Trauma System Consultation
State of Arizona
Phoenix, Arizona

June 26th – 29th, 2007
American College of Surgeons
Committee on Trauma

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Trauma System Consultation
Arizona State Department of Health
Bureau of Emergency Medical Services and Trauma System

ACS COT Trauma System Consultation

Phoenix, Arizona
June 26-29, 2007

Methodology

The Bureau of EMS and Trauma System (BEMSTS) of the Arizona State Department of Health Services requested this trauma system consultation, which was conducted under the auspices of the American College of Surgeons, Trauma System Consultation program (TSC). The multidisciplinary site visit team (SVT) consisted of: two trauma / general surgeons, one emergency medicine physician, one former and one current state EMS director, a trauma program manager, a data specialist, a rural trauma and prehospital specialist, and a public health administrator. Biographical sketches for the team are included as Appendix A of this report.

Prior to the visit, the SVT reviewed the ACS Pre-Review Questionnaire (PRQ) completed by EMS staff. The format of this report correlates with the components outlined in the ACS Trauma Systems Consultation document. The SVT also reviewed a number of supporting documents provided by the EMS Bureau.

The SVT convened in Phoenix, Arizona on June 26-29, 2007, to review the state of Arizona Trauma System. The meetings during the three day visit consisted of plenary sessions during which the SVT engaged in interactive dialogue with a broad range of representative trauma system participants. There was also an opportunity for informal discussion with the stakeholders and time devoted to questions and answers. During the survey, the SVT also met in sequestered sessions for more detailed reviews and discussion, for the purpose of developing a team consensus on the various issues and recommendations involved in the survey.

Overview

The primary objective on this ACS trauma systems consultation is to guide and help promote a sustainable effort in the graduated development of an inclusive system of trauma care for the State of Arizona.

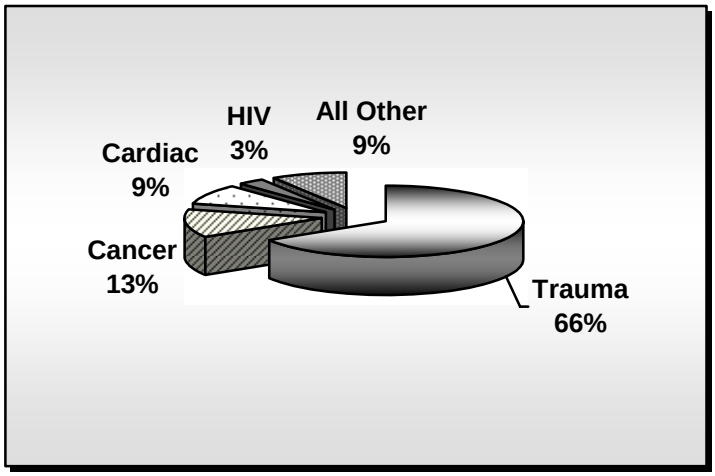

Figure 1: Leading Causes of Death in Arizona, Ages 1-44, 1999-2002. (CDC/NCIPC)

The "perfect storm" of emergency and trauma care exists in Arizona today. In the setting of an expanding population, an increasing number of elderly patients, an underserved American Indian population, and large numbers of undocumented persons, Arizona leads the U.S. in emergency department overcrowding, has a fragmented trauma care system, has challenges with sub-specialist coverage, and has insufficient attention being paid to injured children.

Arizona recognizes the enormity of the injury problem in the state. It is estimated that 3,200 deaths occur each year within the state. As there is not an inclusive trauma system in place, the preventable trauma mortality rate may be as high as 10%; this would mean that 320 trauma patients die each year that could have been saved if there was a fully functional inclusive trauma care system in place.

Arizona, fondly known as the "Valentine State" and the "Grand Canyon State", is the 9th largest state in the U.S with 6.2 million people living within its 113,642 square miles. Three quarters of the population live in two of the fifteen counties. Arizona recently replaced Nevada as the fastest growing population in the U.S. (3.6% per year). Arizona has the third largest American Indian population, exceeded only by Oklahoma and California.

American Indians, who constitute 5% of the population of Arizona (with 63% living on reservations), suffer disproportionately from trauma. Trauma is the leading cause of death for individuals age one through 54 for this group versus age 1 through 44 for the remainder of Arizona's residents. The reasons for this disparity are several; these include: the rural/remote location of their homes, the disproportion of alcohol-related injuries, and the incomplete physician staffing at some of the IHS hospitals. On a

positive note, the Navajo Nation has a trauma system plan under development, including trauma system consultation.

Minimally injured patients in Arizona receive high-quality medical care throughout the state and severely injured patients receive care that is among the best in the U.S. when they arrive at trauma centers. Several significant problems remain:

1. It may take several hours for an injured patient to get to a Level I trauma center (because of rural access issues, trauma center bypass issues, and the distance/time relationship).
2. Patients who are initially determined to have moderate injuries, may instead have undetected severe injuries and succumb to these injuries at the local acute care (non-trauma center) hospital. [undertriage]
3. Conversely, some patients are being transported for Level I trauma center care (or just those needing a CT scan) at great expense, who do not need this level of care. [overtriage]

The current state trauma registry data is not adequate to evaluate trauma care in the prehospital setting, trauma care in acute care facilities (other than trauma centers), timeliness of trauma care, and undertriage / overtriage rates.

Designation of Level II, III, and IV trauma centers, to work in concert with other participating hospitals and the existing Level I trauma centers, is needed to develop an inclusive trauma system for all residents of Arizona.

The SVT sensed a palpable commitment to development of an inclusive trauma system for Arizona among the many stakeholders present. Many of the difficult pieces of the inclusive trauma system “puzzle” are in place. However, most do not connect to adjacent pieces at this time. With the current cooperation of the Level I trauma centers within the Arizona Trauma and Acute Care Consortium, the potential exists (with linkages) to truly capture the extent of the trauma problem in Arizona and craft the trauma system to concurrently optimize patient care and efficiency throughout the state. Trauma system development in Arizona has a bright future, although the challenges of time and distance remain substantial.

Current Status

In 1979, Arizona Emergency Medical Services (AEMS) categorized trauma centers in the central region. This took place in a competitive atmosphere.
AEMS also developed a regional trauma registry in 1986 using hospital-submitted MTOS data. The State underwent a NHTSA EMS consultation in 1990. In 1993, HB 2208 created a trauma system task force to report on trauma system development in Arizona. That same year, Arizona was awarded a Health Resources and Services Administration grant of $88,200 for trauma system planning and development.

The following year, 1994, brought more progress in Arizona's trauma system development. HB 2077 established the State Trauma Advisory Board (STAB) and the trauma registry, required Arizona Department of Health Services (ADHS) to establish trauma center standards for quality assurance, and provided for confidentiality of information used for quality review. Also in that year, Cales and Associates installed a state trauma registry, although some of these data are no longer available. The inaugural meeting of STAB was in September 1994.

Flagstaff Medical Center became the trauma center for Northern Arizona in 1995. In 1996, SB 1060 mandated appropriation of $250,000/year from BEMSTS' operating fund for trauma system development and STAB operating expenses. During the years 1997-1999, the Abaris Group consulted for the State Trauma System. In 1999, the Arizona trauma system plan was released. The Arizona State EMS and Trauma System Plan was adopted by ADHS in 2002.

Proposition 202 was passed by the voters in 2002 and created the Trauma and Emergency Services Fund from Indian gaming revenues to distribute to Level I trauma centers.

In 2004, HB 2197 amended the Arizona Revised Statutes (A.R.S.) § 36-2222 for STAB to remain involved with the development and implementation of the trauma system. American Indian representation was added to STAB membership. HB 2197 also amended A.R.S. § 36-2225 by establishing authority for ADHS to develop and administer the Statewide EMS and Trauma System and adopt rules to establish standards.

In 2005, SB 1134 authorized ADHS to use a national organization for verification of trauma centers and requires trauma centers to submit data to the state trauma registry. Trauma center standards and rules for designation and de-designation were adopted that year.

The State Trauma Registry has a full-time manager and has records for 22,264 trauma patients in 2005. Data are currently submitted by the seven Level I trauma centers and three non-designated facilities. Arizona has no designated Level II, III, or IV trauma centers.

Resources & Advantages/Assets

- Leadership and advocacy for developing a statewide inclusive trauma system within the State Department of Health Services including the EMS Bureau Chief, Deputy Director and the Director of the Department of Health Services
- Leadership and advocacy for developing a statewide inclusive trauma system among Level I trauma center medical directors, program managers, and hospital administration
- Continuing commitment of the Level I facilities from prevention to research to quality improvement

- Authorizing legislation naming the ADHS as the lead agency
- Rulemaking processes in place for trauma center designation
- Dedicated funding stream for Level I trauma centers to partially compensate for costs associated with provision of trauma care
- Nationally recognized trauma system development expertise within the State bureau, physician, nursing, and administration
- Recognition by stakeholders that they need to move the system forward to its next level of integration
- Injury Prevention and Control Statewide planning and intervention program / an inclusive injury prevention program
- Recent leadership change in the state BEMSTS

Challenges

The following were among the challenges to the implementation of a state-wide inclusive trauma system:

- Building capacity as necessary to meet the needs of the injured patient in rural areas of the state with designation of Level II, III, and IV trauma centers
- Developing a prehospital data system compliant with NEMSIS
- Increased funding at the regional level for coordination and oversight
- Recent leadership change in the state BEMSTS
- Considerable regional variation within the state
- Limited enforcement and oversight of the system at the state or regional level
- Vast rural and remote desert areas without any medical care resources
- Rural recruitment and retention of emergency medical personnel (EMTs, physicians, and nurses)
- Timely transfer from rural facilities especially from tribal lands
- Current exclusive system structure
- Limited staffing resources at the state and regional level
- Integration of disaster planning efforts with trauma system infrastructure

Opportunities for Change

- The right timing for system change and to develop and implement a more inclusive trauma system with system wide quality improvement (QI) protection and comprehensive evaluation
- Use of the current data system (trauma registry and other data bases) with addition or linkage to prehospital data to drive policy decisions
- Participation and designation of Level II, III, and IV trauma centers with implementation of transfer agreements can be encouraged
- Expansion of the current state data system to all hospitals and prehospital providers in alignment with National data sets
- Development of a prehospital data system

Key Recommendations

The following are the key recommendations from each component of the trauma system. This is a summary only, and does not include all the recommendations or explanatory language which may be found in the body of the report.

Leadership

- Establish and fund a trauma medical director position to work under the guidance of the Bureau Chief.

Legislation

- Develop guidelines for system quality/performance improvement to ensure that they are conducted in a manner that maximizes protections afforded in existing statutes (e.g., 36-2404 and 36-2403).
- Amend state statutes to model an integrated systems approach to development and implementation of an inclusive trauma system.

Finance

- Develop and implement a standardized system of financial accountability for EMS Regions, prehospital providers, and trauma centers, integrating the public health concepts of assessment, policy development, and assurance.

Injury Prevention & Control

- Establish methods to effectively evaluate injury prevention programs.

Prehospital Care

Emergency Medical Services Management Agency

- Increase the FTE allocation for the state EMS medical director and secure a position for the state trauma medical director.

Ambulance and Non-Ambulance

- Establish regulatory oversight by the state of non-transporting units.

Emergency/Disaster Preparedness Plan

- Provide prehospital training utilizing an all-hazards approach such as provided by the AMA's Basic and Advanced Disaster Life Support Courses.

Definitive Care Facilities

Trauma Care Facilities

- All hospitals should be designated as trauma centers or participating hospitals as part of a statewide inclusive trauma care system.

Information Systems

- The Arizona state trauma registry should expand its reach to include all acute care hospitals in the state.

Research

- Develop a statewide trauma research consortium, linked to the activities and functions of the STAB and AZTQ, for purposes of promoting research throughout the continuum of trauma care.

Leadership

Purpose

There should be a trauma system lead agency with an identified key person. The lead agency will usually be a government agency with the authority, responsibility, and resources to lead the development, operations, and evaluation of the trauma system. The statutes, regulations, policies, or guidelines should direct that the lead agency will:

- *Ensure the integration of the EMS system, including all prehospital components*
- *Coordinate system design*
- *Establish minimum standards for system performance and patient care*
- *Create a Trauma System Advisory Committee that is composed of prehospital personnel, hospital personnel, rehabilitation personnel, payors, consumers, and public interest groups. This committee should serve to guide system planning activities, define system criteria (number of centers, volume), recommend system standards (triage, timelines), and review system performance*
- *Have sufficient staffing, including a trauma system coordinator experienced in trauma system development and implementation*
- *Identify the key person in the lead agency*

The trauma system should have a strong role for a trauma physician(s) as an integral part of its leadership component. This physician, Trauma Medical Director, should be qualified to participate in the planning of the trauma system, work with the lead agency, be incorporated into the system, and be responsible for design and implementation of the trauma system, medical accountability, and ensuring an appropriate medical response to the trauma patient.

CURRENT STATUS

The Arizona Department of Health Services (ADHS) has statewide authority over the development of emergency medical services (EMS) and trauma systems. Various Arizona statutes, which passed from 1993 through 2004, designate ADHS as the lead agency for EMS and trauma systems. These statutes are administered through the agency's Bureau of EMS and Trauma Systems (BEMSTS). ADHS roles include the following:

- Injury prevention
- Public access to EMS
- Trauma center verification and designation
- Trauma registry
- Trauma system evaluation
- Confidentiality of patient care and trauma registry information

Leadership in Arizona begins with the current Director of the Department of Health Services, Ms. Susan Gerard. As a respected former state legislator that served in both the House and Senate, she is poised to direct implementation of the trauma initiatives she helped enact. Additionally, she serves as a valuable resource for future efforts to improve the trauma system, particularly in legislative endeavors.

Arizona is fortunate to have a number of nationally recognized leaders in trauma system development. The new Bureau Chief, Terry Mullins, has an extensive background in EMS and Trauma systems. Dr. Scott Petersen has served the American College of Surgeon (ACS) as a state Committee on Trauma (COT) Chair and Regional Chief, and is recognized as a national expert on trauma centers and systems.

The BEMSTS consists of 38 full-time staff positions; five are dedicated to trauma – Program Administrator, Program Coordinator, Surveyor, Registrar, and Administrative Assistant. Two additional positions within the BEMSTS contribute to the trauma program – Bureau Chief and Bureau Medical Director. The Bureau Chief is administratively responsible for the trauma program, emergency medical services, certificate of need, and enforcement. The Bureau Medical Director has comprehensive advisory responsibilities for emergency medical services and serves as Chair of the State Trauma Advisory Board and the Arizona EMS Council. No trauma medical director position has been established.

The BEMSTS works cooperatively with two statutorily authorized groups – the Arizona EMS Council (AEMSC) and the State Trauma Advisory Board (STAB). Both are multidisciplinary groups with many members serving on each. AEMSC consists of 31 members and STAB, 21 members. Members of the STAB are appointed to 3 year staggered terms by the ADHS director. Subcommittees of the STAB are authorized by statute. The STAB has created a quality subcommittee, the Arizona Trauma System Quality Assurance and System Improvement Committee (AZTQ). Duties of the STAB include the following:

- Recommendations regarding processes necessary for trauma center verification and designation, including trauma center criteria
- Recommendations regarding regional EMS and trauma system plans
- Recommendations regarding quality improvement processes for EMS and trauma systems, and
- Annual reporting of accomplishments to the agency director

Additional ADHS support resources available to the BEMSTS include Public Health Statistics, Emergency Preparedness and Response, and Women and Children's Health Bureaus and Office.

The four local, 501(c)(3) EMS coordinating organizations supported via contract by BEMSTS are Central Arizona EMS (AEMS), Northern Arizona EMS (NAEMS), Southeastern Arizona EMS (SAEMS), and Western Arizona EMS (WACEMS) councils. Each organization is governed by a public multidisciplinary council with broad authority to develop guidelines for local systems for EMS and Trauma activity. Funding is provided through these contracts for annual support of each council and their programs. These contracts have limited requirements from the State regarding trauma program expectations. The majority of regional activities involve prehospital emergency medical care. Specific trauma system activities are left to the discretion of each regional council. As a result, few trauma-related common denominators exist.

RECOMMENDATIONS

- **Establish and fund a trauma medical director position to work under the guidance of the Bureau Chief.**
- Reevaluate the disparity between EMS and trauma system staffing within BEMSTS.

