the 1970’s by the Emergency Medical Services Systems Act of 1973. This act grew out of the landmark study published in 1966 by the National Academy of Sciences and National Research Council, "Accidental Death and Disability: The Neglected Disease of Modern Society,"

which called attention to the deficiencies existing in American trauma care and stressed the need for comprehensive and organized care delivery.[1]

In the early 1990s, the Trauma Care Systems Planning and Development Act of 1990 (P.L. 101-590) provided new opportunities for trauma system development and many states made significant progress until Congress failed to fund the program in 1995. New funds and enabling legislation are critical to the completion of this phase of trauma system development.

States and local communities also must be willing to finance emergency medical services to allow for a "level of readiness" necessary to provide appropriate trauma care services for all injured patients both on a day-to-day basis and in the event of a natural or unconventional disaster.

The Reality for Trauma and EMS in Rural, Remote, and Wilderness Areas

For the 65 million people living in rural America, the fragile health care infrastructure is especially relevant. In rural, remote, and wilderness areas the existing hospitals and other medical care facilities must serve as the safety net for initial stabilization of the time-critically injured prior to transfer to definitive care. This report recognizes the unique characteristics and needs of rural, remote and wilderness areas and the relevance of the EMS and trauma systems to people at risk.

The population in non-urban areas is spread over large areas, making local access to needed services difficult. These areas show higher rates of unemployment, lower median household income, and lower percentage of high school and college graduates. The population is typically older and has higher rates of chronic disease than the urban population.

The aging population, earlier discharges from hospitals, and closure of hospitals increase the demand for emergency services. The main barriers identified for rural, remote, and wilderness areas in providing emergency services include:

Low Volume; high fixed costs: The fact that the ambulance typically makes far fewer runs in non-urban areas than an urban service means that the cost per run of the non-urban service is much higher. Likewise, a typical non-urban hospital emergency department, which sees far fewer patients than an urban hospital, has a higher per-visit cost.

Volunteerism: As with many rural, remote, and wilderness enterprises, the ambulance service historically has relied on volunteers. Unfortunately, volunteerism- even in non-urban America- is on the decline.

Lack of Medical Oversight: There are currently four levels of national standard curricula for prehospital EMS personnel, with each level requiring more training. Each has more skills than the previous: first responders, basic emergency medical technicians, intermediate emergency medical technicians, and EMT-paramedics. Each emergency medical service agency, whether volunteer or paid, needs to have a physician granting authority and accepting responsibility for all aspects of the care provided by pre-hospital providers. Quality medical direction is essential to providing the best care. Due to shortages of physicians, particularly physicians trained in emergency medicine, in rural, remote, and wilderness areas, some EMS units have no medical director and EMS personnel may be the only healthcare providers readily available.

Why Act?

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Only about fifty percent of the United States is served by an organized trauma system.[24] As Americans move freely through the nation, each has a right to quality trauma care wherever he or she may live or travel. This country has accepted the right of each citizen to fundamental health care but, in the realm of trauma, not all citizens are served.

Background and Objective of this Report

After three decades of evolution, the need for consensus regarding trauma system development has never been more evident. Over the past 20 years, a number of multidisciplinary groups have described the essential components and influenced the design of these systems. Focus has shifted from trauma centers to trauma systems, with an emphasis on inclusiveness. A research agenda has been established to strengthen medical evidence and draw conclusions regarding trauma care effectiveness. An international study recently has been undertaken to evaluate the cost-effectiveness of trauma care. And national experts in trauma care have gathered in a series of forums to analyze system needs and recommend strategies for improvement.

At one such meeting held in Skamania, Washington in July 1998, approximately 100 of the nation's leading trauma authorities convened to provide recommendations for improved trauma system performance and evaluation. One recommendation was that leaders from key stakeholder groups be gathered to create a trauma system agenda for the future.

Between 1999 and 2002, the National Highway Traffic Safety Administration (NHTSA), Health Resources and Services Administration (HRSA), and the American Trauma Society (ATS) coordinated development of this vision for a trauma system of the future. The process began in April 1999, when leaders representing hospital and trauma system administrators, state elected officials, EMS system managers, trauma surgeons, emergency physicians, trauma nurses, and public health professionals were convened as a steering committee. The committee met four times over two and a half years to deliberate the many issues surrounding trauma care and develop thoughtful recommendations to guide the future of trauma system development. The American Trauma Society (ATS) launched a complementary Rapid Design® process during their 2000 and 2001 Annual Meetings, during which more than 150 participants drafted a vision of trauma care in 2010.

This input was subsequently combined with that of the steering committee to produce this Trauma System Agenda for the Future, a powerful vision statement representing the perspectives and priorities of the full range of professionals involved in the prevention, treatment, and rehabilitation of trauma victims.

The design of high quality, cost efficient trauma systems for the United States in the 21st century is an iterative process that will involve many organizations and individuals. This report has been prepared as an important first step. Together, the groups convened in this vision process represent a comprehensive range of trauma stakeholders. Their findings complement and strengthen one another, presenting a persuasive analysis of the needs, opportunities, and direction of trauma systems.

The report is organized around a framework that includes all components of a comprehensive trauma care system. It begins with a discussion of the **fundamental components** (injury prevention, prehospital care, acute care facilities, and post-hospital care) that are at the heart of the trauma care system. The report then examines the **key infrastructure elements** that are integrated across the continuum of care: leadership, professional resources, education and advocacy, information management, finances, research, technology and disaster preparedness and response.

II. COMPREHENSIVE TRAUMA CARE SYSTEM: FUNDAMENTAL COMPONENTS OF TRAUMA CARE

A comprehensive trauma system consists of many different components that are integrated and coordinated to provide cost-effective services for injury prevention and patient care. At the center of this system is the continuum of care, which includes injury prevention, pre-hospital care, acute care facilities, and post-hospital care.

Injury Prevention

Current Status

Injury prevention will be a central focus of trauma systems of the future because it offers the greatest potential for reducing the burden - financial and otherwise - of trauma care, as well as morbidity and mortality. At the present time, the public health infrastructure for injury prevention varies greatly among states and regions. Funding for injury prevention is often non-existent or limited, which prevents long-term implementation and program evaluation.

Injury prevention is variably represented in trauma systems; the focus has traditionally been on secondary and tertiary prevention (efforts to reduce the impact of an injury once it has occurred and optimize its outcome). Although primary injury prevention programs have been implemented by pre-hospital and acute care providers, few have been systematically evaluated.

Community-based injury prevention programs have been demonstrated to avert injury-related morbidity and mortality and to reduce health care costs, although there is a huge gap between what is known to be effective and what is done at the local level. Prevention programs are often created on demand (i.e., requested or based on a single incident) rather than based on a systematic analysis of actual injury data. Prevention efforts often are not targeted or evaluated in relation to community needs. In many cases, injury prevention programs on similar topics are conducted by various organizations in the same community without the benefit of coordination.

The Vision

- Each State will have a core injury prevention program that provides assistance to local areas, with information and materials coordinated via a central repository or clearinghouse. Specific injury prevention programs will be based on a quantitative community health assessment. The health assessments will be coordinated with other comprehensive public health community assessments. All programs will be evaluated for their effectiveness on a local level.

- Trauma registry data will help with problem identification and program evaluation and will be fully coordinated with the EMS and public health systems.

- A comprehensive study of the epidemiology of injuries and trauma will be conducted and predictive models regarding injury occurrence will be developed. The information gained through these efforts will reduce the occurrence of injury, expedite the patient's return to productivity, and minimize the impact of injury.

- Injury prevention legislation will be enacted, where compelling evidence exists.

- Injury prevention efforts will be conducted on a collaborative basis, with input from and the involvement of multiple stakeholders and constituency groups. Trauma care systems will establish system-wide injury control coalitions or coordinate with existing initiatives to provide consistent and coordinated community-wide injury prevention programs. Injury prevention programs developed by these coalitions will be evidence-based, using local injury data where available (or linking existing data sources) to identify prevention priorities within the community, with an emphasis on decreasing risk factors. Program evaluation and outcome data will be used to modify or create injury prevention programs, with special effort given to developing rural and frontier models.

