State Trauma Advisory Board
2009 Annual Report

Arizona Department of Health Services
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State Trauma Advisory Board
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CURRENT MEMBERS OF THE STATE TRAUMA ADVISORY BOARD (STAB)

The following is a list of the talented professionals and citizens who serve the State of Arizona on trauma-related advisory board activities, giving of their time and expertise and providing invaluable guidance for the Arizona Trauma System. We thank them for their many contributions to the Arizona Department of Health Services, and their efforts on behalf of the citizens of Arizona.

Bentley J. Bobrow, M.D., Chairman
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Trauma Center Representative
Banner Good Samaritan Regional Medical Center
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Flagstaff Medical Center -- Flagstaff, AZ

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Statewide Neurosurgical Society -- Flagstaff, AZ

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Department of Public Safety Representative
Department of Public Safety -- Phoenix, AZ

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Yuma Regional Medical Center -- Yuma, AZ

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Rural Base Hospital not a Trauma Center – Representative
Summit Healthcare Regional Medical Center -- Show Low, AZ

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Statewide Hospital Association Representative
Arizona Hospital and Healthcare Assoc. -- Phoenix, AZ

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St. Joseph's Hospital and Medical Center -- Phoenix, AZ

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National Organization of Emergency Physicians
Representative
Scottsdale Healthcare/Osborn -- Scottsdale, AZ

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Fire Dept – County with a Population of Five Hundred
Thousand Persons or More – Representative
City of Tucson Fire Department -- Tucson, AZ

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Southwest Ambulance -- Mesa, AZ

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Statewide Rehabilitation Facility Representative
Mountain Valley Regional Rehab Hospital -- Prescott, AZ

Mark Venuti, CEP
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Guardian Medical Transport -- Flagstaff, AZ

Terry Welker, Fire Chief
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Banner Thunderbird Medical Center -- Glendale, AZ

Linda Worthy, R.N.
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John C. Lincoln North Mountain Hospital -- Phoenix, AZ

Michelle Ziemba, R.N., MSN
Regional EMS Council – Southeastern Region
Representative
University Medical Center -- Tucson, AZ

CURRENT MEMBERS OF THE ARIZONA TRAUMA SYSTEM QUALITY ASSURANCE AND SYSTEM IMPROVEMENT COMMITTEE (AZTQ)

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Rural Representative
Flagstaff Medical Center -- Flagstaff, AZ

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Linda Worthy, R.N.
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Trauma Services Representative -- Phoenix, AZ

Michelle Ziemba, R.N., MSN
University Medical Center's Trauma
Services Representative -- Tucson, AZ

INTRODUCTION

This annual report summarizes the State Trauma Advisory Board's (STAB) accomplishments over the past year, provides recommendations, and describes future challenges for the Arizona Trauma System.

STAB was established by the Arizona Legislature through passage of House Bill (HB) 2077, adding § 36-2222 to the Arizona Revised Statutes (A.R.S.). HB 2077 was chaptered into Arizona Laws and signed by the Governor on April 21, 1994. STAB held its inaugural meeting on September 23, 1994, and has since expertly served as an advisory body to the Director of the Arizona Department of Health Services (ADHS). STAB is comprised of health care professionals from hospitals and prehospital care agencies, and individuals representing the public appointed by the Director of ADHS. STAB is mandated by statute to: (1) make recommendations on the initial and long-term processes for the verification and designation of Trauma Center levels, including the evaluation of Trauma Center criteria; (2) make recommendations on the development and implementation of comprehensive regional emergency medical services and trauma system plans; (3) make recommendations on the state emergency medical services and trauma system quality improvement processes, including the state trauma registry; and (4) submit an annual report to the Director of ADHS on or before October 1 regarding the STAB's accomplishments and recommendations.

Injury continues to be the third leading cause of death in Arizona. A systematic and integrated approach to trauma care, including injury prevention, access to state of the art trauma care, and an on-going robust reporting and data analysis system for continued quality improvement, provides the best means to protect the public from the enormous toll of traumatic injuries. An integrated state EMS and trauma system assures that trauma victims receive appropriate field stabilization, triage and transport to the most appropriate level of trauma care in the shortest possible time. The coordinated infrastructure must be in place to deliver the "right" patient to the "right" facility in the "right" amount of time, and utilize the necessary resources to return the trauma victims to the highest level of function possible.

LEADERSHIP

In June of 2007, a multi-disciplinary group of experts from the American College of Surgeons Trauma System Consultation (ACS) group conducted a three-day review of the Arizona Trauma System. In addition to reviewing a comprehensive Pre-Review Questionnaire, the group heard approximately 12 hours of testimony from the EMS and trauma system stakeholder community. Following the conclusion of the review, the ACS prepared a report on Arizona's trauma system which includes a list of recommendations for enhancing the system. A copy of the ACS report is available at http://www.azdhs.gov/bems/trauma.htm.

The ADHS Bureau of EMS and Trauma System (Bureau) has made progress towards achieving several of the ACS system consultation groups' recommendations and has published an 18 month post-ACS review progress report (Appendix A).