Purpose

The trauma system lead agency should have a defined planning process for trauma system development that addresses:

- *Identifying trauma care resources, including resource deficits within the defined area of the trauma system*
- *Developing and implementing trauma care plans and systematically reviewing plans over time*
- *Including health professionals, consumer groups, and payors in trauma system planning*
- *Approving the trauma system plan*
- *Establishing, reviewing, and revising trauma system standards of care, including policies, procedures, and protocols for both the prehospital and hospital personnel*
- *Analyzing the financial impact of developing and implementing the trauma system.*

The trauma system should be integrated with the EMS system and should include a mechanism to interface with and incorporate other EMS plans, such as disaster and mass casualty. It should also have a mechanism to integrate managed care entities in the area.

CURRENT STATUS

ADHS published a trauma plan in 2002 titled *Arizona Emergency Medical Services and Trauma System Plan.* The plan was based on existing national standards and with input from various stakeholder groups within the state. Also, two legislatively authorized groups, the AEMSC and the STAB, contributed to the production of the plan. This plan has not been revised since its publication. However, the BEMSTS conducted a needs assessment for both EMS and trauma in 2005 as a precursor to the plan's revision. The assessment was conducted with a survey tool developed by the state and was completed in cooperation with existing regional EMS councils. Although survey information was shared among the councils and posted on the agency website, the ADHS has not yet used the information to augment its efforts to develop a statewide trauma system. While some trauma system components have been implemented (for example, trauma center designation criteria and trauma registry), ADHS has not

developed processes necessary to implement specific components of the trauma plan. As currently written, the plan is non-binding, and there are no mandated statewide operational trauma policies. Therefore, the goals and objectives outlined within the plan cannot be routinely evaluated. The components are not integrated to provide a "systems approach". Staff has completed a state system analysis using the *HRSA Model Trauma System Plan- Benchmark, Indicators and Strategies* (BIS) tool. The results of those two assessments provide a solid foundation for the continuing evolution of the trauma plan.

The Arizona State Trauma Plan is supported by EMS and trauma-related statutes and rules. While these regulations are comprehensive for EMS, they are limited for trauma, focusing mostly on criteria and processes associated with trauma center designation and trauma registry data. State regulations provide for designations of trauma centers at, Levels I, II, III, and IV. To date, however, only 7 of 90 in-state hospitals have applied for, and been formally designated by ADHS, all of these hospitals are designated as Level I. One Level I trauma center, the Maricopa Medical Center dba Maricopa Integrated Health System, also functions as the state's only designated burn center. Other hospitals have not sought trauma center designation as Levels II, III, or IV, due to the lack of available incentives. Although funding mechanisms are in place, restrictions on funding mandated by the Arizona Legislature provide funding only for Level I trauma centers. As a result, the ***inclusive*** vision articulated in the intent of the Arizona plan has been hindered by the ***exclusive*** nature of the available funding.

To help achieve the inclusive intent of the trauma system, BEMSTS has developed a contractual relationship with four geographic regions for EMS and trauma. The contracts primarily provide a legal conduit for funding regional activities. Few deliverables to ADHS have been included. Each region is governed by a multidisciplinary council and has broad authority to develop local systems for EMS and trauma care. Because the ADHS plan serves predominantly as a guideline, regions are free to develop and implement independent trauma system components. For instance, the Arizona EMS for Children program is working to affect the triage and treatment of pediatric patients through guidelines which may be implemented through regional protocols. But like the plan, there is no assurance that these guidelines will be followed or adopted in all regions. Regions vary significantly in program accomplishments. Most regional efforts have been directed toward improving prehospital care through training of EMS personnel and grants for purchasing EMS equipment. However, ADHS's attempt to integrate its trauma program within the EMS system utilizing regional EMS councils is noteworthy.

BEMSTS participates in mass casualty and disaster response systems planning. Working with the Bureau of Emergency Preparedness and Response (BEPR), efforts to integrate the developing trauma system into Arizona emergency preparedness are ongoing. As an example, BEPR has provided a grant to link the state's only burn center to other hospitals agreeing to treat burn patients for the first 72 hours following a disaster.

RECOMMENDATIONS

- Engage the STAB in the completion of the evaluation process of the Trauma System using the framework and tools contained in the HRSA Model Trauma System Planning and Evaluation document.
    - Conduct a trauma system needs assessment and gap analysis using the Benchmark, Indicators and Scoring tool and process,
    - Conduct in person interviews with senior hospital administrative and medical staff to assess the interest in trauma center designation among non-participating and/or non-designated Arizona hospitals.
    - Develop a working document to project the potential number and location of additional trauma centers by level.
    - See response to Focus Question #1
- Develop a new comprehensive inclusive, state Trauma System Plan that includes a minimum of:
    - Goals, measurable objectives, and strategies.
    - Timelines for implementing trauma system goals and objectives.
    - Assign responsibilities to advisory committees and staff.
- Revise regional contracts to include specific trauma program requirements which support the objectives outlined in the Arizona Trauma System Plan.
- Annually evaluate and report the status of EMS and trauma system development at regional and state levels.
- Tie trauma system compliance by EMS agencies and providers to the issuance of operational licenses and funding eligibility.
- Through the acute care hospital and critical access hospital licensure process, require participation in the state trauma registry at appropriate levels.

Legislation

Purpose

- *Comprehensive legislation is essential for trauma system development. The creation of statutes and regulations to develop the trauma system sets in place the necessary legal authority to move forward without concerns about anti-trust issues. Comprehensive statutes and regulations can provide for the process of planning, implementing, and funding the trauma system. Key provisions in trauma legislation include the ability to work through constituency groups to:*

- *Develop a comprehensive trauma system plan*

- *Integrate the trauma program with the existing EMS system*

- *Incorporate prevention programs and activities*

- *Establish or adopt guidelines for the prehospital, acute hospital, and the rehabilitation phases of trauma care*

- *Collect data and evaluate system performance*

- *Provide for confidentiality of trauma records, reports, and quality of care reviews*

- *Establish authority to designate trauma centers*

- *Provide authority for the inter/intrastate and international planning and implementation of trauma systems, without regard to jurisdictional boundaries.*

Additionally, trauma legislation should include a dedicated funding mechanism and an administrative structure for trauma management and should ensure fiscal support for all components of the system, including the legal authority to ensure that third-party payment is coordinated within the trauma system.

CURRENT STATUS

Trauma program authority has been designated by the Arizona Legislature to the ADHS. This legislation (passed between 1993 and 2004) provides authority for ADHS as the lead agency for trauma system development. The statutes grant authority for most components that are necessary for statewide trauma system development, i.e. trauma system planning, EMS integration, injury prevention, trauma center designation, trauma registry, trauma system evaluation, confidentiality of patient care information and trauma registry information, and funding. However, since the legislation was

passed over a period of years, it does not always lend itself to a fully integrated system approach to EMS and trauma system development.

The regulations necessary for the development of a statewide trauma system are not comprehensive. Regulations and standards developed by ADHS to date primarily address trauma center designation and trauma registry data. Guidelines for treatment of the trauma patient from injury through rehabilitation have not been developed. In contrast, state regulations and standards for EMS are extensive.

The strongest trauma system components addressed in Arizona statutes concern trauma center designation, trauma registry and funding.

Although most are not controlled by ADHS, multiple sources of funding are available to support some of the trauma system, i.e. the Medical Enhancement Fund, Trauma and Emergency Services Fund, the Tobacco Tax and Healthcare Fund. These sources currently provide state and regional support for trauma system development. Additionally, Level I trauma centers receive substantial financial support for trauma center readiness costs and uncompensated care. Other potential trauma centers (Levels II, III, and IV) are not eligible for similar support of readiness costs or reimbursement for uncompensated care.

RECOMMENDATIONS

- Provide stable funding for all levels of trauma center designation and participation. (See Focus Question #1)
- **Develop guidelines for system quality/performance improvement to ensure that they are conducted in a manner that maximizes protections afforded in existing statutes (e.g., 36-2404 and 36-2403).**
- **Amend state statutes to model an integrated systems approach to development and implementation of an inclusive trauma system.**
    - Clarify the authority granted to ADHS in A.R.S. § 36-2225 to develop and implement such a system. Consider evaluation of this with the state Attorney General's Office.
    - Seek passage of amended legislation where gaps are identified.
- Seek liability limits or exemption for appropriate physicians rendering trauma care in a designated trauma center. (note arbitrate as a trade off for total tort reform)
- Seek Legislative authority to coordinate all sources of trauma system funding through ADHS/BEMSTS.

Finances

Purpose

Evaluating the health of a trauma system's finances is still in its early development stages. This section outlines generally accepted business financial principles that are used as baseline.

At all levels of evolution, the trauma system should demonstrate through its trauma system lead agency financial accountability. This accountability should first include lead agency reporting of financial stability. Second, the lead agency should show the development of routine financial reporting by component, which reflects the financial health of the system. Trauma system components include system management, prehospital, trauma facilities, acute care, rehabilitation, and prevention programs. The lead agency should have established the following processes:

Lead Agency Financial Accountability

- *A standardized model accounting report that lists costs and is used consistently with standardized definitions throughout the system*
- *A process to develop, review, approve, and monitor expenditures and revenues by line item*
- *A process to develop, review, approve, and monitor each component's costs over time*
- *A process that allows the trauma system financial costs to reflect its relationship to the trauma plan outcome measures*
- *A process for maintaining at least two years of audited financial records that meet accepted financial accounting principles*
- *A process to audit the financial health of the trauma system over time*

Component Financial Accountability

- *A process that defines how trauma centers integrate alternative delivery systems (payor systems) into the trauma program*
- *A process that defines how rehabilitation centers integrate alternative delivery systems (payor systems) into the trauma program*

- *A process that defines the incremental component costs associated with trauma system participation*

Overall, the lead agency financial component should be integrated with other existing plans of the emergency medical service system to include, but not be limited to, disaster, prehospital, trauma facilities, acute care, rehabilitation, and prevention programs.

CURRENT STATUS

The sources of trauma funding in Arizona are the Medical Enhancement Fund, the Trauma and Emergency Services Fund, and the Tobacco Tax and Healthcare fund. Arizona trauma legislation provides funding for the BEMSTS' trauma program ($392,000 annually). This funding is provided from the Arizona EMS Operating Fund which is part of the Medical Enhancement Fund. Appearing as a line item within the ADHS budget, these funds are used for state-level support of the BEMSTS. An additional ≈ $22 million is available annually from the Trauma and Emergency Services Fund which is administered by Arizona Health Care Cost Containment System (AHCCCS). The AHCCCS (Arizona Medicaid) funds support Level I trauma centers (trauma readiness and uncompensated care costs) and emergency department costs in both trauma centers and non-trauma centers. 90% of this fund is allocated to Level I trauma centers; 10% is distributed to hospitals to offset uncompensated care rendered in the emergency room. No funds are authorized for other trauma center levels beyond what they might capture as their share of the 10% for emergency departments. All funding is subject to annual appropriation by the Arizona State Legislature. The Legislature appropriated an additional $2 million during its 2006 session specifically for the University Medical Center in Tucson. A federal HRSA EMS for Children grant provides support for data collection efforts in Arizona. The four regions each receive an annual allocation ($144,000) by contract from BEMSTS.

To date, the Tobacco Tax Fund of approximately $29 million has been appropriated by the State Legislature to support the Arizona Medical Assistance program (Medicaid).

As a state agency, ADHS, BEMSTS, is monitored as part of governmental processes. ADHS reviews its budget quarterly. These reviews allow the lead agency to track the budget against actual expenditures and variances. Funding to trauma centers, non-trauma centers, and regions is not audited. Trauma centers do provide the lead agency with information regarding trauma center charges through the trauma registry and hospital discharge databases. Based on information provided by the Arizona Hospital and Healthcare Association, ADHS, has collected information on primary and secondary payor mix utilization. This financial information, while limited, indicates the major categories as follows for 2006: Medicaid (29%), commercial (28%), and self-pay (25%). Medicare is surprisingly low at 6%. This information was derived from hospitals designated at Level I and from those voluntarily participating in the trauma registry. As a result, the true payor mix related to trauma care for Arizona is unknown.

While hospitals do report discharge data, which contains primary payor mix information, ADHS has not trended the financial information contained in the trauma registry. Trauma centers submit a trauma funding report to AHCCCS annually. These reports document trauma center program costs and patient outcome information. There are no trauma system financial reports completed by, or made available to, the lead agency. Because there are no trauma system operational requirements, costs associated with trauma system operations are unknown. No information concerning the use of dedicated trauma center funds from individual trauma centers was provided to the review team.

RECOMMENDATIONS

- **Develop and implement a standardized system of financial accountability for EMS Regions, prehospital providers, and trauma centers, integrating the public health concepts of assessment, policy development, and assurance.**
- Tie money to deliverables and the deliverables to the plan.
- Through the trauma registry and hospital discharge databases, annually trend financial information in an effort to document Arizona trauma care costs. Use this information for support of expanded trauma system funding.
- Consider alternate methods of distribution of the Tobacco Tax to provide for trauma system support as intended.
- Develop limits commensurate with trauma center level for readiness cost and uncompensated care to maximize trauma funding.
- Investigate the future use of telephone service surcharges for training standards appropriate for EMS, fire and law enforcement dispatchers (telecommunication law).
- Identify funding mechanisms to support the cost of readiness and uncompensated care at all levels of trauma center designation.

Injury Prevention and Control

Purpose

A comprehensive injury control system includes prevention and rehabilitation in addition to acute care. The ultimate goal of an organized trauma care system is to prevent injuries, just as the ultimate goal of medicine is to prevent disease. Consequently, the trauma care system should participate in the establishment of a system-wide injury control coalition (SICC). One form is an IPC or injury prevention center. Composed of members from public and private sectors interested in prevention activities, this coalition will create prevention partnerships to reduce fragmentation and intensify community interventions.

- *Jointly with the SICC, a plan to promote injury control should be developed and implemented that will:*

  a) *Heighten awareness of injury as a public health problem*

  b) *Educate elected officials and the public about the need for trauma care systems and injury control to promote the passage and implementation of legislation aimed at reducing injury*

  c) *Educate the public about current trauma system development*

  d) *Educate the public about how to safely approach an injury scene, access the trauma care system, and provide assistance to the injured person until professional help arrives*

  e) *Involve public/voluntary organizations to aid system financing*

  f) *Conduct injury surveillance*

  g) *Develop a system-wide consensus approach to injury control interventions using needs assessment and intervention evaluation*

  h) *Communicate key trauma prevention strategies.*

- *The trauma care system should do a needs assessment to identify priority injury problems (including identification of high-risk groups and environmental factors)*

- *With the support of the trauma care system, the SICC should develop and implement priority injury control interventions that follow the injury control plan*

- *The SICC should carry out a public information program that follows the injury control plan*

- *The SICC should evaluate the success of injury control interventions. Outcome evaluations using trauma system data are preferable*

- *The SICC should integrate the potential of an organized entity to promote prevention activities within the system.*

CURRENT STATUS

The trauma system has a statewide injury control coalition called the Injury Prevention Advisory Council (IPAC). The membership of this council is inclusive of numerous injury prevention organizations representing the continuum of trauma care, ADHS personnel and trauma hospital representatives. The Council is under the auspices of the Department of Health, Division of Public Health Services, Office of Women's and Children's Health. This reporting structure appears to be working well, and the Council is integrated into the Trauma System. The invitation to participate in this Council has been extended to a wide variety of organizations, and the meetings are open. There is an Injury Prevention Program Manager with experience and expertise in injury prevention activities. The Program Manager is facilitating growth and development of the statewide injury prevention initiatives. The Manager is also a valuable resource to the trauma hospitals.

There is an impressive and comprehensive *Injury Surveillance and Prevention Plan for the State of Arizona: 2006 – 2010* in which data from multiple credible sources were used. Trauma Registry data were not available at the time this report was written. ADHS has a five year cooperative agreement with the CDC to continue with the implementation of the plan. The Council members and trauma hospitals stated their commitment to implementing the initiatives as outlined in the strategic plan.

The Injury Prevention Coalition has not yet participated in efforts to provide education to elected officials. The Coalition has provided an educational event focusing on the differences between education, advocacy, and lobbying to ensure that officials are informed in an appropriate manner. IPAC developed fact sheets on trauma for distribution by IPAC members to various target audiences.