- Injury prevention will be recognized as a legitimate public and governmental service, similar to other safety programs such as fire prevention. Proper funding will be secured for injury prevention, with a greater portion of public health dollars allocated for injury prevention.

- Injury prevention efforts will be seen as a legitimate health care service that is directly reimbursable to providers.

- Injury prevention programs, and their availability to the general public, will be required by lead agencies who designate all levels of trauma centers and by the public health systems.

- Injury prevention will be integrated into existing health delivery systems, such as pediatric and rural health clinics, and prevention materials will be readily available at places where families usually receive care. Age-appropriate injury prevention information will be added to all periodic health examinations and risk assessment systems. Specialty care providers will also identify injury management issues that specifically relate to their practice area.

Prehospital Care

Current Status

Pre-hospital care and access is a critical component that will be further enhanced in the trauma care system of the future. Currently, out-of-hospital EMS provider agencies are predominantly isolated from other health services and respond to acute illness and injury episodes. They are primarily financed for service to individuals in need and are accessible through fixed-point and wireless telephones, though there are deficiencies in the current 9-1-1 emergency telephone system. EMS delivery is quite diverse at the local level, including a variety of configurations, funding, staffing, geography and mode of delivery (e.g., volunteer, municipal, private, etc.).

There are clear inequities in distribution of EMS resources. The "rural paramedic paradox" is a reality --- rural areas farthest from a hospital have the greatest need for EMS yet have the most trouble maintaining those services. Field stabilization in rural areas is particularly critical because transport times can exceed 1 or 2 hours and total pre-hospital times can exceed 3 or 4 hours.[26] Integration of Critical Access Hospitals (CAHs) with the EMS system and regional trauma systems is also of paramount importance for the rural health infrastructure.

In urban areas, there is an increasing problem of hospital overcrowding and ambulance diversion throughout the country, and there have been cases of inappropriate triage, both under and over-triage, to regional trauma centers.

The Vision

- EMS and first responders will be more integrated within the health care system, with links to prevention and acute care, and will be more focused on promoting overall community health, as described more fully in the "EMS Agenda for the Future".[27] This will facilitate faster access, improved pre-hospital care, and more seamless patient care throughout the continuum of care. Critical Access Hospitals will be better integrated with EMS systems. EMS will continue to serve as the community's safety net and will be funded more reliably and appropriately for service to the community.

- Trauma care will be coordinated and integrated using standard protocols and triage. Triage criteria will be redesigned to produce a more accurate predictive model, which facilitates direction of patients to the most appropriate care setting.

- Transport vehicles (air and ground) will be strategically placed rather than facility based and will be used appropriately to facilitate timely access and response, especially in areas that are least accessible.

- A national 911 system, covering both wireless and conventional wireline telephone systems, will be developed and implemented, with standard, seamless protocols that are evidence-based and that address bystander interface. Rural addressing will be accomplished, where needed, to enable enhanced 911 systems and to ensure that all citizens have better access to EMS and other public safety resources. Dispatcher training will be standardized and EMS response will be based upon medical priority.

- Access to prehospital trauma care in rural areas will be greatly enhanced through development of consistent standards and more efficient deployment of limited resources.

- Enhanced communications among all members of the trauma care team during the pre-hospital phase will speed deployment of resources, produce more appropriate triaging, and result in better patient outcomes. Greater use of wireless technology should enable team members to speak to other hospitals and providers in the field and to give direction and assistance wherever the care is being provided. Discovery (Automatic Collision Notification –ACN), Access (wireless), and Coordination (telemedicine) all will be enhanced through improved technology.

Acute Care Facilities

Current Status

Definitive care of the injured takes place at various levels within the health care system, ranging from primary care settings to highly sophisticated tertiary trauma care facilities. Trauma care providers have identified a continuum of resources necessary to provide optimal care for injured patients, which have been refined through a process that is not often replicated in other areas of medicine. Similarly, improvements in trauma care within a facility depend upon coordinated care of multiple providers and often have led to improvements in care for other patient populations within that same facility. A performance improvement process should continuously be used to enhance the system.

However, resource staging across a trauma system has not been tested, and states or local regions have varied in how they have applied this concept. Resources are often inconsistently allocated. Provider training and research capabilities at the highest echelon of care ultimately may be compromised by an insufficient number of encounters with patients who have specific types of injuries. Volume is important to performance.

It is recognized that rural hospitals are a port of entry for many patients and they should have consistent high standards. This is an area that needs considerable attention, resources and support in order to reduce the disproportionately high rural death rate. Rural America is disproportionately affected by trauma with rural residents nearly twice as likely to die as a result of trauma than their urban counterparts.[26] Rural inhabitants are more often engaged in occupations with a high risk of injury such as farming and manufacturing. Approximately two-thirds of all fatal motor vehicle accidents occur in rural areas and rural trauma patients frequently have multiple severe injuries, co-existing disease, and less prehospital care.[26]

Attention should be focused on exploring systems for rural access such as mobile trauma units and military connection, and other transport/telecommunications models.

The Vision

- There will be a distributed system of acute care facilities and trauma care systems will be implemented across the country.

- Research will be conducted to determine the effectiveness of the current tiered resource allocation guidelines.

- The appropriate volume of patients with specific injuries that are needed at the highest echelon of care will be studied and clearly identified so that research and treatment options can be continually explored.

- Trauma systems will be linked on a regional basis through databases and technology to ensure efficient and effective patient care nationwide.

- There will be consistent standards for rural and urban trauma services, with the goal of every community having access to a consistent level of trauma care.

- All injury care providers within a community will be recognized as part of the system and will provide data to a system-wide database, and injury care will be monitored throughout the system. All facilities that participate in the trauma system will contribute to the national trauma database and there will be a mechanism to fund such a trauma database at the state and national levels.

- Most facilities, whether small community hospitals or large tertiary care centers, will have a designated role to play in the trauma system and the capacity to manage injured patients to one degree or another. Each participating facility's available resources will be catalogued and capabilities defined to facilitate patient management/movement decisions.

- Facilities in the system will have multi-casualty capabilities.

- The appropriate match of resources will be identified for injured patients with special needs, such as elderly, remote rural, or pediatric patients.

- Innovative treatment methods will be explored, including utilization of mobile trauma units for rural areas.

Post-Hospital Care

Current Status

Post-hospital care is an essential step in returning the injured person to a productive life. However, post-hospital care is not uniformly accessible. There is insufficient capacity to provide home-based care and monitoring, and trauma registries frequently lack post-hospital data needed to identify community needs. Patients needing rehabilitation often do not have access to appropriate support groups. And the issue of adequate, affordable, and available long-term health care has not been adequately addressed.

The Vision

- Long-term care coverage will be available, affordable, and encouraged to help address post-hospital care needs.

- Post-hospital care will focus on helping patients achieve greater independence, a higher degree of functionality, and a faster return to productivity.

- Functional recovery will go beyond traditional rehabilitation and include psychological support.

- Home-based care and monitoring will be used to manage costs and speed recovery, especially in areas lacking access to care.

- Appropriate support groups will be established and encouraged.

- Trauma registry data will include post-hospital care and rehabilitation so that the value and cost-effectiveness of the full cycle of trauma care can be more readily assessed.

- Research concerning the effectiveness of post hospital care will be supported.

III. COMPREHENSIVE TRAUMA CARE SYSTEM: KEY INFRASTRUCTURE ELEMENTS

The infrastructure of a trauma care system includes eight key elements: leadership, professional resources, education and advocacy, information, finances, research, technology, and disaster preparedness and response. In a model system, these elements are integrated and coordinated to provide cost-efficient and appropriate services across the continuum of care.

Leadership

Current Status

The fragmentation of trauma leadership is a major impediment to the development of a national trauma system. There is currently little focal point at the state or national level to foster the growth of regional trauma systems or support injury research. (A Federal program for trauma system development was in place until 1995, when budgetary considerations led to the program's demise. The program was reinstated, with limited funding, in FY01 & FY02) Currently, trauma system development funding and support emanates from several Federal agencies, and a variety of professional organizations are involved in trauma care. But there is no single voice representing the broad trauma constituency.