TRAUMA SYSTEM DEVELOPMENT

Trauma Center Designation - Status Update

Arizona Trauma Center designation is available at Levels I, II, III, and IV. Designation as a Level I Trauma Center requires that facilities make available the highest level of resources and capabilities, while designation as a Level IV Trauma Center requires more limited resources and capabilities while still assuring high quality trauma care. There are currently eight designated Level I Trauma Centers and six designated Level IV Trauma Centers in Arizona (Appendix B). While no health care institution has yet applied for Level II or Level III Trauma Center designation, the Bureau continues to work with several hospitals that are considering Level III Trauma Center designation.

Hospitals designated as Level I Trauma Centers receive funding from the 2002 public initiative, Proposition 202. It was as a result of Proposition 202 that the Trauma and Emergency Services Fund was established pursuant to A.R.S. §36-2903.07. Ninety percent (90%) of this fund is distributed to Level I Trauma Centers for unrecovered trauma readiness costs, and ten percent (10%) of the fund is distributed to hospitals for unrecovered costs attributable to providing emergency services. The fund is administered by the Arizona Health Care Cost Containment System (AHCCCS).

The original seven self-designated Level I Trauma Centers in Arizona were grandfathered into Level I status under rules promulgated in 2005. The grandfather clause provided a 36-month timeframe for these seven health care institutions to prepare for and receive an on-site review by the American College of Surgeons Committee on Trauma (ACS-COT). The ACS-COT reviews each hospital's resources and capabilities for ACS Trauma Center verification or state Trauma Center designation. The hospitals receiving state Level I designation continue to be reimbursed for unrecovered trauma readiness costs. Six of the seven original Level I Trauma Centers have successfully undergone the mandatory ACS review and one remains pending at this time.

Phoenix Children's Hospital is the state's only free-standing children's hospital and is the newest hospital to be recommended by the ACS for Level I Trauma Center verification. Official verification is pending as of the writing of this report.

Trauma Workgroup Activities

Based upon state and national events, the STAB formed three workgroups to assess and evaluate potential changes to Arizona's current trauma system. A brief description of each group and their purpose are as follows:

1) Field Triage and Transport

This workgroup was formed to review the current Field Triage Decision Scheme and determine what changes could be made to assist prehospital providers, nurses, and physicians in determining the most appropriate destination facility for injured patients; particularly with the addition of six Level IV Trauma Centers to date, and Level III's expected in the near future. This group met for several months and provided recommendations to the STAB for adoption at its September 2009 regular meeting. A copy of the document is included in this report (Appendix C).

2) Air Ambulance vs. Ground Ambulance Transport for Trauma Patients

This workgroup was formed to develop guidelines for prehospital providers, nurses, and physicians to facilitate trauma patient transports using the appropriate mode of transportation based on the patient's injuries and situation. Based on data obtained from the Arizona State Trauma Registry, the Bureau believes that an analysis of the structure of the transport system is necessary to optimize the use of the current transport infrastructure. While the causes of over-utilization of air ambulance and/or under-utilization of ground ambulance are complex, there are statutory/regulatory components that require attention. The recommendations forwarded by this workgroup to the STAB are attached (Appendix D). The final approved document will be distributed statewide to the stakeholders and to the four EMS Regional Councils.

3) Quality Assurance and Training

When the recommendations from the Triage and Transport and Air vs. Ground Transport workgroups are adopted by the STAB, the Quality Assurance and Training Workgroup will focus on the education and training needed to ensure all prehospital providers, nurses and physicians in the trauma care arena receive the latest guidelines. This will provide a forum to answer questions, and establish processes to track and evaluate implementation of new recommendations.

Increasing the Number of Designated Trauma Centers - Road Show

A substantial amount of time and effort in 2009 was directed towards increasing the number of hospitals formally participating in the Arizona Trauma System. The Bureau has been innovative in its approach to increasing participation of hospitals in the trauma system. The focus has been, and remains, on increasing the access of citizens living in rural Arizona to structured trauma care.

Bureau staff continues to offer interested hospitals a "Road Show" presentation which provides hospital administrators with information and education related to the benefits of formal state Trauma Center designation. These presentations are tailored to each hospital utilizing data from their referral area.

The financial analysis provided uses different cohorts of patients. The first cohort allows the Bureau to estimate potential revenue available only to designated Trauma Centers associated with trauma team activation for injured patients seen in the target hospital's emergency department or admitted to the hospital.

The second cohort allows the Bureau to estimate potential revenue associated with minor and moderately injured patients that could be treated at the target hospital were they to become a designated Trauma Center. In many cases, the target hospital is bypassed and injured patients are transported and treated in a Level I Trauma Center in Tucson, Flagstaff Scottsdale or Phoenix.

The Bureau then calculates costs associated with Trauma Center designation (salary, benefits package, education, travel) and deductions from revenues (write downs, write offs, contract rates). These costs are then deducted from gross revenue allowing the Bureau to estimate net revenue. This provides a conservative financial estimate for the targeted hospital and educates hospital administration on how to undertake a more detailed analysis utilizing their records.