Some of the trauma hospitals have participated in efforts to educate their local elected officials on issues pertaining to injury prevention. In some communities, leaders have been invited to participate in local injury prevention events such as occupant protection campaigns and anti-DUI activities. Community forums to provide public education on injury prevention have not occurred on a wide-spread or systematic basis.

Financial support for injury prevention programs has been provided through a variety of resources, including some regional support. The Level I trauma centers provide funding for injury prevention staff and activities in accordance with ACS guidelines.

The Level I trauma centers are in various phases of implementing the screening and brief intervention (SBI) programs as required by the ACS. The Injury Prevention Coalition has identified alcohol and drug prevention programs as one of their priorities. The Coalition is encouraging hospital based SBI programs to expand beyond the trauma patient population. Indian Health Service (IHS) has received funding to implement SBI programs in the facilities they operate.

Although sporadic, some of the Level I trauma centers have interfaced with law enforcement and the Courts for their injury prevention programs such as the "Wake Up" program. Confidentiality challenges were noted by some stakeholders.

RECOMMENDATIONS

- **Establish methods to effectively evaluate injury prevention programs.**
- Seek opportunities for funding sources to support injury prevention activities.
- Develop web-based injury prevention resources for the public, injury prevention organizations and trauma hospital personnel.
- Review the injury prevention strategic plan on an annual basis and update/revise as needed.
- Develop and implement injury awareness programs for the public, media and elected officials.
- Provide education to the trauma centers in all aspects of injury prevention, e.g., data analysis, strategic planning, resource identification, program implementation, and evaluation.

Purpose

The trauma system should have a distinct process for evaluating the adequacy of human resources available (within and outside the hospitals) to support normal system activity. The process should:

- *Match resources with patient needs*
- *Define the optimal number and type of prehospital personnel and resources to be available to care for trauma patients*
- *Define the optimal number and type of hospital personnel and resources to be available to care for patients in all areas of the hospital*
- *Address periodic reevaluation of resources through an initial needs assessment and identification of trauma care work force resources and matching resources to patient care*
- *Determine a plan for dynamic flexible response for optimal management of patients during peak periods of activity that stress the system (both prehospital and hospital resources should be included in the plan)*
- *Address recruitment and retention of qualified personnel*
- *Identify current numbers of certified prehospital personnel and their level of certification*
- *Identify current hospital personnel resources, including physicians and their specialties, nurses, and other health care personnel*
- *Evaluate resources and personnel in trauma specialty care units for pediatric, burn, spinal cord, head injury, and rehabilitation centers*
- *Identify the number and severity of injured patients cared for by hospitals and individual surgeons*
- *Assess the impact of system operations on existing levels of professional resources within the community, including limited physician specialists, such as neurosurgeons, orthopedic surgeons, anesthesiologists, and so on*

- *Identify the number and severity of injured patients cared for by emergency physicians.*

CURRENT STATUS

The BEMSTS conducts an *Annual EMS and Trauma System Assessment Survey*. The Regional Councils were responsible for distributing and reporting the data from their EMS providers and health care institutions. The survey includes minimal focus on trauma center and trauma system resources.

Hospital-based human resources are evaluated by each trauma hospital, the Arizona Hospital Association, The Coalition for AZ RN Education, and the Emergency Medical Services Access Task Force. This task force was convened following an Executive Order from the Governor to assess ED and trauma center physician supply and determine recommendations. The members of this task force did not include Trauma Center or trauma surgical representation.

There has been a formal effort to clarify and formalize the manner and scope of the use of prehospital human resources to help augment acute care hospital ED staffing. This guideline document outlining the authority for EMT's to work in hospitals, could potentially be beneficial to rural understaffed facilities.

Trauma hospitals are reportedly facing challenges with surgical subspecialty coverage (e.g., hand and plastic surgery). Various solutions are being discussed between and among the regions and trauma hospitals. MOU's have been developed between several the Phoenix area trauma hospitals. These MOU's address resource and staffing needs in surge/multiple/mass casualty and internal disaster situations.

Recruitment and retention for prehospital care providers in rural areas is reported to be a challenge. To date, it was reported that the most successful strategies have been community-based training of local residents. Other efforts include financial support for training of providers and recognition of the National Registry Certification for the initial reciprocity of out-of-state prehospital providers. The BEMSTS has supported these efforts by distributing recruitment and retention materials.

Local and regional EMS programs and hospitals have their own quality management programs for monitoring human resources. The BEMSTS does not have a quality management plan in place for monitoring staffing patterns and resource utilization across the trauma system.

The BEMSTS reports that their staffing for the trauma program is adequate at the present time. Should additional staffing be required as the trauma system develops/matures, additional staffing will require additional FTE and funding appropriations.

RECOMMENDATIONS

- Ensure that trauma center staff and other trauma system providers are represented in forums / councils for statewide resource and work force issues.
- Develop strategies to optimize the utilization of specialty services.
- Develop a strategic plan to address work force issues for all personnel essential to the trauma system (hospital, rehabilitation, prehospital, dispatch).
- Revise the annual survey to ensure that the information needs of the trauma system are addressed.
- Develop a personnel management plan in collaboration with the regions to evaluate resources and work force issues.
- Monitor current staffing pattern in the BEMSTS trauma program and anticipate increased needs.

Education

Purpose

The trauma system should have adequate education for all levels of trauma care personnel, both hospital and prehospital. The trauma plan should address:

- *Standards for the credentials, educational preparation, certifications, and continuing education requirements (including injury prevention and control) for all personnel*
- *Incorporation of injury control information in educational standards for all trauma care personnel*
- *Quality management monitoring of courses and instructors*
- *Processes for state credentialing, certification, recertification, and decertification of trauma care personnel*
- *An organized needs assessment prior to developing new or additional educational activities.*

CURRENT STATUS

There are standards in place for training, credentialing and continuing education for prehospital personnel and at Level I trauma centers. Prehospital care providers are certified through the BEMSTS. Credentialing requirements and ongoing trauma education activities for the Level I trauma centers are reviewed as part of the ACS VRC site survey process. Injury prevention is not a significant component of the credentialing and continuing educational requirements.

Trauma training for professionals is available throughout the state. Many of the trauma educational programs are multidisciplinary such as the Advanced Trauma Life Support (ATLS), Advanced Trauma Care for Nurses (ATCN), Trauma Nurse Core Curriculum (TNCC), the Rural Trauma Team Development Course (RTTDC), grand rounds, seminars and conferences. Quality management of these educational programs occurs through the oversight organizations, e.g., American College of Surgeons (ACS) ATLS Subcommittee, Society of Trauma Nurses (STN)-ATCN Committee.

The ACS' RTTDC has been delivered 16 times. Based on the number of courses offered to date (16), the scheduled courses (6), and the commitment of the medical director and faculty, this program is a valuable component of the trauma system.

The Arizona Trauma and Acute Care Consortium (AZTrACC) also provides trauma education such as state trauma rounds to all trauma care providers. The trauma grand rounds use teleconferencing capabilities in order to address travel and logistical issues. CME and CE are offered for these events. The AZTrACC also has a website. Plans for the website include posting a current and comprehensive list of trauma educational opportunities.

There are numerous multidisciplinary conferences offered throughout the State. In the Southern region, the Southern Arizona Trauma Network has an 18 year history of offering a multidisciplinary trauma conference. Registration has reached greater than 800 trauma care providers annually.

The University Medical Center recently hosted a one-day injury prevention seminar that was well attended. The seminar addressed the educational needs of Level I Trauma Center injury prevention personnel. The ADHS' Injury Prevention Program Manager conducted a state-wide seminar for injury prevention.

There is no formal training process for educating local prehospital administrative medical directors or base hospital physicians.

To date, there has not been an organized needs assessment regarding trauma education. Some new trauma education activities have been implemented / offered based on an observed/perceived need such as the need for injury prevention training.

Prehospital Education

Prehospital trauma training and education include trauma components in the NHTSA National Education Standards. Base hospitals / trauma centers provide trauma education to their prehospital providers through case reviews.

Nursing Education

Numerous ATCN and Trauma Nurse Core Curriculum (TNCC) courses are offered statewide. Each of these courses reaches maximum registration and most classes have a waiting list. Demand for these courses remains high due to the staff turn-over rates.

Physician Education

Five of the Level I trauma centers offer ATLS courses for a total of 18 courses conducted in Arizona on an annual basis.

RECOMMENDATIONS

- Implement strategies, including the use of FLEX grant funding, to sustain and expand the ACS' Rural Trauma Team Development Course, e.g., provide train-the-trainer sessions, increase the pool of instructors, seek grant opportunities for provider and instructor training.
- Expand web-based and teleconferencing capabilities to deliver trauma education to all trauma care providers.
- Perform an annual / routine trauma system educational needs assessment.
- Include injury prevention education as one component for credentialing and ongoing educational requirements for trauma care providers.
- Develop or promote educational programs for prehospital administrative medical directors.

Emergency Medical Services Management Agency

Purpose

Each system should identify an agency that is ultimately responsible for prehospital care.

The administration of this agency should include:

- *A medical director familiar with, experienced in, and currently involved in prehospital care*
- *A medical director whose qualifications are commensurate with his/her scope of responsibility in the EMS system*
- *Quality improvement education and monitoring functions performed by the medical director or designee*
- *Sufficient support staff, including a system administrator experienced in prehospital management*

Educational programs should include:

- *Trauma education integrated with the prehospital training program*
- *Continuing education tied to the quality improvement system*

Criteria evaluated by the agency should include:

- *Triage, patient delivery decisions, treatment, and transfer protocols integrated with the EMS and trauma system*
- *Ongoing quality improvement of triage/treatment/transfer criteria*
- *Policies, procedures, and/or regulations regarding on-line and off-line medical direction*

Certification to provide patient care by the agency should be based on standardized written and practical examinations given at regular intervals.

A system-wide quality improvement program should be established by the lead agency.

CURRENT STATUS

The ADHS, BEMSTS has the authority to regulate prehospital care. There are four EMS Regional Councils, 84 BLS and/or ALS ground ambulance services, and 13 air ambulance services. There are 45 ALS Base Hospitals providing online medical oversight. The Tribal Reservations and Indian Health Service (which serve >45,000 sq. miles within the state and a population of >400,000) manage their own EMS systems.

Dr. Bentley Bobrow is the current state EMS Medical Director (0.4 FTE). He is a board certified emergency physician actively practicing at Mayo Hospital. He has a strong background in EMS and serves as administrative medical director for Scottsdale Fire Department.

EMS quality improvement programs are accomplished at the local level with minimal guidance from the BEMSTS. Initial trauma education follows the National Registry guidelines for certification for each level. Continuing trauma education is dependent on the four EMS Regions, the Level I trauma centers and the individual EMS systems. Pediatric and geriatric trauma continuing education is ill defined.

Protocols are in place for triage, transport and patient care, with pediatric protocols recently updated and adult protocols last updated in 1995. The Bureau plans to update the adult protocols this year. There are no statewide quality improvement activities. However, it is thought that the Regions, hospitals and most prehospital agencies have quality improvement programs in place.

Rules are in place for administrative medical direction that specify physician qualifications and delegation of responsibilities. The rules also outline the responsibilities for EMT monitoring, evaluation, ongoing education, record keeping, and withdrawal or reinstatement an EMT's administrative medical direction. Administrative medical direction is provided to the individual EMT not the prehospital agency. This allows the EMT to practice at various locations across the state while maintaining the same administrative medical director.

Online medical direction is generally provided by the Base Hospital or other receiving facility. A.R.S. § 36-2206 does provide civil liability protection coverage for licensed physicians who provide instruction to EMTs at emergency scenes. It is unclear that liability coverage for activities as an administrative medical director is provided by the State. The number and identity of the administrative medical directors across the state is unknown, however the Bureau is in the process of obtaining this information. No process is in place to evaluate an administrative medical director's performance.

EMTs are required to successfully complete the National Registry written and practical exam for initial certification. Recertification requirements can be met utilizing National Registry recertification or via continuing education requirements specified by the BEMSTS. First Responders must maintain National Registry certification.

RECOMMENDATIONS

- **Increase the FTE allocation for the state EMS medical director and secure a position for the state trauma medical director.**
- Solidify qualifications and duties of the local agency and base hospital administrative medical director.
- Specify minimum medical oversight training requirements for local agency and base hospital administrative medical directors, including web-based training for rural physicians.
- Confirm that volunteer administrative medical directors have liability coverage.
- Require mandatory reporting of local quality improvement process to the BEMSTS.
- Once all administrative medical directors in the state are identified, develop a listserv to provide timely delivery of information pertinent to medical directors and develop a forum for topic discussion.
- Develop and sustain specific and ongoing prehospital educational opportunities for pediatric and geriatric trauma.

Ambulance and Non-Transporting Medical Unit Guidelines

Purpose

Each system should establish guidelines for non-transporting medical units (for example, quick response units) and for ground and air transportation that consider regulations, medical control, geographic boundaries, and topography.

- *Personnel should, at a minimum, be trained and certified/licensed at the EMT-basic level and should have off-line medical direction. On-line medical direction should be available.*

- *Safe, reliable ambulance transportation, whether by ground, air, or water, is a critical component of an effective system. The type of transport should be matched to the system's topography and demography. Distribution of ambulances should facilitate appropriate and timely emergency response for the trauma patient.*

- *Standards, policies, or procedures governing hospital destination must be in place.*

- *Protocols concerning the mode of transport of the trauma patient (air or ground) should exist. The method of coordination between air and ground and procedures for rendezvous should be specified by protocol. These protocols should be carefully coordinated between the emergency medical services system and the trauma system.*

- *Protocols should exist concerning the interface between transporting and non-transporting units.*

- *A process for ambulance certification/licensing and decertification must be in place to ensure that vehicles and services meet minimum standards, including the minimum equipment recommended by the American College of Surgeons and/or state lead agencies.*

- *Mutual aid agreements must be in place among emergency medical services providers to provide adequate ambulance coverage when resources within a system have been exhausted.*

- *There must be interagency agreements with public safety agencies (for example, police and fire) that address security and safety of the injury scene.*

Medical Non-Transporting Unit Guidelines

- A process for medical non-transporting unit (for example, quick response units, rescue units providing a medical response, and so on) certification/licensing and decertification must be in place to ensure that vehicles and services meet minimum standards.

- Personnel should, as a minimum, be trained and certified/licensed at the first-responder level and should have off-line medical direction.

- Protocols should exist concerning the interface between transporting and non-transporting units.

- There should be a placement strategy for non-transporting medical units to ensure they are located in areas where ambulance response may be delayed.

- There should be written agreements between non-transporting and transporting units clarifying, among other things, when non-transporting unit personnel ride with transporting units.

CURRENT STATUS

No system-wide guidelines exist that specify the type of trauma transport in relation to an area's topography and demography. The BEMSTS is in the process of developing rules that address this issue. Additionally, there is an ongoing review concerning air medical transport. However, no data are available at this time. The BEMSTS does regulate and/or license air and ground emergency medical transport. The Bureau utilizes the local population base to determine minimum prehospital staffing requirements. For a prehospital agency in an area with a population of less than 10,000, the scene response minimum staffing level is one First Responder and one Emergency Medical Technician – Basic (EMT-B). For populations over 10,000 the minimum is two EMT-Bs. The BEMSTS has also established this as the minimum staffing level for the interfacility transport of the trauma patient. However, the actual staffing of a trauma interfacility transport is generally determined by the sending and receiving facilities. Such transfers are often augmented by RN, mid-level providers or physicians who may lack formal training in critical care transport. Likewise, there is no formal training or recognition of EMS – Paramedic (EMT-P) critical care personnel.

The BEMSTS uses a Certificate of Need (CON) process to provide for appropriate response and transport times based on the needs of the local community. Minimum equipment requirements are specified by the BEMSTS and ambulances are inspected annually. Mutual aid agreements are encouraged but not required. Tribal EMS and non-transporting units are not regulated by the Bureau. The prehospital agency providing a non-transporting unit was identified as being responsible for the quality of care provided, without medical oversight provided. Few local protocols or agreements exist concerning

the interface of non-transporting units with ambulance services. Facility destination is identified as the most appropriate medical facility, which is generally the closest emergency receiving facility. The Arizona Patient Identification and Field Triage Decision Standard is a guidance document for determining when a trauma patient is to be delivered directly to a trauma center.

Prehospital systems do not have interagency agreements with public safety agencies. However, it is the general opinion that such public safety agencies do show up at the scene to assist with security and safety.