The paucity of dollars invested in trauma system development and research in relation to the magnitude of the impact of trauma on society underscore the need for a lead council to advise the federal government on future trauma system development and to promote support for system development.

As at the Federal level, states and regions commonly lack an agency that has the authority, responsibility, and resources to lead the development, operations, and evaluation of a trauma system in their area. There is a critical need for such lead agencies, either public or private, that are recognized and accepted by the full range of community health and safety organizations as the parties responsible for trauma system development and implementation.

The Vision

- A National Trauma System Leadership Council will be developed to advocate for system development, serve as the locus for policy development and support, and coordinate the work of Federal agencies and professional organizations with injury-related programs. The Council would represent a partnership among private organizations and governmental agencies (national, state, and local) and would include representatives of all major stakeholder groups, including public and private payers and purchasers, and with both rural and urban membership. The Leadership Council will help formulate national trauma system standards and optimal resources guidelines for trauma prevention, and ensure implementation of the recommendations set forth in this Trauma System Agenda for the Future.

- All states will establish a Lead Agency to coordinate and administer trauma system development. About 75% of existing state lead agencies are located in the State EMS office.[25] It is essential that, wherever the lead agency is situated, effective links should

exist between that agency and the state public health, public safety and health care systems.

- A best practices study will be conducted to identify the optimal components and configuration for local and state lead agencies.

- The efficacy of trauma system elements and their integration within the trauma system and between EMS and health care systems will be continually examined.

- State legislators and governors will be informed of the need for an identified and adequately funded lead agency for trauma systems in their region. Enabling legislation at the state level will ensure that public policy supports and sustains leadership on state and local levels.

Professional Resources

Current Status

Personnel shortages are rampant throughout the health care system in the United States. This problem is particularly acute in the field of trauma care, whether it is the availability of nurses and physicians, or adequate numbers of health care providers and pre-hospital volunteers in the field, especially in rural areas.

Many factors contribute to the shortage of trauma care professionals. Funding for graduate medical education has been decreasing. There are few financial incentives for pursuing a specialty that frequently involves night shift work. Standards for EMS providers are not consistent across the country, and volunteer recruitment and retention is a constant challenge. And reimbursement problems are driving nurses to other professions and doctors into other specialties.

The Vision

- Professional resources in the system will be patient focused, team-oriented and physician led.

- New categories of providers and the use of physician extenders will address the need for additional resources.

- Creative opportunities for recruitment and retention of personnel will be explored.

- Reimbursement for all types of providers will be appropriate and sufficient so as to encourage participation in trauma care.

- Incentives for attracting trauma specialization, including addressing the burden of liability, will be explored.

- Ongoing professional education opportunities will be available and accessible.

- Volunteers will supplement career resources and will be enlisted to promote injury prevention as well as deliver care.

Education and Advocacy

Current Status

Most Americans continue to view injuries as "accidents." As a result, there is little appreciation of injury as a public health disease or its relationship to public safety and public health issues. Moreover, in cases of intentional injury or those related to violence, in addition to being a public safety issue, these injuries also should also be seen as a public health problem that is amenable to prevention and treatment. With the aging of the population, there is an increasing frequency of injury to the already infirm.

There is a profound lack of public and legislative awareness about the scope of the injury problem and sources of payment. Most of what the public knows about injury and trauma care has been gleaned from the news and entertainment media where the focus is sensationalism and entertainment. There is little understanding of the operational components of a trauma system; most Americans believe that a trauma *center* actually represents the entire trauma *system*. There is also a significant gap between what the public expects related to local trauma care and the services that may actually exist within their community.

But the general public is not the only group that is poorly informed about injury prevention and trauma care. Aside from emergency and trauma care professionals, most health care providers do not have a clear understanding of how injury management relates to their individual practice, how trauma care systems operate or the costs associated with creating and maintaining these systems. Even those providers who complete clinical residency or fellowship programs in trauma care or related fields often lack a clear understanding of injury prevention and trauma system issues.

Finally, private and public policy officials frequently lack an appreciation of the nature of the injury problem as well as the value of trauma care in supporting the well being of a community. Current emphasis is on the cost of trauma care rather than the total benefit that injury management provides to a community.

The Vision

- A compelling educational campaign will be launched to position trauma and injury as a disease rather than a random occurrence and to increase public awareness of the need for injury prevention and the value of trauma care.

- Targeted educational programs will be developed to inform policy makers about the value of community-based trauma care in order to promote passage of legislation to support trauma system activities, including injury prevention.

- Trauma care providers and advocates will form or integrate into coalitions with trade associations, large corporations (such as Johnson and Johnson's work with the *Safe Kids* campaign) and payers to conduct public education programs about injury and injury prevention and to advocate for legislation to support injury prevention and trauma system activities.

- Health insurers will have a clear appreciation of the cost effectiveness of injury prevention and will provide incentives for safe behavior.

- Communication, education, and training approaches for the public and key constituency groups will be thoroughly coordinated yet distinctly segmented and targeted to achieve maximum impact.

- The number of injuries and trauma cases will be reduced through education and training of clinicians, management and administrative personnel, volunteers, community support groups, potential "bystanders," and other key constituency groups.

- Trauma and injury prevention education and training will be increased for all healthcare professionals, beginning at post-graduate levels and continuing throughout their careers, appropriate to the level of their involvement in health risk assessment, primary care, or injury care. Physician, nursing, EMS, and allied health schools will include injury prevention information in their basic health assessment and patient education modules.

- Advocacy efforts will facilitate passage of new laws designed to reduce injuries and trauma cases (based on evidence) and stronger enforcement of existing laws.

- Tort reform will be enacted to facilitate greater access to trauma services and facilities.

- There will be increased awareness of the vulnerability of the older population.

Information Management

Current Status

While information management should be a cornerstone of the trauma care system enabling research, care management, and performance improvement, often the existing databases and information management systems have serious shortcomings.

There are gaps in existing trauma data registries at the national level. The National Trauma Databank is based on samples of hospitals that choose to submit data. However, the size of these databases (NTDB included nearly 500,000 cases in 2002) may offset some concerns about their representativeness. This creates limitations both in terms of monitoring and evaluating the quality of care and determining the epidemiology of injury. The Pediatric Trauma Registry needs to be linked with the National Trauma Databank at the data element level. The database should be internet accessible and universally available.

Finally, there is a need for more evidence regarding the overall value of trauma care as well as for data regarding the contribution of individual components of a trauma system and what value each provides to the effectiveness of the system. Trauma system advocates need better data in order to garner support from legislators and local policy makers.

While trauma systems historically have set an example for performance improvement, there is a need to change the culture of quality improvement from punishment to system performance improvement. There is building public concern regarding patient safety and error reduction in all

of health care. Patient records are essential to performance improvement (including patient safety information) and such records must be accessible for these purposes, while being protected from inappropriate disclosure.

The Vision

- A national database and uniform data standards will be used to facilitate hospital operations and provide regional and national information regarding availability of post-hospital care. Existing resources should provide the foundation to be built upon. Applicable data sets should be revised as necessary and there should be increasing use of computerized medical records.

- Trauma care will be designated as a specific research area for epidemiological study. Predictive models will be developed regarding outcomes and will be used in making funding and resource deployment decisions.

- Pre-hospital and functional outcomes will be tracked and used in a Total Quality Management initiative to improve policies, procedures, and processes throughout the trauma continuum. Information will be used to develop performance standards and measure system performance against similar systems (benchmarking).

- Information related to the complete cycle of trauma—from prevention to post-hospital care—will be collected, analyzed, and made available to facilitate improvements in injury prevention, response times, patient care, and rehabilitation.

- Information systems should be usable for multi-center studies.

- A standardized training course will be used to enable trauma registrars to collect and categorize data in a consistent, comparable manner.

- Clear evidence will exist to document the contribution of an injury management system (prevention and treatment) to a community's overall health, and additional research will demonstrate which components of a trauma system provide the most value.