During the past year, Bureau staff traveled and delivered on-site presentations (termed "Road Shows") to seven hospitals. Additionally, Bureau staff have also worked directly with nine Critical Access Hospitals, and consulted with a number of other hospitals on Trauma Center designation. In less than 12 months, as a result of this education and outreach, six rural hospitals have been designated as Level IV Trauma Centers, with one application pending an on-site review. All six hospitals meet the resources and capabilities necessary for the provision of trauma care to injured patients. During the course of the designation process, we ensure that staff from the rural hospitals network closely with the Level I Trauma Centers to which they refer critical trauma patients for a higher level of care. During the actual on-site survey to a Level IV applicant hospital, a trauma surgeon and a trauma program manager from a Level I Trauma Center help conduct the survey and provide expertise to the Level IV hospital staff. The communication between hospitals for trauma patients is essential. Each of these hospitals plays a key role and is a critical link in the chain of survival for trauma patients in Arizona.

Letters have been sent to all hospital emergency departments, prehospital agencies and the affected Regional EMS Councils in the state to inform them of the newly designated Level IV Trauma Centers.

We intend to continue to offer the "Road Show" to Arizona hospitals and are optimistic in adding several Level IV and Level III Trauma Centers in 2010.

University of Arizona's Rural Health Office - Grants for Critical Access Hospitals - Level IV Trauma Center Designation

The University of Arizona's Rural Health Office continues to offer to Critical Access Hospitals (CAHs) small grants for those CAHs interested in state designation as Level IV Trauma Centers. Of the current Level IV Trauma Centers, three are CAHs that applied for and received the grant funds. We are working with the staff from two additional CAHs to assist them in meeting all of the requirements for Level IV designation

Trauma Referral Tool

With the assistance of the EMSystem Manager in the Bureau of Public Health Emergency Preparedness, the Bureau of EMS and Trauma System has developed a trauma referral quality improvement tool that is now available to all emergency departments through the web-based EMSystem. The purpose of this one-page tool is to collect information from health care institutions concerning the trauma patient transfer process to the state's designated Trauma Centers. All emergency departments in the state have access to and use the EMSystem to update the status of certain hospital services and components in the event of hospital diversion or a disaster. We have asked emergency departments to complete this brief tool for every trauma patient transferred from the reporting facility to a designated Trauma Center. Completion of the tool should provide the Bureau with important information for evaluating the current process. The intent of this tool is to not collect patient or health care institution information, but rather to ascertain the numbers of trauma patient transfers, the communication requirements for each, and the timeliness of the transfers so that we can identify potential improvements for the transfer process.

In addition to the trauma referral tool, the EMSystem Level I Trauma Center pages have been updated to provide the most current contact information. This will save other hospitals valuable time when needing to contact a Level I concerning an imminent trauma patient transfer.

INFORMATION SYSTEMS

Arizona State Trauma Registry

As noted last year, new rules effective January 12, 2008, aligned the ASTR with the National Trauma Data Standards. The rules include trauma patient inclusion criteria, minimum data element requirements and provisions for trauma registry data quality assurance. The benefits of these changes is that data is more comprehensive and of better quality, rendering a more accurate reflection of trauma in Arizona. For example we are now better able to describe the impact of trauma on the geriatric population by including patients that experienced a fall with specific injury patterns.

Other changes have led to an increase in the volume of trauma cases in the registry. Phoenix Children's Hospital now contributes additional trauma cases as does Yuma Regional Medical Center.

The Bureau, particularly the Trauma Data Manager, has made strides to ensure the quality of data is much improved for 2008 and forward. Individual data checks have been performed greatly reducing the number of blank fields and yielding more accurate data. This form of data validation is the pre-cursor to logic validations which are expected in 2009 to further improve the data quality thereby improving reporting quality.

This report contains data from seven Level 1 Trauma Centers and three non-designated facilities as well as one Level IV Trauma Center reporting only for the second half of 2008 (Appendix E). The number of reporting facilities will grow significantly in 2009 as five additional designated Level IV Trauma Centers will begin reporting.

Arizona State EMS Registry

The Bureau is developing the web-based Arizona EMS Database and Quality Assurance (QA) Program to capture standardized prehospital care data in a format consistent with the National EMS Information System (NEMSIS) of the National Highway Traffic Safety Administration (NHTSA). The database and the quality assurance component comprise the Arizona Premier EMS Agency Program (PEAP) The PEAP is essentially a quality improvement program centered on four diseases:

- Out–of–Hospital Cardiac Arrest
- Stroke
- STEMI
- Trauma

Participating agencies must ensure administrative support for the QA process, identify a QA manager, review all cases associated with the target diseases, and if possible, submit electronic patient care reports to the Arizona EMS Database.