RECOMMENDATIONS

- **Establish regulatory oversight of non-transporting units.**
- Develop critical care paramedic capability to increase options for interfacility transport of the trauma patient and help preserve key facility personnel where they are scarce.
- Conduct an objective review of air transports to maximize utilization and control costs.
- Develop a ‘one call does it all’ approach for trauma transfers.
- Provide a template for out-of-hospital quality improvement activities.
- Require, non-transporting, transporting, and air medical EMS agencies to obtain prior approval of the BEMSTS, and to follow stringent guidelines pertaining to pilot testing or research projects, prior to the adoption of treatments or equipment that do not have current, demonstrable efficacy in the peer-reviewed literature.

Communications System

Purpose

Each system should develop a prehospital communications system that is fully integrated with the remainder of the EMS and emergency/disaster preparedness systems. Beginning with the universal systems access number, the communications network should provide for prioritized dispatch, postdispatch instructions, dispatch-to-ambulance communication, ambulance-to-ambulance communication, ambulance-to-hospital communication, and hospital-to-hospital communication to ensure adequate EMS system response and coordination.

- *Medical direction and dispatch should be coordinated.*
- *An EMS dispatch protocol should be utilized.*
- *A 911 or enhanced 911 system should be in place and should receive all public calls that request EMS response to trauma patients.*
- *All dispatch centers, vehicles, aircraft, and base stations should be equipped with adequate communications systems. Equipment must ensure that there are minimal geographic areas where communications cannot be established and that at least 95% of communications attempts are successful.*
- *Priority dispatch and postdispatch instruction protocols should be in place.*
- *A quality improvement program should be in place.*

CURRENT STATUS

EMS communication throughout the majority of Arizona is covered by a system of mountain-top radio networks utilizing UHF, VHF and 800 MHz. The Arizona Interagency Radio System provides interoperable communications capability for first responders (fire, police, EMS) and others responsible for public safety such as personnel from municipal, county, state, tribal, and federal agencies as well as approved non-government organizations. The *EMSystem* is a 24/7 web-based system providing facility and flight availability status (Hospital ED: open, caution, divert; Flight: available in quarter, unavailable on scene)

The respondents to the 2005 EMS and Trauma System Assessment report that 911 and 911E have wide saturation across the state. 91% of the respondents reported 911 dispatch capabilities, with approximately half utilizing priority dispatch and/or providing pre-arrival instructions. Statewide EMS dispatch protocols and/or training standards have not been developed. It was reported that roughly half of the dispatchers are

estimated to be emergency medical dispatch (EMD) certified, but knowledge of turnover rates are unknown. Most health care institution respondents reported availability of two-way communication with EMS personnel and vehicles in the field.

Radio communication dead spots reportedly exist in the majority of service areas across the state. When online medical control cannot be contacted, protocols may be utilized as standing orders. There was a consensus in the documents and testimony provided by the State and participants that day-to-day EMS communication needs are generally met by the current system but would be inadequate for a disaster response.
The Department of Public Safety has a committee dedicated to interoperability that has performed analysis and planning activities. A 700 MHz system is planned.

A statewide communications quality improvement programs is absent. Some quality improvement activities are accomplished locally.

RECOMMENDATIONS

- Establish statewide protocols and training standards for EMD (including all PSAP personnel), including the use of computer-assisted training where other avenues of training are limited.
- Encourage partnership between dispatch units that provide pre-arrival instruction and those lacking that capability.

Emergency/Disaster Preparedness Plan

Purpose

Each system should develop a prehospital emergency/disaster preparedness plan that is fully integrated with the remainder of the EMS system, local government, private sector, and acute care facilities.

- *The system should have periodic educational exercises with post exercise review.*

CURRENT STATUS

Although the BEMSTS has not adopted a prehospital emergency/disaster plan, EMS is included in the disaster response plan from the Arizona Department of Emergency Management. Prehospital agencies participate across the state in disaster response exercises. The level of participation and the extent of post-exercise review are unknown.

There is, in rule, a protocol for administration of a vaccine, immunizing agent or tuberculin skin test by an EMT Intermediate or Paramedic.

Local prehospital agencies are encouraged but not required to participate with their Local Emergency Planning Committee (LEPC).

RECOMMENDATIONS

- **Provide training for prehospital providers that incorporates an all-hazards approach such as provided by the AMA's Basic and Advanced Disaster Life Support Courses.**
- Utilize the trauma system as a template for disaster response.
- Consider requiring prehospital agencies to participate in the LEPC.

Definitive Care Facilities

Trauma Care Facilities

Purpose

Injured patients should be delivered in a timely manner to the nearest appropriate facility. Regionalization of trauma care involves participation of hospitals that have the resources necessary to provide care for injured patients. A needs assessment study will provide an inventory of available resources, both human and physical, in the area to be regionalized. Trauma systems should be "inclusive" in nature, which means that the trauma care system will:

- *Address the needs of all injured patients requiring hospitalization for injury*
- *Utilize all qualified medical resources*

The trauma system plan should integrate all facilities into an inclusive system or network of definitive care facilities to provide a spectrum of care for all injured patients.

Trauma centers

- *The trauma system lead agency should provide uniform standards for Trauma centers (The criteria established by the American College of Surgeons Committee on Trauma and the Resources document are examples.)*
- *The trauma system lead agency should determine the optimal level and number of Trauma centers, based on anticipated volume, available resources, and geography. This determination should be based on the needs assessment study. Reevaluation should be based on the quality management process plus volume and need.*

Other Trauma Care Facilities

- *The role and responsibility of other acute care facilities within the system should be defined and integrated in the evaluation process.*
- *The role and responsibility of specialty centers (pediatric, burn, spinal cord injury) should be defined and integrated in the evaluation process.*

Designation Process

- *Describe the process for selecting and designating Trauma centers.*
- *Describe the process for monitoring all treatment.*
- *Describe process for re-designation and de-designation.*
- *Describe the process for adding other centers or deleting existing centers.*

CURRENT STATUS

The trauma system in Arizona has developed over the last 20 years with the able assistance of dedicated leadership from the definitive care facilities across the state. Through consensus building and an incrementalist approach, the system has evolved to include seven Level I trauma centers. The majority of these are located in the central portion of the state corresponding to population density. These centers were established on a voluntary basis and have been designated by the state agency according to rules prescribed in administrative code (with the exception of one center which is both state designated and ACS verified).

The trauma system plan is written so that Level I, II, and III trauma centers require verification by the American College of Surgeons or a letter from ACS stating that the facility meets the state standards for a Level I, II or III trauma center. State standards are derived from the *Optimal Care of the Injured Patient (1999)* ACS standards. Level IV trauma centers will be designated by a well-defined state process. No hospital has applied as a Level II, III, or IV trauma center as of the date of this consultation visit. Re-verification is required at three-year intervals.

While there are rules which govern de-designation of trauma centers, none has been de-designated in this system. The current trauma center distribution was not based on a formal needs assessment and plan. For this reason, the distribution and level of trauma centers may not be optimal. The centers function under difficult environmental conditions including, but not limited to: high admission volumes, coverage of massive land areas with low population density, a complex patient demographic including undocumented persons, Native Americans, a disproportionate number of seasonal elderly patients, and a large number of indigent patients.

Trauma care is provided in four geographic zones (Northern, Central, Western, and Southeastern) each area being unique in its geography and challenges. The Northern Region is the largest geographic region with the largest Native American population and one Level I trauma center located in Flagstaff. The Central Region, which is most densely populated, has the majority of the trauma centers in the states and as a region. There are five Level I trauma centers in this region. In addition to managing referrals from outside of their region, they are challenged by a significant “urban” component as part of their injury demographics. The Western Region is highlighted by challenging

geography including the Grand Canyon and vast areas which lack basic health care services. Injured patients in this area access the trauma center in Flagstaff or one of the five trauma centers in the Central Region. The Southeastern Region is served by a single Level I trauma center located in Tucson. This trauma center treats a large number of undocumented persons, many of whom have just entered the U.S.

Injured children in Arizona are typically transferred to one of the three Level I trauma centers that have a Pediatric Intensive Care Unit (PICU). Phoenix Children's Hospital is said to be planning designation as a Pediatric Trauma Center.

The issue of diversion is partially addressed in Chapter 8 of the AEMS (Central Region) Protocols on Prehospital Diversion. The *EMSystem* was developed to facilitate the management of diversion in the Central Region. This web-based program is reported to provide real-time diversion status information. While this system is reportedly effective for prehospital providers, no data were reviewed demonstrating this efficacy. Furthermore, it was reported that this system is inconsequential to non-trauma acute care facilities that routinely resort to placing simultaneous calls to multiple trauma centers in hopes of achieving both a rapid and affirmative response. Moreover, the Level I trauma centers in the Northern and Southeastern Region, for all practical purposes, never divert patients by virtue of the simple fact that no other viable alternatives exist for patients within the region. Due to the heterogeneity of approach to diversion across the system, it makes sense that these practices be carefully evaluated and monitored centrally for efficacy.

In Arizona, some definitive care facilities have already devised creative, leading edge, solutions through the use of electronic tools to manage the challenges of distance, time and geography for the rural injured patient. The University of Arizona University Medical Center has been recognized for its work in telemedicine. Anecdotal experience from this program indicates that both under-triage and over-triage rates have been favorably affected and time to definitive care has been reduced. This model may well represent the future of rural trauma care in its ability to virtually extend the resources of the regional resource center and effectively regionalize care in an efficient manner. This model should continue to be investigated.

The Arizona Trauma and Acute Care Consortium (AZTrACC) is an organization conceived by the Level I trauma center directors to improve education and research pertaining to trauma patient care in Arizona. This consortium is an extremely powerful tool that can drive necessary changes and improvements in the trauma care system; it must not be overlooked by the state if an inclusive trauma care system is to be achieved in Arizona.

Arizona Level I trauma centers reported that they have large numbers of uninsured, undocumented patients. Representatives from these trauma centers estimate costs of uncompensated care at $10 -12 million for each facility, a significant burden to the individual hospitals. At the same time, Proposition 202 funding, allocated from the Indian Gaming Industry, provides a significant offset for hospitals. However, these

monies in no way fully compensate for the financial burden. This proposition, which functions under “voter protection”, allows for the subsidy to be applied only to “Level I” trauma centers, thereby creating a disincentive to other acute care facilities to become Level II, Level III and Level IV trauma centers. This singular fact may represent the most important impediment to inclusive trauma system development.

The capabilities of the remaining “non-trauma” facilities cannot be evaluated within the current system framework. Therefore, several fundamental questions cannot be answered:

- What is the total number of trauma patients being cared for across the state?
- How much trauma care is being rendered at non-designated centers?
- How does the distribution of trauma centers relate to the trauma patient volume of a given region?
- How much of the total trauma care volume is un-reimbursed?

These types of questions are important to answer in every region and must be aggregated for statewide planning. Formation of an inclusive trauma care system with trauma patient data collection from all hospitals and the prehospital setting will help answer these questions.

RECOMMENDATIONS

- **All acute care hospitals should be designated as trauma centers or participating hospitals as part of a statewide inclusive trauma care system.**
    - Mechanisms to encourage verification and designation of Level II, Level III and Level IV trauma centers should be established.
    - Use ORHP FLEX grant monies as incentive for Critical Access Hospitals to become Level IV trauma centers.
- A needs assessment, based on patient volume and geography, should be performed to determine optimal or adequate number and locations of Level I - IV trauma centers.
- The lead agency should review and revise standards for Level I-IV Trauma Centers based on the most recent ACS Optimal Resources document. (Resources for Optimal Care of the Injured Patient 2006).
- Reduce, or eliminate entirely, diversion in accordance with the recommendations contained in the IOM’s report on the Future of Emergency Care in the U.S. Healthcare System. (Hospital-Based Emergency Care: At the Breaking Point, pp. 5-6, IOM, 2006)

Interfacility Transfer

Purpose

Central to the concept of an inclusive trauma system is the provision for appropriate and expeditious transfer, when necessary, of injured patients between acute care facilities. The decision to transfer a trauma patient should be based on objectively agreed upon criteria that pertain to transfers to both higher and, where appropriate, lower levels of care. Established transfer criteria will minimize discussions about individual patient transfers and ensure optimal patient care. It is essential that the transfer agreements include provisions required under the Consolidated Omnibus Reconciliation Act (COBRA) and subsequent revisions of the Act.

Interfacility transfer is particularly important in the following situations:

- *Linkage between the urban and rural components of a trauma system*
- *patients requiring specialty facilities, such as pediatrics, burns, and spinal cord injury, or the need for further rehabilitation*
- *Movement of patients between acute care facilities and trauma centers*
- *Appropriate transfer of patients between trauma facilities*
- *Movement of patients from trauma facilities back to local communities when appropriate*

The process of transferring injured patients from acute to rehabilitation care facilities will be facilitated by establishing written transfer agreements between acute and rehabilitation care facilities in the system. The decision to transfer spinal cord injury (SCI) and traumatic brain injury (TBI) (severe/ moderate TBI) patients to rehabilitation facilities that provide specialized programs in SCI and TBI should be based on objectively agreed upon criteria.

Inherent in the transfer of any trauma patient is feedback from the receiving to the transferring facility.

- *The trauma system should ensure that interfacility transfers occur in a timely fashion commensurate with patients= clinical needs*
- *The trauma system should establish standards for the mode of transportation and qualifications of transport personnel*
- *The trauma system should have a model transfer agreement*

- *The trauma system should ensure that all interfacility transfers are based on patient needs and are in the best interest of the patient*

- *Trauma centers should have transfer agreements with rehabilitation centers that provide specialized programs in SCI and TBI*

- *Trauma centers should have transfer agreements with rehabilitation centers that provide inpatient and intensive outpatient rehabilitation for patients with diagnoses other than SCI or severe/moderate TBI, such as mild TBI, amputations, burns, or other major injuries deemed appropriate for rehabilitation*

- *The trauma system should be cognizant of the cost issues and ensure the most cost-effective strategies that are consistent with optimal care*

- *A process (CQI) to measure patient outcome as it relates to transfer should be in place.*

CURRENT STATUS

Interfacility transfer of trauma patients in Arizona is reported to be a variable process resulting in air or ground transport to a Level I trauma center. This process is not based on objectively agreed upon criteria, nor is it based on routine transfer agreements. In fact, interfacility transfer frequently amounts to the small acute care hospital calling multiple Level I trauma centers at the same time and seeing which one says "yes" first.

Transfer agreements are the exception rather than the rule in Arizona. No model transfer agreement (template) is available to hospitals. However, a transfer agreement does exist between one trauma center and a burn hospital. No data were presented to the consultation team demonstrating that transfer agreements exist between hospitals and pediatric centers, spinal cord injury centers, or more general rehabilitation centers.

Repatriation or "back triage" of trauma patients to the local communities is accomplished sporadically and without transfer agreements. An exception is the transfer agreements between Level I trauma centers and several cities in Mexico. At the point that Mexican nationals from these cities are medically stable for long distance transport, the transfer occurs.

RECOMMENDATIONS

- Develop a model transfer agreement and disseminate to all trauma centers, other acute care facilities, pediatric hospitals, spinal cord injury centers, and rehabilitation hospitals.
- Encourage implementation of transfer agreements between appropriate hospital pairs.
- Collect data at the state level that can be used to determine the appropriateness of transfers, the timeliness of transfers, and the costs associated with these transfers.

- Report these data to the regions, STAB, and hospitals.
- Use these data to ensure optimal patient care.

Medical Rehabilitation

Purpose

As an integral component of the trauma system, rehabilitation centers provide coordinated post-acute care for trauma patients who have sustained catastrophic injuries, resulting in permanent or long-standing impairments.

The trauma system should demonstrate strong linkages and transfer agreements between designated trauma centers and rehabilitation centers located in its geographic region (in or out of state).