- Tools will be developed and region-specific injury data will be available to assist communities in making decisions about their specific needs related to trauma system development, particularly regarding which components will best meet community health needs.

- The culture of quality improvement will shift from using data to blame individuals to using the data to improve performance of the system.

- Access to and appropriate protection of patient records and quality improvement data will be addressed through legislative and regulatory changes at state and federal levels.

- Efforts to enhance patient confidentiality should be balanced with the need for strong research.

Finances

Current Status

For the past three decades, the cost of trauma system development has been a shared responsibility of Federal and state governments. Although new funding sources have been identified to support the initial implementation of trauma system development in many communities, there is a lack of appreciation by the public and policy makers for the costs associated with the continual "level of readiness" necessary to provide trauma care services for all injured patients. In addition, there are few data to document the cost effectiveness of establishing such systems or to support advocacy for continued financial resources.

In 1996, road traffic crashes, homicide, violence, and unintentional injuries, taken together, accounted for more "Disability Adjusted Life Years" (DALY's) for men than did ischemic heart disease. DALY's equal years of healthy life lost to disability plus years of life lost to premature death (unpublished results from "US Burden of Disease and Injury Study," a joint project of the US Centers for Disease Control and Harvard University).

Costs related to trauma care are incurred by multiple organizations within a trauma system such as public agencies, pre-hospital providers, acute care providers, and rehabilitation providers. Funding for trauma care, as for health care in general, is currently based on payment for services delivered (i.e., fee-for-service structure). However, reimbursement by governmental payers (Medicare, Medicaid) does not fully cover the cost of trauma care for their beneficiaries. The resulting shortfall, added to the cost of uncompensated care provided to nearly 50 million uninsured Americans, has shifted the financial burden of trauma care to nongovernmental payers (insurers, both for-profit and not-for-profit). This cost shifting makes the purchase of insurance by employers and others more expensive and less attractive, which increases the number of uninsured and causes the cost of uncompensated care to spiral upward, especially in rural and inner city areas.

Emergency services in many rural regions today still depend on a "wing and a prayer" of grassroots organizations supported by volunteers and vintage equipment. Studies of rural EMS conducted since 1985 repeatedly point out the same problems.[26] Because of the low annual volume of calls and thin tax base, it is difficult to finance the universally high fixed cost of an ambulance operation. Yet, the need and demand for EMS in rural areas—where distance is critical and rates of occupational injury are high—is as great or greater than in urban areas. However, one call per day can't finance the operation.

The Vision

- Trauma systems will be recognized as a public good and therefore valued and adequately funded not only for the clinical care they actually deliver, but also for the level of readiness required to meet the needs of all injured persons. A public supported funding source specifically designated for trauma care will be established and administered at the state level.

- The appropriate level of readiness in a community will be determined by a broad-based group of community members, including citizens, local employers, trauma and health care providers, and payers. Although the level of readiness will vary by community,

components of the trauma system that are related to this readiness—such as prevention programs and system assessment and analysis—will be directly reimbursed.

- There will be a "rural modifier" to the Medicare fee schedule for rural EMS providers. This modifier will be analagous to the payment enhancements made for rural clinics and the Critical Access Hospitals system.

- There will be dedicated funding for trauma system infrastructure costs.

- An open dialogue with managed care organizations, public and private, and other payers will facilitate greater mutual understanding of the costs of providing health care, ultimately leading to equitable payment mechanisms, which may include "carve outs" or risk sharing.

- There will be ongoing dialogue and review regarding the cost-effectiveness of trauma care systems.

- A system will be created for reimbursing providers for uncompensated trauma care without cost shifting to non-governmental payers.

- The public will be encouraged to obtain long-term care coverage to augment other forms of payment for post-hospital care.

- Alternative payment mechanisms will be examined, tested, and piloted, especially in rural areas.

- Additional funding sources, such as seized drug money, will be explored.

Research

Current Status

The purpose of the 1998 Academic Symposium to Evaluate Evidence Regarding the Efficacy of Trauma Systems, previously referred to as the Skamania Conference, was to systematically review the published literature to quantify our current understanding of trauma system effectiveness and chart a course to ensure that future research endeavors would build on current knowledge and expand traditional methods used in trauma system assessment. The research findings and the "future course" mapped during the conference were published in a September 1999 Supplement to the *Journal of Trauma: Injury, Infection and Critical Care*.[11]

There is generally a lack of consensus on research priorities, though the Skamania Conference began to bring some focus to that issue. There is currently no Federal focus for trauma research and Federal resources that do exist are distributed among several agencies. Though the current Administration is increasing the NIH budget, there is inadequate funding for trauma related research. And research that is being conducted is often not interdisciplinary.

The Vision

- Congress will establish a National Institute for Injury, within the National Institutes of Health.

- Federal agencies involved in or funding trauma research will be coordinated through a formal institutional process. One example of such occurred in January 2001, when seven Federal agencies participated on an interagency program announcement, PA-01-044, titled Emergency Medical Services for Children Research.

- There will be formal efforts to interest young professionals in trauma research and there will be sponsored training programs in all types of research.

- Types of research conducted will include fundamental basic research, crash investigation research, evidence-based medicine, best practices, clinical trials, clinical guidelines, and health services and systems research.

Technology

Current Status

Technology plays an important role in the organization, delivery, and effectiveness of trauma services, and it will continue to do so in the future. Recent developments such as automobile telematics (such as On-Star), Global Positioning Systems (GPS), Automatic Collision Notification (ACN), and wireless E9-1-1 promise shorter notification time and could bring beneficial information to dispatch centers, while the nascent field of telemedicine holds great promise for providing trauma care in remote locations. The developments mentioned above are being partially supported through the Intelligent Transportation System (ITS), a Federal program that continues to pursue technological advancements in support of improved mobility and safety on the nation's highways.

But advances in technology do not always lead to advances in trauma care. There is a confusing array of emergency access numbers in various states and localities. The explosion of wireless technology and the proliferation of cell phones have diminished the safety net due to the lack of automatic location notification, which is built into landwire 9-1-1 systems. There is often little up-front medical consideration in technology development, and financial resources for technology development are not always adequate. There is a need for continual development, with benefit of technology effectiveness studies. There is also a need for interoperability in communications technology.

The Vision

- Automotive telematics systems and GPS in motor vehicles will be used to locate crashes, monitor vital signs, and determine injury severity. GPS will also provide real-time route navigation for ambulances.

- Access technologies such as ACN and wireless E9-1-1 will be fully developed.

- Various technological innovations will be used to provide services remotely. For example, video feeds will be used to provide telemedicine to rural areas and will enable remote providers to perform operative procedures. EMS providers will have personal communicators with direct contact to medical providers. The Internet will be used to follow up with patients and train health care professionals. Robotic and diagnostic intervention will be conducted via telemedicine, and national teleconferencing will be used for education, outreach, and policy development.

- Monitoring devices will be used in a variety of settings, including computer chip implants to monitor patients and the use of monitoring devices in a patient's home, which would support injury prevention and rapid response.

- Computer chips will enable automatic transfer of sophisticated crash information and will permit injury research databases to be utilized to evaluate and improve auto design.

- An artificial neural network will determine the most appropriate site for patient care, given the extent of a patient's injury.

- Access numbers will be consolidated to eliminate confusion and streamline access nationwide.

- Patient simulation technology will be used for provider education.

- Medical input will be sought early in the design phase of future technologies to ensure that these developments are coordinated with the health care system and result in improved patient outcome.

- Dedicated resources will be available for technology analysis.

Disaster Preparedness and Response – Conventional and Unconventional

Current Status

The best preparation for an effective EMS and trauma system response to mass casualty incidents or disasters, whether natural or manmade, is an organized and effective system that responds well to day-to-day emergencies. Traditional disaster response requires surge capacity of the normal organized response to illness and injury. The existing infrastructure is an outstanding foundation to build upon for disaster medical readiness and response. The new disaster paradigm emerging from the September 11, 2001, terrorist attacks brings new challenges to the health care system, including EMS and trauma systems. Front line responders need targeted education on the various weapons of mass destruction, surveillance and decontamination. They also may become secondary victims in certain scenarios, such as in the September 11, 2001 attacks on the World Trade Center and the Pentagon.