The Arizona EMS Database, in its final configuration, will have interoperability with the Arizona State Trauma Registry (ASTR), the Arizona Department of Health Services (ADHS) Hospital Discharge Database and Emergency Department Database, the ADHS S.H.A.R.E (cardiac arrest) and A.S.P.I.R.E. (stroke) databases, and the Arizona Department of Transportation (ADOT) Crash Data.

The Arizona EMS Database, in conjunction with the other patient care databases, will assist the Bureau in modifying existing and introducing new treatment protocols and guidelines to

promote a regionalized EMS and trauma system that ensures each patient receives the right level of care at the right facility in the right amount of time.

The PEAP will also enable the Bureau and individual EMS agencies to evaluate, measure, and improve targeted performance measures via an evidence-based approach. EMS agencies will be able to compare their individual performance against aggregated regional and statewide performance. To facilitate the process, the Bureau will be able to generate standard reports and special reports on request, as well as enable individual EMS agencies to generate their own reports.

Public Health Data Reporting

The value of a trauma registry can be seen in how the data are used. The Data & Quality Assurance Section of the Bureau has produced many valuable reports this year including a "Golden Hour" report which describes access to trauma care by zip code, an "Under/Over Triage report describing the destination of injured patients stratified by injury severity, and a "Mode of Transport" report that describes the use of air/ground ambulances stratified by injury severity and mortality. Each of these reports has been instrumental in informing stakeholders and Bureau staff as they consider policy decisions. To view these reports refer to http://www.azdhs.gov/bems/TraumaServices.htm.

In addition, the DQA section provided each Trauma Center with quarterly reports about their performance on a number of system indicators benchmarked against the aggregate of Trauma Centers. They have also responded to public queries, developed ad-hoc reports and contributed to this report.

CONCLUSION

Many talented and dedicated professionals participate in Arizona's trauma system. A truly inclusive statewide trauma system relies on the collection of data and the participation of all hospitals for the systematic care of trauma patients. The Bureau will continue to strongly encourage hospitals to formally participate in the Arizona Trauma System and to conduct on-going trauma system evaluation to assure the highest level of care in Arizona.

Bureau of EMS and Trauma System

Progress on Achieving the American College of Surgeon's Recommendations - 18 months post review

Background: In June of 2007, a multi-disciplinary group of experts from the American College of Surgeons Trauma System Consultation (ACS) group conducted a three-day review of the Arizona Trauma System. In addition to reviewing a comprehensive Pre-Review Questionnaire (PRQ), the group heard approximately 12 hours of testimony from the EMS and trauma system stakeholder community. Following the conclusion of the review, the ACS prepared a report on Arizona's trauma system which includes a list of recommendations for enhancing the system. This document reports on progress made to some of these recommendations. A copy of the ACS report is available on the following website: http://www.azdhs.gov/bems/trauma.htm.

Leadership

Recommendation 1: Establish and fund a trauma medical director position to work under the guidance of the Bureau Chief.

Progress: In October of 2008, then Governor Napolitano released an Executive Order directing BEMSTS to accomplish three activities:

1. Hire a Trauma Medical Director;
2. Increase the number of rural hospitals that formally participate in the State's trauma system;
3. Increase the number of hospitals that submit data to the Arizona State Trauma Registry.

While the Department was under a hiring freeze at the time, the Bureau moved forward and developed a position description for the trauma medical director. Due to the hiring freeze and budget deficit the trauma medical director position could not be filled. The current Bureau EMS medical director position, which was funded at 40%, has been increased to 75% effective March 1, 2009. Dr. Bobrow will continue to serve as the EMS Medical Director and serve as the trauma medical director performing trauma system development activities.

Recommendation 2: Reevaluate the disparity between EMS and trauma system staffing within BEMSTS.

Progress: It is evident that program funding increases in this fiscal environment are unlikely and that increasing the fte numbers established by the Legislature beyond the current 4 is unlikely. Therefore the Bureau performed a strategic evaluation of its current staffing and position descriptions to identify opportunities to spread trauma system development activities among the existing workforce or to consolidate duplicated activities into a more efficient structure.

- 4 additional BEMSTS staff has been trained to participate in Level IV Trauma Center site surveys.
- 1 additional fte (trauma program coordinator) is funded through the trauma appropriation. This position is currently vacant and will not be filled until the hiring freeze is lifted and the funds are available.
- All BEMSTS data collection and quality improvement activities have been consolidated into a single section – the Data and Quality Assurance Section. On paper, this appears to be an fte loss for the trauma program, but this does not take into account efficiency gained Bureau wide by consolidating these specialized activities into a single group. Additionally, this ensures that all DQA initiatives benefit from the confidentiality and HIPAA protections associated with the development of this section.

Additionally, the trauma section is no longer burdened with the intensive data reporting requirements that it was previously required to complete, freeing staff to concentrate on other initiatives.

System Development

Recommendation 3: 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;

Progress: Essentially no progress has been made. While BEMSTS staff completed this activity internally two years ago, this activity will be effective only with broad stakeholder involvement. Optimally, this would be a facilitated event that requires participants to commit to a one and a half day meeting.