- *The trauma system should convene a joint liaison committee to be comprised of appropriate health professionals from designated trauma centers and rehabilitation centers (for example, trauma surgeon, physician with expertise in rehabilitation, physical therapist, occupational therapist, nurse case manager, hospital administrator, and so on).*

- *Input from payors should be sought.*

- *The trauma system should ensure that the rehabilitation process begins in the acute care facility as soon as possible.*

- *To maintain clinical expertise and skills, each rehabilitation center that provides specialized programs in SCI and TBI should have a critical mass of patient volume in SCI and TBI.*

- *Each rehabilitation center that provides a specialized program in TBI should have an appropriately qualified Medical Director for TBI. It is recommended that the Medical Director of the TBI Program meet all of the following requirements: (a) have two years of experience in brain injury rehabilitation and/or completed a fellowship in brain injury, and (b) have board certification in a specialty field of medicine.*

- *Each rehabilitation center that provides inpatient and intensive outpatient rehabilitation for trauma patients should have an appropriately qualified Medical Director for Rehabilitation. It is recommended that the Medical Director of Rehabilitation meet the following requirements: (a) have two years of experience in rehabilitation and/or completed a fellowship in a rehabilitation specialty, and (b) have board certification in a specialty field of medicine.*

- *The trauma system should encourage clinical pathways for the major traumatic diagnoses that affect patients' rehabilitation outcomes.*

- *The trauma system should identify and collect, at appropriate times, the necessary data elements for analyzing patient outcomes and evaluating the effectiveness of the trauma system. Data to be collected may include:*
  - *new injury admissions per year of SCI, TBI, and dual-diagnosis patients to each rehabilitation center*
  - *indicators of patient severity, including complications (for example, ASIA classification system for SCI, Glasgow coma scale for TBI)*
  - *time between acute care and initiation of rehabilitation*
  - *acute care length of stay*
  - *length of stay at rehabilitation center*
  - *functional independence measure (FIM) score*
  - *facility or location to which patient was discharged*
  - *type of outpatient rehabilitation care received (for example, hospital-based, home, nursing home).*

- *The trauma system should have data exchange procedures that will provide feedback (for example, patient outcomes, effectiveness of delivery system, and so on) to the trauma, acute care, and rehabilitation care providers.*

- *The trauma system should conduct long-term outcome research in rehabilitation of trauma patients and provide for appropriate dissemination of research results.*

CURRENT STATUS

A comprehensive trauma system for the injured patient mandates a continuum of care that includes adequate rehabilitation facilities available throughout the state for all patients requiring inpatient rehabilitation for brain, spinal cord, or orthopedic injuries. Many of the in-patient rehabilitation facilities in the state are associated with acute care facilities. Current standards for rehabilitative care are limited to the definitive care facilities and are guided by the *ACS COT Optimal Resources for Care of the Injured Patient.* However, at this time there is little or no integration with the system as a whole. No joint liaison committee composed of clinical and administrative representatives from the trauma centers and the rehabilitation centers exists. Long term functional outcome data for injured patients are not reported in the trauma registry. Moreover, no exchange of outcome data on a statewide basis occurs.

Despite this, it is apparent from the Medical Rehabilitation Objectives outlined in the Arizona Statewide EMS and Trauma System Plan written in 2002, that there is a clear understanding of the importance of this system component and a need for future development. As stated, the objectives per that state plan include:

- Use national hospital accreditation standards and processes to identify a model for the designation of rehabilitation centers as part of the trauma center network.
- Identify the need for, and distribution of, medical rehabilitation hospitals to meet the need for post-acute trauma medical rehabilitation services.

- Integrate rehabilitation centers into the EMS and Trauma System.
- Ensure that trauma patient flow to rehabilitation facilities is based on patient need and the facility services as well as payer preference.

The issue of transfer of injured patients to rehabilitation centers on the basis of payor source is a challenge for trauma systems and centers across the United States. This challenge can only be met if the trauma system participants (trauma centers, acute care faculties and rehabilitation facilities) utilize a well-coordinated strategy to address their concerns directly with the payer, with the common goal of meeting the rehabilitative needs of the patients. In this regard, full integration of the rehabilitations centers into the trauma system can achieve optimal patient outcomes.

RECOMMENDATIONS

- Develop specific tactics through the State Trauma Advisory Board to achieve the objectives for Rehabilitation Medicine as outlined in the Arizona Trauma System Plan.
- Integrate outcome data from each rehabilitation center with State Trauma Registry to benchmark functional outcomes with the acute phase of care.
- Transfer agreements between trauma centers and rehabilitation facilities should be developed and implemented to ensure appropriate and timely transfer of the trauma patient (to optimize the potential for return to prior level of function).

Information Systems

Purpose

The ideal trauma care system has an information system which provides for the timely collection of data from all providers in the form of consistent data sets with minimum standards. The information system should be designed to provide system-wide data that allow and facilitate evaluation of the structure, process, and outcomes of the entire system, all phases of care, and their interactions. An important use of this information is to develop, implement, and influence public policy. Policies and procedures to facilitate and encourage injury surveillance and trauma care research should be developed, including:

- *System-wide plan for collection and collation of trauma care data and cost data should be encouraged*
- *Definition of minimum data sets*
- *Well-defined roles and responsibilities for agencies and institutions regarding data collection*
- *Process to evaluate the quality, timeliness, and completeness of data*
- *Process to ensure appropriate patient and provider confidentiality*
- *Data acquisition from all the appropriate sources. These can include:*

    1. *Law enforcement, crash, and incident reports*
    2. *Prehospital care reports \ run sheets*
    3. *Emergency department data*
    4. *Trauma registry*
    5. *Hospital discharge data, including rehabilitation and specialty care facility*
    6. *Medical examiner/coroner records*
    7. *Death certificates*
    8. *Payor records*

- *Attempts to benchmark outcomes against larger data sets (such as NTDB).*

CURRENT STATUS

In the past two years, the BEMSTS within the ADHS has completed a number of preliminary steps necessary to solidify statewide data collection systems for prehospital care and hospital trauma registries. The development of these two statewide data sets would complement other existing health-related information systems that are mature

and well maintained. In this section, current status of information systems and committee recommendations will be subdivided into three sections:

1. IT Structure within the Bureau of EMS and Trauma System
2. Development of a Statewide Prehospital (EMS) Database
3. Development of a Statewide Trauma Registry

Information Technology Structure within the Bureau of EMS and Trauma System

ADHS is responsible for implementing and maintaining collection systems for emergency department data, hospital discharge data and trauma registry data. Hospitals licensed in the state of Arizona are required to submit emergency department and inpatient hospital discharge data twice per year in a standardized format. Hospitals within the state that have acquired designation as a Level I trauma center are required to submit standardized trauma registry data on a quarterly-basis. The BEMSTS is beginning the process of writing rules for EMS data collection from Certificate of Need (CON) agencies with the help of several constituent consensus groups to develop the RFP process and provide guidance in the selection of data elements and definitions. The BEMSTS has dedicated substantial resources in the past two years to bolster the IT and analytic infrastructure of the Bureau. The BEMSTS structure now includes a 1.0 FTE state trauma registry manager and a 1.0 FTE biostatistician.

The BEMSTS maintains a strong working relationship with the Arizona Office of Vital Records. This relationship bolsters IT expertise and resources available to the BEMSTS for analysis of existing data and development of new data collection efforts. Robust datasets available to personnel within the BEMSTS include a statewide hospital discharge database, statewide ED discharge database, FARS, child fatality review and vital statistics datasets.

The potential exists in Arizona to utilize existing health-related datasets to augment the information contained in a state-wide or regional trauma registry. These datasets could be ”linked” with trauma registry information to support quality improvement (QI) efforts and provide researchers with information describing the entire “medical course” for each patient suffering a serious traumatic injury. Nevertheless, the ability to “link” these existing, but disparate, datasets requires specific training in probabilistic linkage. Please see the operational addendum following this section for specific information regarding probabilistic linkage.

The BEMSTS appears to be adequately staffed at present. However, as more datasets become available and are regularly populated, current levels of administrative and analytic support will become taxed. Additional investments in BEMSTS resources will become necessary to ensure that data and reports on prehospital care and emergency care for trauma patients are based upon evidence drawn from statewide datasets.

Development of a Statewide EMS Database

As mentioned, the BEMSTS is beginning the process of formulating a structure for a statewide EMS data collection system. Regional EMS Councils are currently investigating application of electronic EMS data collection software. Two regions in particular (AEMS and SAEMS) have made substantial financial and resource investments with different software vendors. However, some concerns were raised during public comment regarding vendor costs to collect EMS data. Informants indicated that some vendors are charging up to $2 per EMS report. It will be important to ensure that each software vendor utilized in the state is capable of providing a product that is compliant with the NEMSIS EMS data standard. Please see the operational addendum for additional information regarding the National EMS data standard.

Development of a Statewide Trauma Registry

The BEMSTS recently underwent a lengthy process to standardize all trauma registry data submitted by the seven Level I Trauma Centers and other non-designated hospitals that wish to participate in data collection. A standardized state trauma registry data dictionary has just been released. Early attempts to aggregate clean and report these data appear promising. A state trauma registry report for 2005 was recently published and final cleaning is complete for the 2006 data.

The BEMSTS staff should be applauded for their early efforts to develop data quality measures and error checks to evaluate the validity of trauma registry data submitted to the state. At present, data quality checks are implemented once the state has received data from the hospitals. Additional information regarding error checking trauma registry data may be found in the operational addendum.

Efforts to revitalize the state trauma registry have included reworking the inclusion criteria. The new registry inclusion criteria, as written in rule and scheduled to take effect in early January, do not include a measure of severity. The criteria require inclusion of the following: 1) A patient with injury or suspected injury who is triaged based on the trauma triage protocol; 2) A patient with injury or suspected injury for whom a trauma team activation occurs; or 3) A patient with injury who is admitted as a result of injury or who dies as a result of injury with an ICD-9_CM N code within the 800-959 range. The breadth of these inclusion criteria will create a rich dataset.

However, the current recommended revisions to the inclusion criteria do not include a measure of severity to limit the number of minor injuries included in the registry. Many state trauma registries impose a hospital admission length of stay requirement as a proxy for injury severity. The lack of a hospital admission length of stay criterion will increase the burden on hospital abstractors to enter data on many minor injuries. This will be particularly true for Level IV trauma centers and non-designated hospitals that are likely to admit many patients with minor trauma with short lengths of stay. The

burden on trauma registrars should be monitored and the inclusion criteria modified, if necessary.

The BEMSTS should be congratulated on recent efforts to standardize trauma registry data collection across participating hospitals. Considering the variability in hospital datasets and users' reluctance to revise data variables and definitions, this effort was nothing short of heroic. Nevertheless, two important attributes of this effort should be mentioned. First, trauma registry data collection is limited to designated Level I trauma centers. Thus, the available trauma registry information characterizes only severely injured patients treated in the "right place" and provides no information regarding patients who were not transferred to designated centers. Finally, in parallel with the revision of the Arizona State Trauma Registry, the American College of Surgeons (ACS) developed a standardized National Trauma Data Standard (NTDS). Variables contained in the existing Arizona trauma registry appear very similar, but not perfectly congruous with this standard. Please refer to the operational addendum for additional information regarding the National Trauma Data Standard.

RECOMMENDATIONS

- **The Arizona state trauma registry should expand its reach to include all acute care hospitals in the state.**
- Acquire a commercial software package at the BEMSTS to convert hospital discharge data (HDD) ICD-9-CM codes to AIS scores and a commercial probabilistic linkage software package.
- Establish a procedure for the generation of specific state prehospital and trauma registry audit filters that are reported to regional EMS councils quarterly with a process to request further data analysis based upon questions resulting from the audit filters.
- Investigate methods allowing state prehospital and trauma registry data to be made available via a password protected Web site for designated EMS agencies and hospitals to dynamically evaluate their data, benchmarked to state-level data (e.g., OLAP Cube technology).
- Begin the planning and procurement process for additional FTE and resource support to sustain additional system administration and data analysis needs that will be required to link and maintain the multiple new databases that are soon to become available.

Operational Addendum: Information Systems

Operational Information regarding Probabilistic Linkage:

Not only do linked datasets greatly enhance one's ability to conduct injury epidemiology and outcome studies, linked data can also be used to enhance the value of a state trauma registry. Below are listed specific examples of how linked data can address trauma registry data quality:

1. Existing trauma registry data can be linked within its own structure to identify multiple hospital admissions for the same patient and injury event.
2. Existing trauma registry data can be linked to hospital discharge data to determine the "completeness" of registry submissions from each hospital. This is accomplished by applying trauma registry inclusion criteria to patients contained in the hospital discharge database (HDD) and comparing the number of HDD patients discharged from each trauma center compared to the number submitted through the trauma registry.
3. Existing trauma registry data and HDD data can be linked to vital statistics death records to determine the number of severely injured patients that die shortly after discharge from a trauma center. This analysis can provide a more accurate picture of the number of trauma patients that die during and shortly after medical treatment.

The National EMS-C Data Analysis Resource Center (NEDARC) provides training in the use of a popular (yet affordable) probabilistic linkage software package.

The BEMSTS should investigate possible avenues for acquiring multiple years of hospital discharge data (HDD) to provide a "denominator for trauma" and to assess the distribution of severe trauma patients treated within non-designated hospitals. Once obtained, the following steps should be taken to prepare the data for analysis:

1. Blind the HDD hospital identifier by adding a new data field "dichotomizing" hospitals as designated trauma centers vs. non-designated hospitals.
2. Construct a "region" variable based upon hospital location.
3. Convert ICD-9-CM coding into Abbreviated Injury Scale (AIS) scores and Injury Severity Scores (ISS) using appropriate software.
4. Identify "index injuries", based upon ICD-9-CM coding, that represent conditions which should be treated in designated trauma centers.

Operational Information regarding the National EMS Data Standard:

As mentioned earlier, it will be important to ensure that each software vendor utilized in the state is capable of providing a product that is compliant with the NEMSIS EMS data standard. Compliance to this national standard will facilitate and enhance EMS data collection and its use in the state of Arizona in several ways. First, NEMSIS-compliant vendors export data using one XML standard that facilitates data collection on the state and national level. Thus, regardless of the number of vendors utilized in the state, all data will be exported to the state using the exact same structure. Secondly, providing NEMSIS-compliant data allows agency and state-level data to be benchmarked with similar state and national data. Staff within BEMSTS have begun the process of comparing data elements contained in the two prominent EMS software products used in the state with national data elements contained in the NEMSIS standard.

With regard to concerns raised during public comment about vendor costs to collect EMS data, a number of software vendors have achieved NEMSIS compliance at the gold (complete) or sliver (partial) level. Some of these vendor products are very low cost. No matter which (or how many) software vendors are used within the state, if all are NEMSIS-compliant, they will export data to the state in exactly the same structure. A list of NEMSIS-compliant software can be found at: (http://www.nemsis.org/compliance/compliantSoftware.html).

Based upon the initial work accomplished in regions with reference to standardized electronic EMS data collection, regional EMS councils could "take the lead", with direction from the state, in coordinating and implementing the utilization of NEMSIS-compliant electronic EMS software for their regions.

Operational Information regarding Development of a Statewide Trauma Registry Data Validity Process (error checking):

The state trauma registry vendor should implement data validity checks in the software at the time of data abstraction. This would reduce the time and resource burden placed upon state employees to validate data received from hospitals. This will also reduce the frustration among hospital personnel (who must re-pull medical records to correct errors reported by the state) and will improve data quality by requiring "good quality" at the time of abstraction. A list of simple data error checks is associated with the ACS National Trauma Registry Standard and could be implemented by the vendor.

Operational Information regarding Development of a Statewide Trauma Registry Data Reporting System:

As years of state trauma registry data accumulate, the state should investigate novel methods of providing data to constituents. The experience of many states has shown that it is nearly as hard to effectively communicate trauma registry results as it is to collect the data. The development of several mechanisms for distribution of trauma

registry data will improve its visibility and use. For example, the development of .PDF printable reports on topics important to outside constituents (e.g., legislators, hospital administrators, etc.) is one option. Also consider the development of flash charting that could be loaded on the website for lay and public consumption. Lastly, consider the addition of a web-based (OLAP) cube that would allow individual hospitals to dynamically search their hospital-specific data on any topic and benchmark it to state data.

Operational Information regarding the National Trauma Registry Data Standard:

The BEMSTS should be congratulated on recent efforts to standardize trauma registry data collection across participating hospitals. The BEMSTS should undertake a revision process one more time. Ensuring that trauma registry data collection is compliant with the new National Trauma Data Bank (NTDB) standard (called the National Trauma Data Standard [NTDS]) will reap many long-term benefits. The major trauma registry vendor within the state has made a commitment to migrate to the NTDS standard. Hospitals and the state of Arizona will benefit from this migration by meeting the requirement that ACS-verified hospitals submit NTDB data using the NTDS standard and will ensure that state and hospital-level data can be benchmarked to national data contained in the NTDB. See Appendix C for a preliminary mapping for the new ASTR data elements with the National NTDS variable list.