In much of the country there has been inadequate incorporation of trauma systems in local and regional disaster planning. There is often confusion and conflict concerning roles. Both radio communications and wireless telecommunications are generally problem areas in disaster situations. Disaster preparedness must include a special examination of rural communities, their vulnerability and capacity to respond.

The Vision

- Trauma systems will be an integral part of regional and state disaster plans and will integrate with efforts of the public health system to provide disaster preparedness.

- Trauma and EMS systems will be integrated with other resources through the incident command system and will coordinate in advance with other regional resources such as law enforcement and public health.

- There will be targeted education covering all weapons of mass destruction (identification and response) for all providers.

- Hospital-based decontamination will be available in addition to more traditional field decontamination.

- A nationwide network of hospital and community surveillance systems will enable rapid identification of all major health threats, including those related to weapons of mass destruction. EMS electronic data systems will be an integral part of this surveillance system.

- Emergency communications systems will connect all levels of the response infrastructure, and will be developed with redundancy to assure backup when needed.

- The public health infrastructure will be reinforced to enable it to more effectively respond to emerging threats.

- Medical command centers will be an integral part of disaster incident command or incident management systems, to ensure the most appropriate medical response.

- There will be an optimal resources document for the role of trauma systems in disaster preparation and response.

IV. CONCLUSION

Americans view basic health care as an unalienable right. Yet, for more than half of all Americans, appropriate treatment after injury will be, at best, unorganized and, at worst, unavailable, resulting in death and disability for thousands this year alone.

Trauma is predictable. It happened yesterday, it is happening today, and it will happen tomorrow. Fortunately, some answers already exist. There is tremendous consensus currently among trauma stakeholders. With subtle differences on minor points, experts and professionals in the field agree on the major points outlined in this report.

Broad-based groups of professionals involved with trauma care have outlined this plan to reduce death and disability from the disease of trauma. What they need now is support-- support from policy makers, support from other health providers, and support from the community.

The first step is to build, to the extent permitted by law, a national base of advocacy for implementation of enabling legislation and dedication of funding for the completion of the Trauma Systems Planning and Development Act of 1990. Finalizing this effort, which began years ago, will not only serve the thousands of Americans who are injured in single incidents across the nation on a daily basis, but will also add greatly to the readiness of the nation for future potential mass casualty situations.

This is an urgent call for action. When it comes to trauma, time is truly a life and death matter.

V. GLOSSARY

bypass - transport of an EMS patient past a normally used EMS receiving facility to a designated medical facility for the purpose of accessing more readily available or appropriate medical care

citizen access - the act of requesting emergency assistance for a specific event

communications system - a collection of individual communication networks, a transmission system, relay stations, and control and base stations capable of interconnection and interoperation that are designed to form an integral whole. The individual components must serve a common purpose, be technically compatible, employ common procedures, respond to control, and operate in unison.

Critical Access Hospital (CAH)– a rural limited service hospital that has been converted to a special designation as a Critical Access Hospital under the Medicare Rural Hospital Flexibility Grant Program. The majority of CAHs are in Health Professional Shortage Areas and/or Medically Underserved Areas.

designation - formal recognition of hospitals as providers of specialized services to meet the needs of the severely injured patient; usually involves a contractual relationship and is based on adherence to standards

disaster - any occurrence that causes damage, ecological destruction, loss of human lives, or deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community area

dispatch - coordination of emergency resources in response to a specific event

emergency medical services for children (EMS-C) - an arrangement of personnel, facilities and equipment for the effective and coordinated delivery of emergency health services to infants and children that is fully integrated within the emergency medical system of which it is a part

emergency medical services system (EMS) - a system that provides for the arrangement of personnel, facilities, and equipment for the effective and coordinated delivery of health care services in appropriate geographical areas under emergency conditions

field categorization (classification) - a medical emergency classification procedure for patients that is applicable under conditions encountered at the site of a medical emergency

inclusive trauma care system - a trauma care system that incorporates every health care facility in a community in a system in order to provide a continuum of services for all injured persons who require care in an acute care facility; in such a system, the injured patient's needs are matched to the appropriate hospital resources

injury - the result of an act that damages, harms, or hurts; unintentional or intentional damage to the body resulting from acute exposure to thermal, mechanical, electrical or chemical energy or from the absence of such essentials as heat or oxygen

injury control - the scientific approach to injury that includes analysis, data acquisition, identification of problem injuries in high risk groups, option analysis and implementing and evaluating countermeasures

injury prevention - efforts to forestall or prevent events that might result in injuries

injury rate - a statistical measure describing the number of injuries expected to occur in a defined number of people (usually 100,000) within a defined period (usually 1 year). Used as an expression of the relative risk of different injuries or groups

lead agency - an organization that serves as the focal point for program development on the local, regional or state level

major trauma - that subset of injuries that encompasses the patient with or at risk for the most severe or critical types of injury and therefore requires a systems approach in order to save life and limb

mechanism of injury - the source of forces that produce mechanical deformations and physiologic responses that cause an anatomic lesion or functional change in humans

medical control - physician direction over prehospital activities to ensure efficient and proficient trauma triage, transportation, and care, as well as ongoing quality management morbidity - the relative incidence of disease

mortality rate - the proportion of deaths to population

off-line medical direction - the establishment and monitoring of all medical components of an EMS system, including protocols, standing orders, education programs, and the quality and delivery of on-line control

on-line medical direction - immediate medical direction to prehospital personnel in remote locations (also know as direct medical control) provided by a physician or an authorized communications resource person under the direction of a physician

overtriage - directing patients to trauma centers when they do not need such specialized care. Overtriage occurs because of incorrect identification of patients as having severe injuries when retrospective analysis indicates minor injuries.

protocols - standards for EMS practice in a variety of situations within the EMS system

quality improvement - a method of evaluating and improving processes of patient care which emphasizes a multidisciplinary approach to problem solving, and focuses not on individuals, but systems of patient care which might be the cause of variations

quality management - a broad term which encompasses both quality assurance and quality improvement, describing a program of evaluating the quality of care using a variety of methodologies and techniques

regionalization - the identification of available resources within a given geographic area, and coordination of services to meet the needs of a specific group of patients

rehabilitation - services that seek to return a trauma patent to the fullest physical, psychological, social, vocational, and educational level of functioning of which he or she is capable, consistent with physiological or anatomical impairments and environmental limitations

response time - the time lapse between when an emergency response unit is dispatched and arrives at the scene of the emergency

risk factor - a characteristic that has been statistically demonstrated to be associated with (although not necessarily the direct cause of) a particular injury. Risk factors can be used for targeting preventative efforts at groups who may be particularly in danger of injury.

rural - those areas not designated as metropolitan statistical areas (MSAs)

service area (catchment area) - that geographic area defined by the local EMS agency in its trauma care system plan as the area served by a designated trauma center

specialty care facility - an acute care facility that provides specialized services and specially trained personnel to care for a specific portion of the injured population, such as pediatric, burn injury, or spinal cord injury patients

surveillance - the ongoing and systematic collection, analysis, and interpretation of health data in the process of describing and monitoring a health event

trauma - a term derived from the Greek for “wound”; it refers to any bodily injury (see injury)

trauma care system - an organized approach to treating patients with acute injuries; it provides dedicated (available 24 hours a day) personnel, facilities, and equipment for effective and coordinated trauma care in an appropriate geographical region