Recommendation 4: 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;

Progress: The Bureau has been innovated in its approach to increasing participation of hospitals in the trauma system. Our focus has been, and remains, on increasing the access of citizens living in rural and frontier Arizona to structured trauma care. We continue to work closely with the University of Arizona's Rural Health Office that is providing some seed money to Critical Access Hospitals. Additionally, BEMSTS staff has:

- Sent letters to 10 rural hospital CEOs offering to provide a Trauma Center designation technical assistance site visit.
- Developed an innovative cost/benefit analysis utilizing data from the hospital and emergency department discharge databases and the Arizona State Trauma Registry (ASTR). This tool provides realistic social and financial cost and revenue analysis that is specific to the facility.
- In addition, BEMSTS staff has performed several pre-review visits to interested hospitals.

Importantly, as of April 1, 2009 the citizens of Arizona are now served by 8 Level I Trauma Centers and 4 Level IV Trauma Centers – an increase of over 50% from this date last year. As of this report, there are two more applications pending for designation as Level IV Trauma Centers.

Recommendation 5: Develop a working document to project the potential number and location of additional Trauma Centers by level. See response to Focus Question #1.

Progress: Although the Bureau has worked to recruit hospitals to become designated Trauma Centers, projecting the number and location of additional centers by level has not been done. Arizona's trauma system is a voluntary system. The Bureau has no authority to require participation but we continue to actively pursue new participants in rural Arizona.

Recommendation 6: 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.

Progress: The existing plan needs to be updated. This will flow from the assessment described in recommendation # 3.

Recommendation 7: Revise regional contracts to include specific trauma program requirements which support the objectives outlined in the Arizona Trauma System Plan.

Progress: Contract deliverables allow for some leeway. Regions are very cooperative and continue to conduct needs assessments including basic trauma information. BEMSTS is working with Regions to provide brief, reliable needs assessment for statewide use.

Recommendation 8: Annually evaluate and report the status of EMS and trauma system development at regional and state levels.

Progress: BEMSTS staff regularly attends the regional meetings and routinely updates the groups on EMS and trauma system initiatives. An annual report is also developed for the Department Director that provides updates and accomplishments of trauma system status and activities. The annual report is available on the trauma website and also distributed to a number of individuals by the Director's Office staff.

Recommendation 9: Tie trauma system compliance by EMS agencies and providers to the issuance of operational licenses and funding eligibility.

Progress: We believe that this recommendation is not reflective of the progress that Arizona has made and intend to continue our use of a consensus driven approach to system improvement.

Recommendation 10: Through the acute care hospital and critical access hospital licensure process, require participation in the state trauma registry at appropriate levels.

Progress: Designation and the submission of trauma data are voluntary. Data submission is only mandatory if the facility is designated as a Trauma Center at any level. To require participation in the registry would require statutory change. The Bureau will continue to seek to increase the number of facilities that contribute data to the trauma registry

Legislation

Recommendation 11: Provide stable funding for all levels of Trauma Center designation and participation.

Progress: This is very unlikely for some time due to Arizona's significant budgetary issues.

Recommendation 12: Develop guidelines for system quality/performance improvement to ensure that they are conducted in a manner that maximizes protections afforded in existing statutes (A.R.S. §§ 36-2403 & 36-2404).

Progress: Ongoing. The Bureau has established a Data and Quality Assurance Section to handle all aspects of quality improvement, data collection, evaluation, and reporting (see progress note on recommendation 2).

Recommendation 15: Seek Legislative authority to coordinate all sources of trauma system funding through ADHS/BEMSTS.

Progress: This would require statutory change. Proposition 202 funding (gaming revenue) is administered by AHCCCS.

Finances

Recommendation 18: 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.

Progress: Additional financial information is now being collected via hospital databases and will be forthcoming in the form of hospital charges not costs. The ASTR is also collecting some information in relation to trauma charges.

Recommendation 19: Consider alternate methods of distribution of the Tobacco Tax to provide for trauma system support as intended.

Progress: Tobacco tax monies (Proposition 303) were subject to appropriation by the legislature. The legislature chose to apply these funds to expand AHCCCS eligibility.

Recommendation 20: Develop limits commensurate with Trauma Center level for readiness cost and uncompensated care to maximize trauma funding.

Progress: AHCCCS is the agency mandated to administer the Trauma and Emergency Services Fund.

Human Resources (Workforce Resources)

Recommendation 29: Ensure that Trauma Center staff and other trauma system providers are represented in forums/councils for statewide resource and work force issues.

Progress: Trauma stakeholders are invited and do participate in many EMS and trauma-related activities. Additionally, each region conducts an annual assessment, including workforce issues.

Recommendation 34: Monitor current staffing pattern in the BEMSTS trauma program and anticipate increased needs.

Progress: See progress note on recommendation 2.

Education

Recommendation 36: Expand web-based and teleconferencing capabilities to deliver trauma education to all trauma care providers.

Progress: The Arizona Trauma and Acute Care Consortium provides quarterly trauma grand rounds before the business meeting. All presentations are available free at www.aztracc.org and continuing medical education credit is awarded after taking a post-test.