Evaluation

Purpose

The trauma care system should monitor its own performance and the performance of its components. This evaluation should include continual reassessment of system operations and goals as they relate to patient needs, availability of appropriate resources, and costs. It is essential to measure compliance to standards, document system effectiveness, and identify quality improvement opportunities. System evaluation should include:

- *System-wide quality management plan*
- *Lead agency responsible for system quality management plan*
- *Monitoring of system performance and performance of individual components*
- *A periodic review and update of system standards as they relate to patient needs, system resources, and costs*
- *Periodic review and update of trauma facility standards*
- *A quality improvement process that assesses the effectiveness of the trauma system*
- *A quality improvement process that measures the compliance to standards by each agency and institution*
- *A process to ensure patient and provider confidentiality*
- *A process to require and ensure appropriate facility quality management programs and appropriate interaction between facility quality management programs*
- *A process to determine the changes and incentives (risks and benefits) in caring for trauma patients*

CURRENT STATUS

The State Trauma Advisory Board (STAB) has an excellent multi-disciplinary participation. It is a dynamic stakeholder group that has been primarily responsible for several important system development initiatives. The Arizona Trauma System Quality Assurance and System Improvement (AZTQ) a subcommittee of STAB, is working on state level trauma system quality improvement. STAB has been the driving force behind recent efforts to expand trauma registry capabilities. Future system development hinges upon the ability to benchmark outcomes for individual centers and the four regions in the state. Moreover, individual specialty patient cohorts such as pediatric and elderly patients, Native Americans, and undocumented immigrants must be studied. This form of system-wide outcomes benchmarking is central to the development of a mature system.

The leadership of the Arizona trauma system readily acknowledges that evaluation is a weakness within their system. The underlying reasons for the fragmented evaluation are twofold in nature. First, it is difficult to evaluate a fragmented, partial and exclusive system. Clearly the leadership understands the necessity of broadening the system to an inclusive model and recommendations to achieve that goal are embedded throughout this document. The second impediment to system evaluation is the absence of a complete trauma system dataset.

However, in spite of this challenge, the leadership has a clear vision of what they would like to accomplish in terms of evaluation. They note that the AZTQ, when fully implemented will: develop and recommend standards for a uniform data collection, define a “trauma patient”, recommend confidentiality safeguards, develop guidelines for system quality assurance/quality improvement (QA/QI), identify procedures for the release of information, and define processes for continuous improvement of data quality. These activities, when completed, will provide an excellent environment for the conduct of quality improvement activities.

The PRQ and individual discussants did note that quality improvement processes are in place and ongoing within individual institutions and agencies. However, system QI is limited. Given the evolutionary process of trauma system development in Arizona, which began as a largely exclusive trauma center centric model, it is not surprising that the majority of the quality improvement activities are institutionally focused.

At the local level base hospitals and trauma centers reported providing feedback to prehospital care providers on quality of care issues. It was noted that this feedback is largely reactive, rather than proactive, and typically is provided when a performance problem has been noted. When asked about the presence of multi-disciplinary trauma quality improvement committees at the local or regional level it was noted that individual prehospital agency heads are invited only when there is a challenge with one of their

cases. No ongoing multi-disciplinary system improvement committees were noted to be functioning at local, regional or state system levels.

The STAB, through the AZTQ has established indicators for system performance. These include: patient transfers greater than six hours, wash out of open fractures greater than eight hours, transfers to multiple facilities prior to arriving at the trauma center, and patient deaths in a non-trauma hospitals after 24 hours. These audit filters are admirable, but as noted by the discussants some of the measures are unattainable through existing trauma registry data. The reliability of such measures are dependent upon a truly inclusive model in which all acute care facilities have a role in the care of the injured patient including the submission of data to the trauma registry.

It is notable that the ADHS has access to a number of databases along with the expertise to query and analyze those datasets. A draft paper titled “Under/over triage in Arizona” used the AZ hospital discharge database to estimate the number of injured patients admitted to both trauma centers and non-trauma hospitals, stratified by ISS. The paper identifies raw numbers that can be used to extrapolate rates of over and under triage. It is an example of system performance monitoring that can be completed even in the absence of an inclusive trauma registry system. The review team encourages the authors to further refine, edit and widely distribute the results of this paper and the completion of other analyses from the multiple complete and partial databases available. The discussants noted that barriers exist to effectively use of Crash Outcome Data Evaluation System (CODES) data to support trauma system development. The reader is directed to the Information Systems section of this document for recommendations pertaining to developing additional expertise among BEMSTS and ADHS staff in probabilistic linkages.

The absence of a standardized, electronic database for prehospital care providers was noted by the review team, the PRQ and the discussants as a system weakness. While the individual regional efforts and various demonstration projects are admirable, they should occur in a coordinated fashion and MUST be consistent and compliant with the National EMS Information System (NEMSIS) Standards. The Information Systems section of the report provides additional operational detail.

Of major concern to the review team is the protection for system QI activities. The AZTQ, in the absence of standards and criteria for Quality Improvement activities, may not have sufficient protection. As the standards and criteria are developed and implemented this protection may be in place for the AZTQ. The content, scope and membership for the QI activities will be defined in the standards and criteria which should also ensure a comfortable level of non-discoverability. The AZTQ should become the model for multi-disciplinary, proactive, quality improvement that can be emulated at regional and local levels. Particularly in rural areas of Arizona where resources are scarce it is important to develop a team concept in all aspects of trauma care, including evaluation and quality improvement.

RECOMMENDATIONS

- Maximize the protections afforded in existing statutes pertaining to the STAB and, more specifically the AZTQ sub-committee of the STAB, to ensure that they are sufficient to protect discussions and findings from discoverability and to create a safe atmosphere for system QI activities.
- Use existing data sets, within their functional limits, to help frame and answer system questions.
- Support the continued evolution of the AZTQ in establishing processes and standards for system evaluation and quality improvement so that when confidentiality assurance is achieved, formal system-wide evaluation and QI can begin.
- Move toward the expansion of the existing trauma registry to include all acute care facilities and the establishment of a statewide electronic prehospital data system, consistent with the recommendations contained in the Information Systems section of this report.
- Foster a collaborative multi-disciplinary team-based environment for trauma QI activities at the State, regional and local levels.

Purpose

The system should facilitate and encourage trauma-related research. The system should facilitate epidemiological research in pre-hospital care, acute care, rehabilitation, and prevention.

- *There should be a process to facilitate access to data for trauma-related research, including, but not limited to:*

    a. *Cost-effective research*
    b. *Outcomes research*
    c. *Epidemiology*
    d. *Injury control research*
    e. *Quality-of-life research*

- *There should be a process to acquire funding for research.*

- *There should be a definition of the research requirements from each system component and for each type of facility.*

CURRENT STATUS

The State of Arizona has an important legacy of research by nationally recognized investigators making significant contributions to the trauma and prevention literature. The preponderance of this research, however, appears to be organized and conducted through individual centers or organizations with limited coordination at the state level. Opportunities for inter-organizational coordination of research have not been fully explored. Several nationally ranked universities exist in the state and could provide graduate students with opportunities for involvement in state or regional injury-related research. However, the linkage between ADHS (specifically BEMSTS), including its available databases, and for example, schools of public health remains mostly uninvestigated. In addition, little contact appears to exist between the regional EMS councils and area universities or independent researchers.

The BEMSTS expressed an interest in the development of a process to coordinate opinions from regional committees and other content experts to guide the linkage and analysis of trauma-related data. The BEMSTS has resources necessary to provide statistical analysis and reporting, but lacks the expertise to develop pertinent trauma-related research questions that would support the issues facing regions of the state. Some discussion was heard during the public forum regarding the development of a new board (i.e., a trauma hospital research consortium) or some combination of "research-minded" experts on existing committees (e.g., STAB, AZTQ) who could

facilitate, guide and track data requests and research questions focused on use of trauma-related datasets.

Currently, strict confidentiality polices inhibit the release of state trauma registry data to a large extent. These policies are much more restrictive than confidentiality policies associated with the hospital or ED discharge databases, even though many of these databases could be used to answer the same trauma-related questions. For example, no mechanism was reported to be in place allowing a researcher to request Institutional Review Board (IRB) approval for release of Arizona State Trauma Registry data, even though such a mechanism exists for release of hospital or ED discharge data. Described differently, case-level state trauma registry data apparently cannot be released, even if satisfying the requirements associated with a HIPAA de-identified dataset. These restrictions greatly reduce the utility of state trauma registry data for research purposes.

RECOMMENDATIONS

- **Develop a statewide trauma research consortium, linked to the activities and functions of the STAB and AZTQ, for purposes of promoting research throughout the continuum of trauma care.**
- Integrate injury research into regional EMS council activities, encouraging them to structure formal investigations, where possible, with an eye towards expansion into publishable research.
- Develop liaisons with university faculty, students in public health and other injury-related disciplines for the purpose of facilitating multidisciplinary trauma-related research using existing databases and other trauma system resources.
- Revisit confidentiality polices associated with release of state trauma registry data, and bring those policies into alignment with other state health-related datasets.
- Identify, characterize, and catalogue injury prevention programs, injury-related research projects, and injury-related databases to facilitate collaboration, reduce redundancy and leverage scarce resources.

Operational Addendum: Research

Until such time that a “research consortium” can be organized, BEMSTS has requested a list of commonly requested data tables that evaluate trauma system processes and characterize familiar trauma-related research topics. Appendix D: contains a list of tables that are tailored to ASTR data elements and comply with confidentiality policies associated with release of the data. Additionally, the appendix identifies a short list of “trauma system” topics that can be addressed with use of the Arizona hospital discharge data and death records. These tables are designed to stimulate thought and additional analyses to develop meaningful (and potentially publishable) research associated with trauma system care in the state.

A common thought shared by discussants during the public forum was the idea that the state lacks a statewide trauma registry, and this is considered the primary reason why research into trauma center care and trauma system effectiveness has not been readily conducted. While this is true, it would be important to point out to stakeholders that much valuable research could be conducted using available datasets. For example, issues related to over and under triage within the state cannot be evaluated with the current state trauma registry, but could be evaluated using the hospital discharge data set. The outcome and care of head injuries in rural areas is another example of a research topic that cannot be addressed with the state trauma registry but could be assessed by a linkage of vital statistics data with hospital discharge data. The BEMSTS should organize the necessary resources to make available “linked” health-related datasets that could be used (by independent content experts) to conduct pertinent trauma and injury-related research.

Focused Questions

Question Posed

1. Please identify ideas (financial and non-financial) for recruiting hospitals into the trauma system Level II through Level IV.

Surveyor Response

Arizona has a number of different funding streams supporting trauma care in the State. Currently dedicated trauma center funding is restricted by Proposition 202 to Level I trauma centers in support of readiness costs and uncompensated hospital care. In order to recruit and maintain other levels of trauma centers, incentives must be developed to encourage and promote participation.

RECOMMENDATIONS:
Financial:

- Research the fines and forfeiture fund (EMSOF) allocations and redirect a greater share of those funds to expanding trauma centers in Arizona.
- Fund rural Trauma Centers (CAH) through the Office of Rural Health, Rural Hospital Flexibility Grant program (FLEX).
- Redirect hospital bioterrorism funding to trauma center readiness in rural facilities.
- Investigate opportunities for use of Preventative Block Grant funds.

Non Financial:

- Promote the passage of legislation which would minimize or exempt from liability physicians providing trauma care in designated trauma centers (all levels).
- Require CAH, as part of their licensing, to be verified at the appropriate level as designated trauma centers and contribute to the trauma registry data base.
- The Office of Rural Health and the BEMSTS should collaborate on providing technical assistance to rural facilities to assist them in attaining the highest achievable and sustainable level of trauma center designation possible.
- Tie acute care hospital licensing to participation in the trauma system commensurate with hospital resources. At a minimum, this includes contributions to the trauma registry data system.
- Seek FLEX funding to promote grassroots public education campaign to encourage the development of trauma centers in rural and remote areas of Arizona.

Question Posed

2. Please identify priorities for supporting the rural prehospital provider and the rural health care institution.

Surveyor Response

From a systems perspective, the greatest priority for supporting both rural facilities and providers at all levels would be to find the necessary combination of resources, incentives and regulatory oversight to bring all rural areas into the Arizona trauma care system. As roles become more clearly defined for Level II, III and IV trauma facilities, the contributions of the rural prehospital providers will become more evident. The transition to an inclusive system will have many benefits to the rural components of the system. First, it will allow for the formalization of the processes necessary for the identification of the critical trauma patient and subsequent stabilization and transfer to a higher level of care. Equally as important, it will also allow for the identification of the less acutely injured patient who can be managed at the local facility. By providing both rural hospital and prehospital personnel with the knowledge and skills to make these determinations and a responsive system to support their needs, the stress and pressures on the rural providers can be greatly relieved. The training, oversight and quality improvement activities associated with a fully functioning, inclusive, trauma care system also work to make rural providers more competent and confident in their trauma care skills.

The BEMSTS desires to meet the needs of rural facilities and providers are commendable. Likewise, their approach of collaborating with key partners such as the four EMS regions, the Office of Rural Health, and Indian Health Service represents an appropriate strategy. The key to succeeding in such a strategy may be to work en masse with these collaborators, and to ensure representation of the target groups (e.g. rural facility representatives and prehospital personnel) to help frame the challenges and potential solutions. If, as the BEMSTS perceives, the answers to these challenges and opportunities are found at the grassroots level, then it will be important to ensure that sufficient quantity and quality of rural representatives participate to help identify the strategies, outputs and outcomes necessary to overcome the challenges. If the solutions were easy, they would have been fixed by a rural population that generally prides itself in its self-sufficiency. The resolution of the challenges will be based on a combination of solid leadership by and among the key agencies, coupled with clear problem identification and solutions that fall outside the box.

The regions provided feedback that funding to continue the rural grant program is necessary. On the surface this is an absolute truth. Clearly the cost of readiness and the inability to defray those costs among a few transports each year make the per capita “cost of doing business” in rural EMS very high. However, while providing a few hundred or thousand dollars to meet specific equipment or training needs makes the wound feel a bit better, it is something akin to using a butterfly closure when reconstructive surgery is necessary. The regions, along with the BEMSTS, IHS and ORH should look for ways

to guide the use of grant funds in a manner that will produce lasting infrastructure. This might include increasing the administrative skills and capacities of local EMS leaders, supporting planning processes, assisting with budget and finance issues, and building evaluation mechanisms into all grant programs. Experience in many other states suggests that it is only through thoughtful distribution of funds in a planned and monitored manner that small pots of money can have a lasting effect. All too frequently those scarce resources get obligated in a repetitive manner paying for the same expendable materials, equipment, or training over and over again.

Investing in a rural data infrastructure is vitally important to the evolving trauma system. As an example, the State of Nevada has clearly demonstrated that rural EMS providers are anxious and able to collect the requisite patient care data in an electronic format that is readily accessible for a variety of administrative and quality improvement functions as well as for continuity of care issues. Likewise, data networks between and among Critical Access Hospitals in several states indicate that rural facilities are capable and interested in contributing to quality improvement issues. In an era of pay for performance such data investments are critical to the long-term survival of both hospital and prehospital resources in rural Arizona.

Training of all rural medical personnel is critical to the survival of the critically injured patient. The team approach espoused by the ACS' RTTDC and other courses is essential to the optimal care of the injured patient in areas where specialty resources are scarce. Prehospital personnel, along with medical staff and ancillary personnel (medical and non-medical) may be necessary to resuscitate and stabilize a critical patient in a rural facility prior to transfer. The team approach also validates the essential role of each provider or team member. Trauma training for all provider groups and addressing all age patients must be institutionalized in both initial training and CME for rural providers. Contact with critical trauma patients with survivable injuries is rare for any individual rural provider. The use of simulators, televideo and other asynchronous or distributive learning approaches should be rigorously evaluated.

RECOMMENDATIONS:

- Increase incentives, reduce barriers, and encourage all acute care facilities and EMS agencies to become part of an inclusive trauma care system in Arizona.
- Convene a "rural trauma" stakeholder group, subcommittee, task force to identify challenges facing rural providers and solutions to those challenges.
- Continue the local grant program with an emphasis on creating lasting outcomes.
- Ensure that rural facilities and agencies are provided with the necessary incentives and resources to contribute data to the statewide system.
- Support training of all rural trauma care professionals, leverage existing and emerging televideo and other asynchronous resources.