Trauma Care Systems Planning and Development Act of 1990 - The law that amended the Public Health Service Act to add Title XII - Trauma Programs. The purpose of the legislation is to assist State governments in developing, implementing and improving regional systems of trauma care, and to fund research and demonstration projects to improve rural EMS and trauma
trauma center - a specialized hospital facility distinguished by the immediate availability of specialized surgeons, physician specialists, anesthesiologists, nurses, and resuscitation and life support equipment on a 24 hour basis to care for severely injured patients or those at risk for severe injury

trauma registry - a collection of data on patients who receive hospital care for certain types of injuries. Such data are primarily designed to ensure quality trauma care and outcomes in individual institutions and trauma systems, but have the secondary purpose of providing useful data for the surveillance of injury morbidity and mortality

trauma team - the multidisciplinary group of professionals who have been designated to collectively render care for trauma patients in a particular trauma care system

triage - the process of sorting injured patients on the basis of the actual or perceived degree of injury and assigning them to the most effective and efficient regional care resources, in order to insure optimal care and the best chance of survival

triage criteria - measures or methods of assessing the severity of a person's injuries that are used for patient evaluation, especially in the prehospital setting, and that use anatomic and physiologic considerations-and mechanism of injury

uncompensated care - care for which no reimbursement is made

undertriage - directing fewer patients to trauma centers than is warranted because of incorrect identification of patients as having minor injuries when retrospective analysis indicates severe injuries

9-1-1 - a three-digit telephone number to facilitate the reporting of an incident or situation requiring response by a public safety agency

enhanced 9-1-1 - a telephone system that includes automatic number identification, automatic location identification, and (optimally) selective routing, to facilitate appropriate public safety response

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VII. APPENDICES

Appendix A - Summary of Recommendations

Appendix B - Historical Overview of Trauma Systems Development

Appendix C - Trauma System Chronology Chart

Appendix D - List of Trauma System Vision Steering Committee Members

Appendix A - SUMMARY OF RECOMMENDATIONS

Fundamental Components of Trauma Care

Injury Prevention

- Each State will have a core injury prevention program that provides assistance to local areas, with information and materials coordinated via a central repository or clearinghouse.

- Trauma registry data will help with problem identification and program evaluation and will be fully coordinated with the EMS and public health systems.

- A comprehensive study of the epidemiology of injuries and trauma will be conducted and predictive models regarding injury occurrence will be developed.

- Injury prevention legislation will be enacted, where compelling evidence exists.

- Injury prevention efforts will be conducted on a collaborative basis, with input from and the involvement of multiple stakeholders and constituency groups.

- Injury prevention will be recognized as a legitimate public and governmental activity, similar to other safety programs such as fire prevention. Proper funding will be secured for injury prevention, with a greater portion of public health dollars allocated for injury prevention.

- Injury prevention efforts will be seen as a legitimate health care cost that is directly reimbursable to providers.

- Injury prevention programs, and their availability to the general public, will be required by lead agencies who designate all levels of trauma centers and by the public health systems.

- Injury prevention will be integrated into existing health delivery systems, such as pediatric and rural health clinics, and prevention materials will be readily available at places where families usually receive care.

Prehospital Care

- EMS and first responders will be more integrated within the health care system, with links to prevention and acute care, and will be more focused on promoting overall community health, as described more fully in the EMS Agenda for the Future.

- Trauma care will be coordinated and integrated using standard protocols and triage. Triage criteria will be redesigned to ensure more accurate assessment, which facilitates direction and placement of patients to the most appropriate care setting.

- Transport vehicles (air and ground) will be strategically placed rather than facility based and will be used appropriately to facilitate rapid access and response, especially in areas that are least accessible.

- A national 911 system, covering both wireless and wireline telephone systems, will be developed and implemented, with standard, seamless protocols that are evidence-based and that address bystander interface. Access to prehospital trauma care in rural areas will be greatly enhanced through development of consistent standards and more efficient deployment of limited resources.

- Enhanced communications among all components of the trauma care team during the pre-hospital phase will speed deployment of resources, produce more appropriate triaging, and result in better patient outcomes.

Acute Care Facilities

- There will be a distributed system of acute care facilities and trauma care systems will be implemented across the country.

- Research will be conducted to determine the effectiveness of the current tiered resource allocation guidelines.

- The appropriate volume of patients with specific injuries that are needed at the highest echelon of care will be studied and clearly identified so that research and treatment options can be continually explored.

- Trauma systems will be linked on a regional basis through databases and technology to ensure efficient and effective patient care nationwide.

- There will be consistent standards for rural and urban trauma services, with the goal of every community having access to a consistent level of trauma care.

- All injury care providers within a community will be recognized as part of the system and will provide data to a system-wide database, and injury care will be monitored throughout the system.

- Most facilities, whether small community hospitals or large tertiary care centers, will have a designated role to play in the trauma system and the capacity to manage injured patients to one degree or another.

- Facilities in the system will have multi-casualty capabilities.

- The appropriate match of resources will be identified for injured patients with special needs, such as elderly, remote rural, or pediatric patients.

- Innovative treatment methods will be explored, including utilization of mobile trauma units for rural areas.

Post-Hospital Care

- Long-term care coverage will be available, affordable, and encouraged to help address post-hospital care needs.

- Post-hospital care will focus on helping patients achieve greater independence, a higher degree of functionality, and a faster return to productivity.

- Functional recovery will go beyond traditional rehabilitation and include psychological support.

- Home-based care and monitoring will be used to manage costs and speed recovery, especially in areas lacking access to care.

- Appropriate support groups will be established and encouraged.

- Trauma Registry data will include post-hospital care and rehabilitation so that the value and cost-effectiveness of the full cycle of trauma care can be more readily assessed.

- Research concerning the effectiveness of post hospital care will be supported.

Comprehensive Trauma Care System: Key Infrastructure Elements

Leadership

- A National Trauma System Leadership Council will be developed to advocate for system development in a facilitative manner, serve as the locus for policy development and support, and coordinate the work of federal agencies and professional organizations with injury-related programs.

- All states will establish a Lead Agency to coordinate and administer trauma system development.

- A best practices study will be conducted to identify the optimal components and configuration for local and state lead agencies.

- The effectiveness of trauma system elements will be continually examined.

- State legislators and governors will be informed about the need for an identified and adequately funded lead agency for trauma systems in their region.

Professional Resources

- Professional resources in the system will be patient focused, team-oriented and physician led.

- New categories of providers and the use of physician extenders will address the need for additional resources.

- Creative opportunities for recruitment and retention of personnel will be explored.

- Reimbursement for all types of providers will be appropriate and sufficient so as to encourage participation in trauma care.

- Incentives for attracting trauma specialization, including addressing the burden of liability, will be explored.

- Ongoing professional education opportunities will be available and accessible.

- Volunteers will supplement career resources and will be enlisted to promote injury prevention as well as deliver care.

Education and Advocacy

- A compelling educational campaign will be launched to position trauma and injury as a disease rather than a random occurrence and to increase public awareness of the need for injury prevention and the value of trauma care.

- Targeted educational programs will be developed to inform policy makers about the value of community-based trauma care in order to promote passage of legislation to support trauma system activities, including injury prevention.

- Trauma care providers and advocates will form or integrate into coalitions with trade associations, large corporations (such as Johnson and Johnson's work with the *Safe Kids* campaign) and payers to conduct public education programs about injury and injury prevention and to advocate for legislation to support injury prevention and trauma system activities.

- Health insurers will have a clear appreciation of the cost effectiveness of injury prevention and will provide incentives for safe behavior.

- Communication, education, and training approaches for the public and key constituency groups will be thoroughly coordinated yet distinctly segmented and targeted to achieve maximum impact.

- The number of injuries and trauma cases will be reduced through education and training of clinicians, management and administrative personnel, volunteers, community support groups, potential “bystanders,” and other key constituency groups.

- Trauma and injury prevention education and training will be increased for all healthcare professionals, beginning at post-graduate levels and continuing throughout their careers, appropriate to the level of their involvement in health risk assessment, primary care, or injury care.

- Advocacy efforts will facilitate passage of new laws designed to reduce injuries and trauma cases (based on evidence) and stronger enforcement of existing laws.

- Tort reform will be enacted to facilitate greater access to trauma services and facilities.

- There will increased awareness of the vulnerability of the older population.

Information Management

- A national database and uniform data standards will be used to facilitate hospital operations and provide regional and national information regarding availability of post-hospital care.

- Trauma care will be designated as a specific research area for epidemiological study. Predictive models will be developed regarding outcomes and will be used in making funding and resource deployment decisions.