Prehospital Care (Emergency Medical Services Management Agency)

Recommendation 40: Increase the FTE allocation for the state EMS medical director and secure a position for the state trauma medical director.

Progress: ADHS has increased the EMS medical director's hours to provide coverage for trauma.

Ambulance and Non-Transporting Medical Unit Guidelines

Recommendation 47: Establish regulatory oversight of non-transporting units.

Progress: This would require statutory change as the Bureau does not regulate fire departments and fire districts unless they are transporting agencies. The Bureau actively participates in meetings with municipal and district first responder agencies.

Recommendation 50: Develop a "one call does it all" approach for trauma transfers.

Progress: Most of the Level I's have instituted changes internally to their systems, which should alleviate some of the issues with getting authorization to transfer a patient. The Bureau has implemented a web-based methodology for hospital personnel to anonymously report both positive and negative scenarios related to trauma transfers.

Definitive Care Facilities (Trauma Care Facilities)

Recommendation 58: 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.

Progress: The Bureau has been innovative in its approach to increasing participation of hospitals in the trauma system. Our focus has been, and remains, on increasing the access of citizens living in rural and frontier Arizona to structured trauma care. We continue to work closely with the University of Arizona's Rural Health Office that is providing some seed money to Critical Access Hospitals. Additionally, BEMSTS staff has:

- Sent letters to 10 rural hospital CEOs offering to provide a Trauma Center designation technical assistance site visit.
- Developed an innovative cost/benefit analysis utilizing data from the hospital and emergency department discharge databases and the Arizona State Trauma Registry (ASTR). This tool provides realistic social and financial cost and revenue analysis that is specific to the facility.
- In addition, BEMSTS staff has performed several pre-review visits to interested hospitals.

Importantly, as of April 1, 2009 the citizens of Arizona are now served by 8 Level I Trauma Centers and 4 Level IV Trauma Centers – an increase of over 50% from this date last year. As of this report, there are two more applications pending for designation as Level IV Trauma Centers.

Recommendation 59: 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.

Progress: BEMSTS, through the Data and Quality Assurance Section, is beginning to look at injury incidence by zip code, patient volume and I.S.S, the trauma system is a voluntary system. BEMSTS staff will use this information as we identify and target our outreach efforts to recruit additional Trauma Centers.

Recommendation 60: 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)

Progress: When STAB was approached about revisions to mirror ACS after the new "green book" was distributed, it suggested that we not make changes to the state designation criteria. If we pursue the changes, it will require rulemaking.

Recommendation 61: 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).

Progress: Diversion and ambulance off-load delays have decreased significantly in Arizona. This is likely related to lighter than normal influenza loads and also to

increased analysis of data, improved communication and the development of standards for diversion. More work needs to be done.

Interfacility Transfer

Recommendation 62: Develop a model transfer agreement and disseminate to all Trauma Centers, other acute care facilities, pediatric hospitals, spinal cord injury centers, and rehabilitation hospitals. Sample agreements placed on web-site for other facilities to use.

Progress: Hospitals, particularly the Trauma Centers, have transfer agreements in place as developed by the hospital attorneys. BEMSTS has placed three sample transfer agreements on the trauma web page.

Recommendation 63: Encourage implementation of transfer agreements between appropriate hospital pairs.

Progress: Many of the hospitals have established referral patterns for a higher level of care and therefore have transfer agreements in place with those hospitals.

Medical Rehabilitation

Recommendation 66: Integrate outcome data from each rehabilitation center with State Trauma Registry to benchmark functional outcomes with the acute phase of care.

Progress: Rehabilitation centers do not submit data to the trauma registry.

Recommendation 67: 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).

Progress: Designated Trauma Centers are required to have transfer agreements with rehabilitation facilities if they don't provide rehab in-house.

Information Systems

Recommendation 68: The Arizona State Trauma Registry should expand its reach to include all acute care hospitals in the state.

Progress: Non-designated hospitals may voluntarily submit data to the registry. There is no requirement for all acute care hospitals to submit data. A statutory change would be needed to require all hospitals to report.

Recommendation 69: 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.

Progress: This has been accomplished.

Recommendation 70: 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.

Progress: Currently, the AZTQ is the quality assurance group for the trauma registry audit process, Plans are in place to develop an EMS audit group in the near future. Only blinded data may be shared with the regional EMS Councils.

Recommendation 71: 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).

Progress: This is a goal of the Bureau.

Recommendation 72: 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.

Progress: Bureau reorganized to add a new Data and QA Section with staff. Please see the response to recommendation # 2

Evaluation

Recommendation 73: Maximize the protections afforded in existing statutes pertaining to the STAB and, more specifically, the AZTQ subcommittee 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.

Progress: Current statutes are sufficient.

Recommendation 74: Use existing data sets, within their functional limits, to help frame and answer system questions.

Progress: Ongoing.

Recommendation 75: 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.

Progress: Ongoing. See progress note for recommendation 2.