- **Question Posed**

3. Does the Trauma System Planning and Evaluation Committee Consultation Team believe that Arizona's current trauma system adequately addresses trauma care for the pediatric and geriatric populations? Please provide specific recommendations for improving the trauma system care for these patients.

Surveyor Response

Surveyor Response – Children

Three Level I trauma centers provide the care for children within the state (two centers in Phoenix and one center in Tucson). All three trauma centers have pediatric intensive care units. Phoenix Children's Hospital has made a commitment to become a trauma center, seeking ACS verification in 2008. Interfacility transfer agreements between non-trauma acute care facilities and trauma centers caring for children do not uniformly exist.

Trauma center designation standards for pediatrics generally follow the requirements in the ACS' *Resources for the Optimal Care of the Injured Patient (1999)*. However, Arizona Trauma Center standards do not specify any pediatric clinical qualifications for surgeons and physicians for any designation level. A pediatric performance improvement program is a requirement for trauma centers of all designations. The state does plan to use the ACS standards and verification process, so changes in requirements for pediatric patients should become more rigorous if the existing trauma centers become pediatric trauma centers as outlined in the ACS' *Resources for the Optimal Care of the Injured Patient (2006)*.

Prehospital providers have current pediatric protocols for trauma that were developed in association with the EMSC Advisory group (PACES), and a plan for annual review was stated. In the metropolitan areas, the prehospital providers have destination guidelines directing transport to the three trauma centers caring for children. Outside the metropolitan areas, children are often taken to the nearest facility for stabilization, and then transferred to a trauma center. Prehospital providers in all regions have good access to pediatric training programs (PEPP and PALS). Notably, these programs have a minimal focus on trauma. Some recent and planned multidisciplinary conferences have a pediatric focus, including ones with pediatric simulator training.

From a system perspective, no needs assessment for pediatric trauma care has been conducted. A survey of pediatric equipment on all ambulances was recently conducted, and 100% of required pediatric equipment is present on ambulances across the state. However, no survey has been conducted of hospital emergency department preparedness for pediatric patients, thus it is not possible to evaluate the ability of non-trauma hospitals to provide initial care and stabilization for injured children.

The State Trauma Advisory Board (STAB) has had no designated pediatric representative to address the needs of children within the trauma system. An ad hoc

pediatric representative was recently invited to attend STAB, but formal membership requires a statutory change in membership.

Quality improvement and benchmarking for pediatric trauma is not performed on a system-wide basis. The Child Fatality Review Committee did achieve 100% autopsy rate for children who died in Arizona last year. This committee provides a means to review deaths for preventable mortality.

RECOMMENDATIONS:

- Conduct a statewide needs assessment and gap analysis of resources for the care of the injured child.
- Revise the state standards for designation of trauma centers caring for children using the pediatric trauma center requirements in the *Optimal Resources for the Care of the Injured Patient (2006).*
- Designate pediatric trauma centers.
- Establish guidelines for the care of injured children for all hospitals (e.g., Emergency Departments Approved for Pediatrics), including essential emergency department equipment and pediatric training for providers, and require all hospitals to meet guidelines.
- Institute transfer agreements between hospitals to ensure that injured children go to the most appropriate trauma center for care.
- Establish and include prehospital and non-trauma hospital providers in a system-wide pediatric performance improvement process.
- Formalize the appointment of a pediatric surgery representative on STAB.
- Refer to the Institute of Medicine report *Emergency Care of Children: Growing Pains* for additional guidance.
- Better integrate EMSC into BEMSTS activities.

Surveyor Response – Geriatric

The elderly trauma patient presents specific and unique challenges to Arizona's trauma system and trauma centers. Statistics for the 65 years and older age group by race and ethnicity show that White, non-Hispanics constitute 86.7 percent of the Arizona elderly. Consider the following facts as outlined by Patricia Gober, PhD from May of 2002 in a technical paper on Aging, Health and Arizona's Capacity to Care entitled, *Geo-demographics of Aging in Arizona: State of Knowledge* (3):

1. Arizona's elderly population will triple in size and represent 26% of the population in 2050.
2. Arizona's elderly are growing increasingly old.
3. Many Arizona elderly are migrants from outside the state.
4. Women will represent an increasing share of the state's elderly population.

Approximately 20% of Arizona elderly live in rural settings. Since 1990, the number of people 65 years and older in Arizona has increased by almost 40 percent, and the geriatric population swells by over 300,000 in the winter months with vacationing

seniors from the northern climates. Often these seasonal residents are in isolated areas without cell phone contact and little or no local support in case of emergency. While citizens over age 65 years represent 13% of the general population, they constitute over 36% of trauma discharges.

The trauma literature is clear relative to injury outcomes in the high risk groups. The elderly experience both greater disability and a higher death rate at lower Injury Severity Scores when compared to their younger counterparts. The loss of physiologic reserve and greater susceptibility actually occurs at a much younger age. In fact, the increase in case fatality rate begins at age 45 and steadily increases through the fifth, sixth, and seventh decades of life and beyond. Falls constitute the most common injury mechanism in the elderly age group followed by motor vehicle crashes. Given the altered physiology of the elderly patient, the high rate of associated pre-existing conditions, the propensity for recidivism particularly with falls, the poor outcomes at low injury severity and the special needs at discharge, the elderly injured patient represents an extraordinary demand on the system and warrants special attention.

At the time of the consultation review, no specific efforts aimed at management of the geriatric patient population were noted. By virtually any measure, without specific system-wide planning in the areas of prehospital care, definitive care, rehabilitation and performance improvement, the Arizona Trauma System will, at best, strain under the increased demand for elder trauma care in the future.

RECOMMENDATIONS

- Perform a needs assessment relative to the:
    - Educational needs of providers for the care of elders.
    - Capabilities of all non-trauma hospitals to assess and stabilize injured elders, and facilitate transfer to trauma centers.
    - Prehospital triage and destination guidelines for elders.
    - Disposition needs of elders including a gap analysis between current and projected demand for services against capabilities in a range of areas including: inpatient rehabilitation, scalable independent living to skilled nursing facilities and home care services.
- Look for opportunities to collaborate with pre-existing advocacy groups for the aged, focused on injury and other support services.
- Create a Task Force on the Aging Injured through the State Trauma Advisory Board to devise recommendations. The following areas should be considered:
    - Pre-Hospital – strengthen triage protocols to include threshold adjustment for trauma center transfer based on age and co-morbidity.
    - Definitive Care – develop trauma center-based multidisciplinary “Geriatric Trauma Consultation Teams” to address the special needs of the elders through the continuum of care.
    - Initiate a system-wide geriatric performance review program to identify opportunities for improved care to elders.

        - Prospectively track and report demographic data and acute injury outcomes and report these centrally to the State Trauma Registry based on a statewide Performance Improvement and Patient Safety for the elderly.
        - Integrate geriatric specific outcome data from each rehabilitation center with State Trauma Registry to benchmark functional outcomes with the acute phase of care.
    - Incorporate these developments into the Arizona Trauma System Plan.

Question Posed

The focus of question numbers three and four are similar in nature. Therefore, there is a great deal of overlap between the two answers. Information from the injury prevention program will help evaluate the effectiveness of trauma system activities targeting these special populations.

4. Does the TSC Committee believe Arizona's injury prevention efforts adequately address pediatric and geriatric specialty populations? Please provide specific recommendations for improving our injury prevention activities for these groups.

Surveyor Response

Several injury prevention programs currently exist for the pediatric and geriatric population although opportunities for improvement exist. The *Injury Surveillance and Prevention Plan for the State of Arizona 2006-2010* identifies the injury patterns in these populations. The strategic plan includes programs targeting these groups. The Injury Prevention Advisory Council (IPAC) has an inclusive membership with representation from SAFEKIDS, Phoenix Children's Hospital and three Level I adult/pediatric trauma centers. No representation from groups that focus on injury prevention activities for the elderly was noted.

Opportunities for improvement regarding injury prevention activities for these two groups are as follows:

- Collaborate with current established groups that offer injury prevention programs, e.g., representatives from groups whose focus is injury prevention in the elderly population.
- Determine /develop evaluation tools for the injury prevention programs targeting these populations.
- Educate trauma hospital injury prevention personnel on all aspects of injury prevention, e.g., data analysis, strategic planning, program implementation and evaluation.
- Develop and distribute educational materials to numerous entities / groups, e.g., trauma hospital personnel, elected officials and the public.
- Link trauma system injury prevention activities for the pediatric and geriatric population to the priorities stated in the state.

Appendix A: Site Visit Team – Biographical Sketches

CHRISTOPH R. KAUFMANN, MD, MPH , FACS (TEAM LEADER)

Dr. Christoph Kaufmann is Associate Medical Director, Trauma Services at Legacy Emanuel Hospital in Portland, Oregon. He attended medical school at the Uniformed Services University of the Health Sciences (USUHS) in Bethesda and completed his general surgery residency at Tripler Army Medical Center, Honolulu, Hawaii. He then completed the Trauma/Critical Care Fellowship at Harborview Medical Center in Seattle. He is board certified in general surgery and surgical critical care.

In 1990, while on the teaching faculty of Madigan Army Medical Center in Tacoma, Dr. Kaufmann was deployed with the 47th Combat Support Hospital to Saudi Arabia and Iraq. In 1993, Dr. Kaufmann was assigned to the USUHS Department of Surgery with responsibility as trauma consultant to the U.S. Public Health Service. He served as Director, Division of Trauma and Emergency Medical Systems, Health Resources and Services Administration (HRSA), where he administered the federal grant program to develop trauma care systems across the United States. He also participated as an author of the Model Trauma Care System Plan. In 1996, he returned to the Department of Surgery at USUHS as Principal Investigator of the Demonstration Project for Telepresence Surgery. He served as Chief, Division of Trauma and Combat Surgery, and Region Chief, American College of Surgeons Military Committee on Trauma. Dr. Kaufmann was the Surgical Director of the National Capital Area Medical Simulation Center and Professor of Surgery at USUHS at the time of his retirement from the U.S. Army in 2002. He is now International Chair of the Advanced Trauma Life Support (ATLS) Subcommittee for the ACS Committee on Trauma.

Dr. Kaufmann is an author of the current revision of the HRSA Model Trauma Care System Plan. He has given over 100 presentations in 16 different countries. He has been a member of numerous local, state, national and international committees, both military and civilian, relating to trauma systems and trauma care, including:

- Member, Trauma Systems Consultation Committee, ACS Committee on Trauma
- Associate Examiner, American Board of Surgery
- Executive Committee, American College of Surgeons Committee on Trauma
- Site Surveyor, ACS Trauma Center Verification & Review Committee
- Trauma Center Site Surveyor, Virginia, Pennsylvania, Illinois, and Washington
- Member, Committee on a Vision for Space Medicine Beyond Earth Orbit, Institute of Medicine
- Editorial Board, NATO Emergency War Surgery Handbook, 3rd U.S. Revision
- President, Ambroise Paré International Military Surgical Forum of ISS-SIC
- Examiner, Society of Apothecaries of London, Diploma in the Medical Care of Catastrophes

JANE W. BALL, R.N. DR. P.H (OBSERVER)

Dr. Jane W. Ball served as the Director of the National Resource Center (NRC) at the Children's National Medical Center in Washington, D.C., from 1991 through 2006. The NRC provided support to two Federal Programs in the U. S. Department of Health and Human Services' Health Services and Resources Administration (HRSA): the Emergency Medical Services for Children (EMSC) Program and the Trauma-Emergency Medical Services Systems Program. As director of the NRC, she coordinated the support provided to the Federal Program Directors as well as the provision of technical assistance to state grantees. Support to the Federal Program Directors often included meeting facilitation, preparation of special reports (such as the Model Trauma Systems Evaluation and Planning document), and consultation on Program issues. Technical assistance often included strategic planning, providing guidance in securing funding, developing and implementing grants, developing injury prevention plans and programs, building coalitions, shaping public policy, conducting training, and producing educational resource materials.

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

Dr. Ball recently completed her term as the President of the National Academies of Practice, an organization composed of distinguished health care practitioners from 10 disciplines that promotes education, research, and public policy related to improving the quality of health care for all through interdisciplinary care. She is currently serves as the organization's Immediate Past President.

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

GAIL F. COOPER, PUBLIC HEALTH ADMINISTRATOR (RETIRED) (TECHNIAL ADVISOR)

Gail Cooper retired from the County of San Diego, Health and Human Services Agency in March 2002, and since that time has worked on special projects in EMS, Trauma, and Public Health Preparedness. Prior to retiring, she served as the Public Health Administrator for the County of San Diego and was responsible for over 500 employees and a budget of over $71 million. This included not only the EMS Division but also the Epidemiology Section, Emerging Diseases, Chronic diseases, Communicable Diseases, Disaster Medical Response, Vital Records, Public Health Laboratory, Maternal and Child Health, Tobacco Control, Medical Health Quality, Immunizations, Office of AIDS Coordination, Border Health, Public Health Nursing and Public Health Preparedness.

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

JANET GRIFFITH KASTL, MA, DIRECTOR (OBSERVER)

Janet Griffith Kastl is the Director of the Washington State Office of Emergency Medical Services and Trauma System. She has held this position since passage of the Washington State Trauma Care Act in 1990. Prior to serving as Director, she oversaw the Trauma Assessment Project that planned and created the 1990 *Report to the Legislature*, resulting in enactment into statute with full funding. In 1997, the Legislature passed the Trauma Care Fund Act, which provides a dedicated fund that is available for designated facilities, physicians and EMS providers of care to major trauma patients.

Ms. Kastl began her career as an EMS Systems Planner and Regional EMS Administrator when the state's EMS system was in its infancy. An early advocate of addressing trauma care through a systems approach, she played a strong role in the development and successful implementation of a statewide EMS and Trauma System in Washington. During her 30-year career in public health, Ms. Kastl has taken on increased responsibilities in the development, administration and evaluation of health delivery systems, specializing in EMS and trauma systems development. Due in no small measure to her extensive experience, knowledge, skills and dedication, Washington's system enjoys a broad reputation for excellence and is considered a national model by many public health professionals.

HEIDI A. HOTZ, RN (TRAUMA PROGRAM MANAGER)

Heidi Hotz is the Trauma Program Manager at Cedars-Sinai Medical Center, a DHS-EMS designated / ACS verified Level I Trauma Center. She is also the Past President of the Society of Trauma Nurses (STN). She is the President of the Trauma Managers Association of California (TMAC). She has over 17 years of trauma program management experience inclusive of trauma data, trauma performance improvement, trauma program and systems development and implementation, injury prevention, consultant for trauma centers and systems, and all trauma related issues across the continuum of care. She has extensive experience in trauma education participating in many educational conferences and events. She was the Chair of the Advanced Trauma Care for Nurses® (ATCN) Committee in Arizona for 6 years. She was the first appointed Chair of the ATCN National-International Committee, and remains actively involved in this premier educational program as International Faculty and Committee Member. She is an instructor for the STN's Trauma Outcomes Performance Improvement Course (TOPIC). She has been a member of the STN Board of Directors for over 6 years in the position of Director at Large, Treasurer, and President Elect. She is also a Board Member with the American Trauma Society.

Ms. Hotz has provided testimony at formal hearings in support of trauma systems funding, and participated in press conferences and media events drawing attention to the need for trauma systems and trauma systems development. She is a Board Member of the Los Angeles County Association of Trauma Program Managers. She has extensive involvement in many trauma-related national programs.

N. CLAY MANN, PHD, MS (DATA ANALYSIS)

Dr. Clay Mann is a Professor in the Department of Pediatrics at the University of Utah School of Medicine and Director for Research at the Intermountain Injury Control Research Center. Dr. Mann received his Ph.D. from the University of Texas in Preventive Medicine and has a Masters Degree from the University of Utah in Statistics/Epidemiology. Dr. Mann also completed a graduate certificate in Health Services Administration.

Prior to his current position, Dr. Mann served as faculty at Oregon Health and Sciences University (OHSU) working within the Department of Emergency Medicine as the Director of Health Services Research. During his tenure at OHSU, he and Dr. Richard Mullins hosted the Skamania Conference, to assess the efficacy of trauma system development in improving trauma patient outcomes.