- Pre-hospital and functional outcomes will be tracked and used in a Total Quality Management initiative to improve policies, procedures, and processes throughout the trauma continuum.

- Information related to the complete cycle of trauma—from prevention to post-hospital care—will be collected, analyzed, and made available to facilitate improvements in injury prevention, response times, patient care, and rehabilitation.

- Information systems should be usable for multi-center studies.

- A standardized training course will be used to enable trauma registrars to collect and categorize data in a consistent, comparable manner.

- Clear evidence will exist to document the contribution of an injury management system (prevention and treatment) to a community's overall health, and additional research will demonstrate which components of a trauma system provide the most value.

- Tools will be developed and region-specific injury data will be available to assist communities in making decisions about their specific needs related to trauma system development, particularly which components will best meet community health needs.

- The culture of quality improvement will shift from using data to blame individuals to using the data to improve performance of the system.

- Access to and appropriate protection of patient records and quality improvement data will be addressed through legislative and regulatory changes at state and federal levels.

- Efforts to enhance patient confidentiality should be balanced with the need for strong research.

Finances

- Trauma systems will be recognized as a public good and therefore valued and adequately funded not only for the clinical care they actually deliver, but also for the level of readiness required to meet the needs of all injured persons.

- The appropriate level of readiness in a community will be determined by a broad-based group of community members, including citizens, local employers, trauma and health care providers, and payers.

- There will be a "rural modifier" to the Medicare fee schedule for rural EMS providers.

- There will be dedicated funding for trauma system infrastructure costs.

- An open dialogue with managed care organizations, public and private, and other payers will facilitate greater mutual understanding of the costs of providing health care, ultimately leading to equitable payment mechanisms, which may include "carve outs" or risk sharing.

- There will be ongoing dialogue and review regarding the cost-effectiveness of trauma care systems.

- A system will be created for reimbursing providers for uncompensated trauma care without cost shifting to non-governmental payers.

- The public will be encouraged to obtain long-term care coverage to augment other forms of payment for post-hospital care.

- Alternative payment mechanisms will be examined, tested, and piloted, especially in rural areas.

- Additional funding sources, such as seized drug money, will be explored.

Research

- Congress will establish a National Institute for Injury, within the National Institutes of Health.

- Federal agencies involved in or funding trauma research will be coordinated through a formal institutional process.

- There will be formal efforts to interest young professionals in trauma research and there will be sponsored training programs in all types of research.

- Types of research conducted will include fundamental basic research, crash investigation research, evidence-based medicine, best practices, clinical trials, clinical guidelines, and health services and systems research.

Technology

- Automotive telematics systems and GPS in motor vehicles will be used to locate crashes, monitor vital signs, and determine injury severity. GPS will also provide real-time route navigation for ambulances.

- Access technologies such as ACN and wireless E9-1-1 will be fully developed.

- Various technological innovations will be used to provide services remotely.

- Monitoring devices will be used in a variety of settings, including computer chip implants to monitor patients and the use of monitoring devices in a patient's home, which would support injury prevention and rapid response.

- Computer chips will enable automatic transfer of sophisticated crash information and will permit injury research databases to be utilized to evaluate and improve auto design.

- An artificial neural network will determine the most appropriate site for patient care, given the extent of a patient's injury.

- Access numbers will be consolidated to eliminate confusion and streamline access nationwide.

- Patient simulation technology will be used for provider education.

- Medical input will be sought early in the design phase of future technologies to ensure that these developments are coordinated with the health care system and result in improved patient outcome.

- Dedicated resources will be available for technology analysis.

Disaster Preparedness and Response – Conventional and Unconventional

- Trauma systems will be an integral part of regional and state disaster plans and will integrate with efforts of the public health system to provide disaster preparedness.

- Trauma and EMS systems will be integrated with other resources through the incident command system and will coordinate in advance with other regional resources such as law enforcement and public health.

- There will be targeted education covering all weapons of mass destruction (identification and response) for all providers.

- Hospital-based decontamination will be available in addition to more traditional field decontamination.

- A nationwide network of hospital and community surveillance systems will enable rapid identification of all major health threats, including those related to weapons of mass destruction. EMS electronic data systems will be an integral part of this surveillance system.

- Emergency communications systems will connect all levels of the response infrastructure, but will be developed with redundancy to assure backup when needed.

- The public health infrastructure will be reinforced to enable it to more effectively respond to emerging threats.

- Medical command centers will be an integral part of disaster incident command or incident management systems, to assure the most appropriate medical response.

- There will be an optimal resources document for the role of trauma systems in disaster preparation and response.

Appendix B - Historical Overview of Trauma System Development

The theoretical foundations of trauma care and the essential characteristics of trauma systems have been continually refined over the past 30 years. The following discussion provides a summary of system development based on the circumstances that prompted progressive development including shifts in public interest, changes in government policy, and establishment of priorities within professional associations.

The organized care of injured patients has its roots in military models of trauma care; many of the advances in caring for major trauma patients can be attributed to the lessons learned during past military conflicts. During World War II, well-developed triage systems were instituted and wounded soldiers were evacuated through tiers of increasingly capable medical care. Throughout the Korean and Vietnam wars, the time from injury to definitive treatment was sharply reduced by transporting patients with serious injuries directly to acute care field military hospitals that delivered immediate, organized trauma care. Although the principles learned during wartime were not automatically or easily implemented at home, the military's success in dealing with severe injuries led to heightened public expectations about trauma care and provided an impetus for the development of trauma systems.

The first defacto trauma centers were municipal hospitals in major urban areas that mostly provided emergency services to the uninsured. Because these hospitals were usually affiliated with medical schools, injured patients received timely treatment from in-house staff officers while these staff members gained expertise in dealing with injuries. This concentration of expertise and the early development of centers of excellence for trauma care contrasted sharply with the care in suburban hospitals in the same geographic area, which did not have a similar systematic response for injured patients.

Community and public education regarding the status of EMS and trauma care peaked in 1966 with the publication of the classic National Research Council/National Academy of Sciences white paper Accidental Death and Disability: the Neglected Disease of Modern Society."[1] This landmark document reflected the gross deficiencies in prehospital care and proposed a long range plan for changes in every facet of emergency care. This farsighted report provided the basic blueprint and building blocks for subsequent improvements in EMS programs nationwide but fell somewhat short in describing the need for systems of care. Congress responded to publication of this white paper by enacting both the National Traffic and Motor Vehicle Safety Act and the Highway Safety Act of 1966, which summoned a national commitment to reducing injuries on the nation's highways. The Department of Transportation was empowered to set motor vehicle standards, fund research and programs that promoted highway safety, provide leadership for the development of regional EMS systems, and develop standards for EMS provider training. States were required to include EMS as part of their highway safety programs. Several prototype emergency medical systems were developed under the auspices of this funding that identified the essential characteristics of regional trauma systems and provided the first indications that implementation of such systems saved lives[14-16]. The unique design of an early system, the Illinois Trauma Program, which incorporated both urban and rural areas, utilized a controlled systems approach that profoundly influenced future trauma system development[17]. Based on this original legislation from 30 years ago, the National Highway Traffic Safety Administration (NHTSA) continues to develop and implement EMS programs and other traffic safety programs today.

The EMS Systems Act of 1973 was perhaps the single most important piece of legislation affecting the development of regional emergency and trauma care systems. The Act called for the creation of a lead agency under the Department of Health, Education and Welfare and identified 15 components (one being trauma systems) to assist system planners in establishing areawide or regional EMS programs. At that time, regionalizing services was viewed as one way of distributing resources more equitably while expanding access to health care systems. A substantial amount of federal funds were devoted to the establishment of an EMS infrastructure in over 300 EMS regions nationwide. A primary failure of the Act, however, was its inability to adequately stimulate initiatives to continually fund EMS at the local level.

In 1981, funding sharply declined when the Omnibus Budget Reconciliation Act altered the method of allocating federal EMS funds. EMS and trauma system funding was consolidated into the state preventive health block grant program. The purpose of the block grant concept was to shift responsibility of funding for EMS services to the states while still providing support for lead agencies that direct EMS services. States were given wide discretion regarding the use of health funds; many regional EMS management programs lost funding and were dismantled due to this change, while others responded by increasing their involvement in EMS system development. At the same time, several pivotal studies highlighted the relationship between untoward patient outcomes and lack of surgical support or delays in caring for injured patients, which drew public attention and accelerated progress towards systems development in some areas[18-21].