Recommendation 76: 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.

Progress: The Bureau continues to actively recruit additional participants in the trauma registry. In addition, we utilize hospital discharge data and emergency department data to help describe the nature and impact of trauma on the citizens of Arizona. The Premier EMS Agency program, a diseased based EMS registry will play a key role once established.

Research

Recommendation 78: 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.

Progress: The Arizona Trauma and Acute Care Consortium (AZTrACC) exists for this purpose as well as educating interested individuals in trauma care through grand rounds and continuing medical education opportunities.

Recommendation 79: Integrate injury research into regional EMS council activities, encouraging them to structure formal investigations, where possible, with an eye towards expansion into publishable research.

Progress: Interested individuals/hospitals moving forward with research opportunities using ADHS data. Bureau staff participate in the Injury Prevention Coalition and help shape priority areas.

Recommendation 81: Revisit confidentiality policies associated with the release of state trauma registry data and bring those policies into alignment with other state health-related datasets.

Progress: Statutory changes made in 2008 allow the use of confidential trauma registry data for research purposes. The statutory language was written using similar language from other registries in the Department of Health Services.

Arizona Focused Questions

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

Financial:
Fund rural Trauma Centers (CAH) through the Office of Rural Health, Rural Hospital Flexibility Grant Program (FLEX).

Progress: The Office of Rural Health has provided small grants to rural hospitals for Level IV Trauma Center designation.

Non-financial:
Require CAH, as part of their licensing, to be verified at the appropriate level as designated Trauma Centers and contribute to the trauma registry database.

Progress: This would require statutory change. BEMSTS believes that by working with the Arizona Rural Health Office we can achieve significant progress without statutory change.

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.

Progress: This is being done with very positive results. Thus far, 4 Level IV designations have been made with two applications pending.

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.

Progress: This would require statutory change.

Seek FLEX funding to promote grassroots public education campaign to encourage the development of Trauma Centers in rural and remote areas of Arizona.

Progress: The Office of Rural Health has provided small grants to rural hospitals for Level IV Trauma Center designation. This was very successful.

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

No progress to date.

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 population? Please provide specific recommendations for improving the trauma system care for these patients.

Children:
Revise the state standards for designation of Trauma Centers for children using the pediatric Trauma Center requirements in the Optimal Resources for the Care of the Injured Patient 2006.

Progress: Current statutes and rules do not provide for a separate state pediatric Trauma Center designation. Pediatric requirements are included in the state criteria for those hospitals that accept pediatric trauma patients. The Arizona EMS for Children Program is actively pursuing a voluntary pediatric emergency department designation process with very broad support from the community. BEMSTS now performs an inventory of pediatric EMS equipment of every ambulance in the state on an annual basis.

Designate pediatric Trauma Centers.

Progress: Developing methodology and criteria.

Formalize the appointment of a pediatric surgery representative on STAB.

Progress: The Bureau was successful in acquiring additional specialty categories for the State Trauma Advisory Board. New laws 2008 included the appointment of a pediatric surgical representative to the Board. The ADHS Director appointed the Trauma Medical Director for Phoenix Children's Hospital - Dr. David Notrica.

Geriatric:
No progress to date.

Arizona State Designated Trauma Centers

Health Care Institution	Address	Effective Date	Expiration Date
Level I Trauma Centers			
Banner Good Samaritan Medical Center	925 East McDowell Road Phoenix, AZ 85006	11/17/08	11/17/11
Flagstaff Medical Center	1200 North Beaver Street Flagstaff, AZ 86001	05/27/08	05/27/11
John C. Lincoln - North Mountain	250 East Dunlap Avenue Phoenix, AZ 85020	04/23/08	04/23/11
Maricopa Medical Center	2601 East Roosevelt Phoenix, AZ 85008	12/28/05	12/28/08 (Renewal Pending)
Phoenix Children's Hospital **(Provisional Designation)**	1919 East Thomas Road Phoenix, AZ 85016	07/01/08	12/31/09
St. Joseph's Hospital & Medical Center	350 West Thomas Road Phoenix, AZ 85013	11/20/07	11/20/10
Scottsdale Healthcare - Osborn	7400 East Osborn Scottsdale, AZ 85251	10/26/08	10/26/11
University Medical Center	1501 North Campbell Avenue Tucson, AZ 85724	11/11/08	11/11/11

Health Care Institution	Address	Effective Date	Expiration Date
Level IV Trauma Centers			
Banner Page Hospital	501 North Navajo Page, AZ 86040	11/05/08	11/05/11
La Paz Regional Hospital	1200 West Mohave Road Parker, AZ 85344	06/02/09	06/02/12
Little Colorado Medical Center	1501 North Williamson Avenue Winslow, AZ 86047	03/10/09	03/10/12
Northern Cochise Community Hospital	901 West Rex Allen Drive Willcox, AZ 85643	12/04/08	12/04/11
Summit Healthcare Regional Medical Center	2200 Show Low Lake Road Show Low, AZ 85901	08/13/08	08/13/11
Tuba City Regional Health Care Corporation	P. O. Box 600 Tuba City, AZ 86045	05/06/09	05/06/12