Dr. Mann has published 80+ peer-reviewed research articles dealing with traumatic injuries to children, trauma system evaluation, cardiac and trauma resuscitation and the role of emergency medical services in health care. Dr. Mann has special expertise in nonparametric statistics and small sample analysis. He has published methodological papers dealing with the specification of risk adjusted log odds using injury data, improving diagnostic accuracy by pooling test findings and design issues associated with multi-site community trials with continual data collection.

Dr. Mann has served as principal investigator or co-investigator on 50 federal, state, foundation or industry grants. He has conducted several randomized, controlled community trials dealing with cardiac resuscitation, acute coronary disease education and paramedic training. Currently, Dr. Mann currently serves as the Principal Investigator for the NEMSIS Technical Assistance Center. Dr. Mann also currently serves on several national committees including the Basic Life Support Subcommittee for the American Heart Association, Advisory Council for the National Trauma Registry Standardization Project and guest member of the Trauma Systems Consultation Committee for the American College of Surgeons.

MICHAEL F. ROTONDO, MD, FACS (OBSERVER)

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

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

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

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

NELS D. SANDDAL, MS, REMT-B (TECHNICAL ADVISOR)

Mr. Nels Sanddal is currently the president of the Critical Illness and Trauma Foundation (CIT), in Bozeman, Montana. CIT is a non-profit organization dedicated to improving the outcomes of people who are injured in rural America through programs of prevention, training, and research. He recently completed a three year assignment as the Director of the Rural EMS and Trauma Technical Assistance Center which was funded by the Department of Health and Human Services, Health Resources and Services Administration. He received his EMT training in Boulder, Montana, in 1973 and has been an active EMT with numerous volunteer ambulance services since that time. He currently responds with the Gallatin River Ranch Volunteer Fire Department where he serves as the Medical Officer and Assistant Chief. Mr. Sanddal worked as the training coordinator for the EMS and Injury Prevention Section of the Montana Department of Public Health and Human Services in the late 1970's. He has served as the Chairperson of the National Council of State EMS Training Coordinators and as the lead staff member for that organization, as well as the National Association of EMT.

Mr. Sanddal has been a co-investigator for seven state or regional rural preventable trauma mortality studies and has conducted research in the area of training for prehospital and nursing personnel as well as in rural injury prevention and control. He has published more than 20 peer-reviewed articles and authored many policy documents pertaining to rural EMS and trauma care. He is a core faculty member for the NHTSA Development of Trauma Systems course and has conducted several statewide EMS assessments for NHTSA. Mr. Sanddal served on the IOM Committee on the Future of Emergency Care in the U.S Healthcare System and chaired the IOM Committee charged with the dissemination of that report.

He completed his undergraduate work at Carroll College, received his Master's degree in Psychology from Montana State University and is a doctoral candidate in Health and Human Behavior from Walden University.

WADE N. SPRUILL, JR. (EMS DIRECTOR)

Wade N. Spruill, Jr., CPM, has served as the Chief Executive Officer of AAA Ambulance Service, Southeast Mississippi Air Ambulance District, and the Southeast Trauma Care Region since 2000. AAA Ambulance Service, established in 1965, is a not-for-profit public prehospital health care provider. AAA currently provides advanced life support service in nine southeast Mississippi counties. Southeast Mississippi Air Ambulance District, established in 1971, is a not-for-profit public provider of helicopter ambulance service in ten southeast Mississippi counties. Southeast Trauma Care Region is a not-for-profit public organization established in 2000. The Region manages a thirteen-county inclusive trauma care system in southeast Mississippi.

He is a graduate of the University of Mississippi and is a 30-year veteran of the Mississippi State Department of Health. He served as Director of the Division of Emergency Medical Services from 1974 to 2000. He authored and steered the legislative adoption of the Mississippi EMS Act of 1974 and all subsequent amendments which include Advanced Life Support, EMS Fees, EMS Operating Fund, the Good Samaritan law, The Mississippi Trauma System Law; he also assisted in the passage of the seat belt, road numbering system, and the telecommunications laws. Currently, he is the Governor's appointed representative of the Mississippi Hospital Association to the Mississippi State EMS Advisory Council, and to the Mississippi Trauma Advisory Committee. Nationally he is faculty for the National Highway Traffic Safety Administration's Development of Trauma Systems curriculum, consultant to the American College of Surgeons for trauma systems development, independent consultant for trauma center designations, consultant to NHTSA for the Emergency Vehicle Operators Training Program, member of the NHTSA Technical Assessment Program, and former founding member of the National Association of State EMS Directors.

JIM UPCHURCH, MD, MA, REMT-P (ED PHYSICIAN)

Dr. Jim Upchurch began his medical career in 1971 as a Special Forces Medic in the U.S. Army. He graduated from the University of Texas Medical Branch at Galveston in 1982 and completed a Family Practice residency from the University of Oklahoma in 1985. Since 1985, he has served as an Indian Health Service (IHS) Physician on the Crow Indian Reservation in Montana. The majority of his clinical practice involves emergency medicine (EM), Emergency Medical Services (EMS), surgery and obstetrics. He maintains current National Registry certification and state licensure as an EMT-Paramedic. In 2003, he completed a Master's degree in Educational Technology from George Washington University.

Dr. Upchurch is a long-standing member of the National Association of EMS Physicians and the American College of Emergency Physicians. Since 1986, he has functioned as EMS medical director for Big Horn County in Montana and guided their basic care program to the advanced life support level, including critical care interfacility transport. He also provides EMS medical direction for Big Horn Canyon National Park and the Incident Medical Specialist Program, US Forest Service, Region VI.

Dr. Upchurch is director of a small non-profit organization, EMS Education & Training. They offer distance and face-to-face educational opportunities to rural and frontier EMS personnel in Montana who desire to advance their level of care. He is an active ACLS, ACLS EP, ATLS and PHTLS instructor. Recently, he authored the Geriatric chapter for the sixth edition of *Nancy Caroline's Emergency Care in the Streets*, released in 2007.

Although Montana has no recognized state EMS medical director, Dr. Upchurch has served in that function for many years and represents Montana on the National Council of State EMS Medical Directors of the National Association of State EMS Officials. He functions at the IHS national level as a consultant on EM and EMS issues. He also sits on the Montana Board of Medical Examiners and on the board for the Critical Illness and Trauma Foundation.

Appendix B: List of AZ ACS Participants

Name	Hospital/Agency	Department	E-Mail Address
Dr. Andy Aldridge	Flagstaff Medical Center	Trauma	Aldridgeaj1@msn.com
Dr. Charles Allen	Banner Good Samaritan Hospital	Trauma	Charles.allen@bannerhealth.com
Sarah Allen	Arizona Department of Health Services	PHS	Allensa@azdhs.gov
Janine Anderson	NAEMS/FMC	Prehospital Trauma	Janinea@nahealth.com
Ron Anderson	Arizona Department of Health Services	BEMSTS	andersro@azdhs.gov
Krista Anheluk	Arizona Department of Health Services	BEMSTS	anheluk@azdhs.gov
Ed Armijo	Arizona Department of Health Services	BEMSTS	armijoe@azdhs.gov
Bill Ashland	Flagstaff Medical Center	Trauma	Bill.ashland@nahealth.com
Gary Baker	Scottsdale Healthcare	Admin	jbaker@shc.org
Jake Bar-low	WACEMS		jake.barlow@wacems.org
Marcia Barry	Banner Good Samaritan Hospital	Trauma	Marcia.barry@bannerhealth.com
Joel Bunis	Arizona Department of Health Services	BEMSTS	bunisj@azdhs.gov
Vatsal Chikani	Arizona Department of Health Services	BEMSTS	chikanv@azdhs.gov
Paul Coe	NAEMS	Council	psfdchief@hotmail.com
Vicki Conditt	Arizona	BEMSTS	conditv@azdhs.gov

	Department of Health Services		
Sandi Espinoza	Flagstaff Medical Center	ED	Sandra.espinoza@nahealth.com
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Barbara Fanning	Arizona Department of Health Services	Legislative Affairs	fanninb@azdhs.gov
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Appendix C: Preliminary Mapping of Arizona Trauma Registry Data Elements to the NTDS 1.1.1 Data Dictionary

Arizona Required Data Element	Common Data Elements w/ NTDS 1.1.1	Additional NTDS 1.1.1 Data Elements
Registration Number		National Trauma Registry Number
Medical Record Number		Alternate Home Residence
Admit Date		Patient's Occupational Industry
Site ID/Institution Number		Patient's Occupation
Patient Last Name		Other Transport Mode
Patient First Name		Initial Field Pulse Rate
Patient Middle Initial		Initial Field Oxygen Saturation
Social Security Number		Initial ED/Hospital Pulse Rate
Date of Birth	Date of Birth	Initial ED/Hospital Oxygen Saturation
Age	Age	Initial ED/Hospital Supplemental Oxygen
Units of Age	Age Units	ED Discharge Date, Time
Gender	Sex	ED Death
Race	Race	Primary E-Code, Additional E-Code
Ethnicity	Ethnicity	Hospital Procedure Start Time/Date
Zip Code of Residence	Patient's Home Zip Code	Inter-facility Transfer
City of Residence	Patient's Home City	Transport Mode
County of Residence	Patient's Home County	Drug Use Indicator
State of Residence	Patient's Home State	Total Ventilator Days
Country of Residence	Patient's Home Country	
Co-morbidity/Pre-existing Conditions	Co-morbid Conditions	
Date of Injury	Injury Incident Date	
Time of Injury	Injury Incident Time	
Actual versus Estimated Time of Injury		
E 849. Place of Occurrence	Location E-Code	
Street Location of Injury		
Zip Code of Injury Scene	Incident Location Zip Code	
City of Injury	Incident City	
County of Injury	Incident County	
State of Injury	Incident State	
Injury ICD9-CM E-Code		
Injury Classification	Injury Classification	
Work-relatedness of Injury	Work-Related	

Patient Position in Vehicle		
Protective Devices Used	Protective Devices	
Safety Equipment Issues		
Transport Agency		
Run Sheet Available?		
Run Sheet Date		
Transported From		
Date EMS Called	EMS Dispatch Date	
Time EMS Called	EMS Dispatch Time	
Time EMS Left for Scene		
Time EMS Arrived at Scene	EMS Unit Arrival on Scene Time/Date	
Patient Contact Time		
Time EMS Departed Scene	EMS Unit Scene Departure Time/Date	
Time at Final Destination		
Actual Destination		
Scene Time (minutes)		
Transport Time (minutes)		
System Access		
Triage Criteria		
Date of Measurement of Vital Signs		
Time of Measurement of Vital Signs		
Unassisted Respiratory Rate	Initial Field Respiratory Rate	
Prehospital Airway Management		
Was Patient Intubated?		
Systolic Blood Pressure	Initial Field Systolic Blood Pressure	
Eye Opening	Initial Field GCS- Eye	
Verbal Response	Initial Field GCS- Verbal	
Motor Response	Initial Field GCS- Motor	
Glasgow Coma Score	Initial Field GCS – Total	
Paralytic Status		
Revised Trauma Score	Revised Trauma Score	
Date of Arrival in ED	ED/Hospital Arrival Date	
Time of Arrival in ED	ED/Hospital Arrival Time	
Date of Initial Transfer from ED (Exit Date)		
Time of Initial Transfer from ED (Exit Time)		

Length of Stay in ED (Hours)		
Complete Trauma Team Arrival Time		
ED Disposition	ED Discharge Disposition	
Blood Alcohol Level	Alcohol Use Indicator	
Unassisted Respiratory Rate	Initial ED/Hospital Respiratory Rate	
Was Patient Intubated?		
Systolic Blood Pressure	Initial ED/Hospital Systolic Blood Pressure	
Eye Opening	Initial ED/Hospital GCS - Eye	
Verbal Response	Initial ED/Hospital GCS - Verbal	
Motor Response	Initial ED/Hospital GCS - Motor	
Glasgow Coma Score	Initial ED/Hospital GCS - Total	
Paralytic Status	Initial ED/Hospital GCS Qualifiers	
Temperature	Initial ED/Hospital Temperature	
Units of Temperature		
Temperature Route		
Revised Trauma Score	Revised Trauma Score	
Toxicology Findings		
Toxic Substance Found		
Date of Arrival at Referring Hospital		
Time of Arrival at Referring Hospital		
Date of Transfer from Referring Hospital		
Time of Transfer from Referring Hospital		
Transport Agency		
Transferring Facility		
Facility Type		
Length of Stay in Referring Hospital (Hours)		
Actual Destination - Transporting		
Date of Arrival at Referring Hospital (2nd)		
Time of Arrival at Referring Hospital (2nd)		
Date of Transfer from Referring Hospital (2nd)		
Time of Transfer from Referring Hospital (2nd)		
Transport Agency (2nd)		
Transferring Facility (2nd)		
Facility Type (2nd)		

Length of Stay in 2nd Referring Hospital (Hours)		
Actual Destination (2nd)		
Vital Sign Designation (1st or 2nd Referring)		
Unassisted Respiratory Rate		
Systolic Blood Pressure		
Glasgow Coma Score		
Revised Trauma Score		
Date of Hospital Discharge	Hospital Discharge Date, Time	
Hospital Length of Stay (Days)	Total Hospital Length of Stay	
Final Outcome - Dead or Alive		
Length of Stay in Intensive Care Unit	Total ICU Length of Stay	
Hospital Discharge Disposition	Hospital Discharge Disposition	
Autopsy Identification Number		
Injury Diagnosis ICD9-CM Code	Injury Diagnoses	
AIS-90 Severity Value		
AAAM Full Code (AIS)		
Body Part Injured		
Injury Severity Score	Injury Severity Score	
Probability of Survival		
Location of Procedure Performed		
Procedure Performed (ICD9-CM Code)	Hospital Procedures	
Non-Injury Complications (per NTDB list)	Hospital Complications	
Primary Payor	Primary Method of Payment	
Secondary Payor		
Total Hospital Charges		
Total Reimbursements		

Appendix D: Sample Data Tables to Asses Trauma Systems Performance Needs

This appendix identifies tables that may be generated by BEMSTS, with available data, which characterize attributes of trauma care that may be affected by implementation of a trauma system. The purpose of these tables is to identify (or trend) areas of trauma system care that may be assessed to guide further development of a statewide trauma system.

Tables Generated using the Available Trauma Registry

1. Injury and demographic characteristics of patients transported to a Level-1 Trauma Center (via EMS) and discharged from the ED (or in less than 24 hours).
2. Characteristics of patients who are over-triaged to a Level-1 Trauma Center based upon an ISS less than 16.
3. Transport characteristics (e.g., transport time) of patients arriving (via EMS) hypotensive or hypoxic, based upon presenting ED vital signs.
4. Elapsed time in local hospital before inter-hospital transfer to Level-1 Trauma Center stratified by hospital (blinded if necessary).
5. Injury Zip Code for patients with transport times (from scene to Level-1 arrival) greater than 30 minutes.
6. Average "on-scene" time for patients transported by EMS with an ISS greater than 15 stratified by injury type and/or EMS service (blinded if necessary).
7. Injury and patient characteristics for patients dying in a Level-1 Trauma Center stratified by mode of EMS arrival (inter-facility transfer vs. direct transport) and transport time.
8. Injury characteristics of patients admitted to local hospitals then, not transferred to a Level-1 Center in less then 10 hours.
9. Outcome (and hospital LOS) for patients admitted to a Level-I Trauma Center but injured in rural vs. urban Zip Codes.
10. Comparison of documented field triage criteria by ISS and outcome for patients transported from the field to a Level-I Trauma Center.

Tables Generated using Hospital Discharge Data (e.g., UB-92)

1. Injury and geographic characteristics (e.g., Zip Code or county) of patients discharged (alive or dead) from non-trauma centers with ISS $\geq$ 16.
2. Comparison of over-triage (ISS < 16 and transport to a Level-I Trauma Center) and under-triage triage (ISS $\geq$ 16 and discharged from a non-designated hospital).
3. ICD-9-CM codes resulting in injury death in non-designated hospitals stratified by patient age.

Table to Validate the Completeness of the Trauma Registry Dataset

1. Comparison of the number of patients contained in the trauma registry with patients contained in the hospital discharge data meeting trauma

registry inclusion criteria. This database comparison will estimate how many patients fulfilling registry inclusion criteria are not include statewide registry by Level-I Trauma Center.