In 1984, Congress authorized the Emergency Medical Services for Children (EMS-C) Program to support state-of-the-art emergency medical care for injured children and adolescents. Although the program focused on the entire continuum of pediatric emergency services, the intent was to ensure that pediatric services were fully integrated into trauma systems. In addition, the National Pediatric Trauma Registry was established in 1985 to study the causes, circumstances and consequences of injuries to children.

In 1986, the National Research Council and the Institute of Medicine conducted a 20 year follow-up analysis of advancements made since the 1966 white paper focused the nation's attention on EMS. Although the authors of "Injury in America: A Continuing Health Care Problem" concluded that considerable funding and effort had been utilized to develop systems of care, little progress actually had been made towards reducing the burden of injury[2]. A conceptual pathway for the field of injury control was introduced in this report that called for a major investment in research related to the epidemiology of injury and development of parallel prevention programs. The committee successfully advocated for the creation of a new injury research center to lead national efforts in injury control and establish research programs related to all aspects of injury including prevention, pre-hospital care, acute care, and rehabilitation. The Centers for Disease Control (CDC) was chosen as the site for this new center because of the CDC's strong relationship to state health departments and emphasis on research rather than regulation. Today, this program continues to fund trauma related research and support the growth of Injury Control Research Centers across the US.

1988, the NHTSA provided additional requisite resources for trauma system development and evaluation through establishment of the Statewide Technical Assessment Program and the Development of Trauma Systems course. The technical assessment team approach has been used by states to assess the effectiveness of individual EMS system components, as well as the

interrelationship of these components in producing a comprehensive system[22]. The Development of Trauma Systems course provided states and regions with a detailed tool for system development that was tailored to their individual needs[23].

The Trauma Care Systems Planning and Development Act of 1990, which created Title XII of the Public Health Service Act (PHSA), was enacted to improve emergency medical services and trauma care. From 1992-1994, funds were appropriated to carry out the responsibilities specified in this Act and administered by HRSA. The program was not funded in FY95. Under this program, a model trauma care system plan to use in trauma system development was written by a consensus panel of experts.[8] Many states were making significant progress[25] when Congress failed to reauthorize resources for the program in 1995. It was funded again in FY2001 and 2002. Title XII of the PHSA is responsible for improving trauma and emergency medical care through system improvement. This goal is accomplished through: (1) a grant program available to State EMS offices to improve the trauma care component of the EMS plan; (2) a grant program to improve rural EMS care; and (3) discretionary activities including research, evaluation, and grants for special EMS/trauma initiatives.

In the midst of these changes in federal policy and funding, professional health care associations have also provided guidance for trauma system development. The American College of Surgeons Committee on Trauma (ASCOT) made substantial contributions to the conceptual framework of trauma care systems by advocating for a network of trauma centers with verified capabilities. ASCOT assumed the mantle of leadership in 1976 by identifying the key characteristics for categorization of hospitals as trauma centers in the first edition of their publication, "Optimal Resources for Care of the Seriously Injured".[5] Through successive revisions, this document became recognized as the standard for trauma hospital performance. In 1987, ASCOT developed an external review program to verify hospital capabilities, which provided further incentives for the designation of trauma centers. Recently, ASCOT published a multidisciplinary work group document entitled, "Consultation for Trauma Systems," which provides guidelines for evaluating trauma system development and making system enhancements[10]. In addition, the American College of Emergency Physicians (ACEP) published "Guidelines for Trauma Care Systems," which provided a detailed description of critical prehospital care components in a trauma system[6].

In 1999, the Institute of Medicine (IOM), with support from several private foundations, published its third assessment of the public and private response to injury. The report provided evidence of significant advances in trauma system development but also highlighted the profound gap between the current investment in system development and the magnitude of the injury problem[4]. The group recommended additional funding for surveillance, research, training and program evaluation by federal agencies.

Recent events have even further accelerated the momentum for the development of a nationwide trauma system. The Skamania Conference held in July 1998 reviewed the medical literature to quantify current understandings of trauma system effectiveness and proposed a plan for research in trauma. Participants included representatives of many different specialties in addition to trauma experts. A key recommendation from this conference was to use a national consensus process involving a spectrum of national committees and organizations interested in trauma care and prevention to design a vision document describing a trauma system for the future, including current status, a future vision, and an implementation strategy based on valid, reliable data. The

Skamania Conference also recommended renewed federal funding for trauma system development.

Appendix C - Trauma Systems Chronology

1913	National Safety Council established.
1922	American College of Surgeons establishes Committee on Treatment of Fractures (later became Committee on Trauma).
1966	National Academy of Sciences, National Research Council publishes "Accidental Death and Disability: The Neglected Disease of Modern Society." Landmark document identifies injury as a national health care problem.
1966	Highway Safety Act establishes the EMS Program in the Dept. of Transportation. First national commitment to reducing injuries and deaths on highways.
1968	American Trauma Society established.
1973	Emergency Medical Services Systems (EMSS) Act provides federal guidelines and funding for development of regional EMS systems. Trauma systems identified as one of 15 essential components of EMS systems.
1976	American College of Surgeons Committee on Trauma publishes "Optimal Hospital Resources for Care of Injured Patient," which identifies three tiers of trauma center commitment.
1981	Omnibus Budget Reconciliation Act consolidates EMS funding into state preventive block grants; EMSS Act funding eliminated.
1984	Congress authorizes the EMS-C Program to address pediatric injury.
1985	National Research Council and Institute of Medicine publish "Injury in America: A Continuing Public Health Problem," which recognizes the field of injury control as linking prevention, acute care, and rehabilitation.
1986	Injury Prevention Act (followed by Injury Control Act of 1990) establishes Division of Injury Epidemiology and Control at Centers for Disease Control (elevated to National Center for Injury Prevention and Control in 1992) to provide leadership for a spectrum of injury-related public health activities.
1987	American College of Emergency Physicians publishes "Guidelines for Trauma Care Systems" that identifies essential criteria for trauma care systems, especially prehospital care components.
1988	National Highway Traffic Safety Administration establishes the Statewide EMS Technical Assessment program and Development of Trauma Systems course.
1990	Trauma Systems Planning and Development Act creates Division of Trauma and EMS (DTEMS) within the Department of Health and Human Services.
1990	American College of Surgeons Committee on Trauma publishes *revised* guidelines as " Resources for Optimal Care of the Injured Patient," changing focus from trauma centers to trauma systems.
1992	Position paper from Third National Injury Control Conference (CDC) first addresses concept of "inclusive" trauma systems.
1992	DTEMS publishes Model Trauma Care System Plan to aid states in development of inclusive

	regional trauma care systems.
1999	Institute of Medicine publishes "Reducing the Burden of Injury," which calls for greater national commitment to trauma care systems at all levels.
1999	American College of Surgeons publishes "Consultation for Trauma Systems" to facilitate objective evaluations of trauma systems.
2000	Trauma System Planning & Development Reauthorized and Funded.

Appendix D – Trauma Vision Steering Committee

David B. Hoyt, M.D., FACS
Brent Eastman, M.D., FACS
Thomas J, Esposito, M.D., MPH, FACS
Richard J. Mullins, M.D., FACS
Norman McSwain, Jr., M.D., FACS
Herbert G. Garrison, M.D., MPH
Richard Hunt, M.D., FACEP
Robert Bass, M.D., FACEP
Ellen J. MacKenzie, PhD.
Jorie Klein, R.N.
Jay Goldman, M.D.
David Yoon, M.D.
Arthur Cooper, M.D., FACS, FAAP, FCCM
John Sacra, M.D., FACEP
Gail F. Cooper
Maurine Goehring, RN, MSN
Marc A. Levison, M.D.
Dennis Berens
COL Chris Kaufman, M.D.
Harry Teter, Jr.

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