DRAFT ARIZONA FIELD TRIAGE DECISION SCHEME WITH MARYLAND MODIFICATION

Measure vital signs and level of consciousness

Step One --- RAPID ASSESSMENT

Glascow Coma Scale	< 14 or
System blood pressure	< 90 or
Respiratory rate	< 10 or > 29 (< 20 in infant < one year)

YES → Transport to Trauma Center or specialty center per protocol; consider helicopter if quicker & of clinical benefit

NO → Assess anatomy of injury

Step Two --- INJURY

- All penetrating injuries to head, neck, torso, and extremities proximal to elbow and knee
- Flail chest
- Two or more proximal long-bone fractures
- Crush, degloved or mangled extremity
- Amputation proximal to wrist and ankle
- Pelvic fractures
- Open or depressed skull fracture
- Paralysis

YES → Transport to Trauma Center or specialty center per protocol; consider helicopter if quicker & of clinical benefit

NO → Assess mechanism of injury and evidence of high-energy impact

Step Three --- MECHANISM

- Falls
  - Adults: > 20 ft. (one story is equal to 10 ft.)
  - Children: > 10 ft. or 2-3 times the height of the child
- High-risk auto crash
  - Intrusion: > 12 in. occupant site; > 18 in. any site
  - Ejection (partial or complete) from automobile
  - Death in same passenger compartment
  - Vehicle telemetry data consistent with high risk of injury
- Auto v. pedestrian/bicyclist thrown, run over, or with significant (> 20 mph) impact
- Motorcycle crash > 20 mph

YES → Transport to Trauma Center per protocol. Patients within a 30 min drive time of the closest appropriate trauma/specialty center shall go by ground unless there are extenuating circumstances. Receiving Center Medical Consultation required when considering whether helicopter transport is of clinical benefit.

NO → Assess special patient or system considerations

Step Four --- CO-MORBIDITY

- Age
  - Older Adults: Risk of injury death increases after age 55
  - Children: Should be triaged preferentially to pediatric-capable trauma centers
- Anticoagulation and bleeding disorders
- Burns
  - Without other trauma mechanism: Triage to burn facility
  - With trauma mechanism: Triage to trauma center
- Time sensitive extremity injury
- End-stage renal disease requiring dialysis
- Pregnancy > 20 weeks
- EMS provider judgment

YES → Transport to Trauma Center per protocol. Patients within a 30 min drive time of the closest appropriate trauma/specialty center shall go by ground unless there are extenuating circumstances. Receiving Center Medical Consultation required when considering whether helicopter transport is of clinical benefit.

NO → Transport according to protocol.

WHEN IN DOUBT, TRANSPORT TO A TRAUMA CENTER

Modified from the American College of Surgeons (ACS) Committee on Trauma's Resources for Optimal Care of the Injured Patient 2006
Revised July 2009

STATE TRAUMA ADVISORY BOARD WORKING GROUP

RECOMMENDATIONS TO STAB 091709

I OVERVIEW

A representative group of ground, air and medical personnel met three times (3 hours each) this past summer with a primary focus on field trauma helicopter usage in the State of Arizona. The group divided into 2 subdivisions (most people attended both) with a focus on Safety/Operations/Cost Containment as well as Medical topics. Listed below are recommendations from this group.

II SAFETY, OPERATIONS AND COST CONTAINMENT - RECOMMENDATIONS

1. All flight programs (fixed and rotor wing) - CAMTS certified within two years of operating in the State of Arizona.

(Remaining items in section II pertain to rotor wing only)

2 Adopt 3 recommendations from the January 25, 2006 NTSB report
   a. All flights - Part 135
   b. Develop/implement flight risk evaluation programs
   c. Update dispatch and flight following to include weather and assistance within flight risk assessment decisions

3. Equipment
   a. Mandate the usage of night vision goggles when appropriate for night flying
   b. Traffic collision avoidance system (TCAS) - (Future consideration)

4. External communication
   a. Continuous monitoring of air-to-air frequency 123.025
   b. Transmission of location and intent when landing or taking off at an uncontrolled airspace (such as hospital or road) as follows:
      - Landing
        - 5 miles out
        - 1 mile out
        - Arrival
      - Departing
        - Departing
        - 1 mile out
        - 5 miles out
   c. Streamline dispatch communication processes
   d. Use predetermined ground frequency established by the EMS Regional Councils

5. Sterile cockpit
   a. Sterile cockpit is maintained 5 minutes out, below 300 feet AGL, or based on pilot discretion so that the pilot is able to transmit and receive vital information and to minimize distractions during any critical phase of flight.

b. No external communications are permitted by the medical team and no patient information is transmitted at this time. The pilot will announce to the medical crew members when sterile cockpit is to start and when it is to end. Pilots will announce his/her intentions – where the aircraft is and where the aircraft is going.

c. One crew member, at a minimum, will maintain outside vigilance during the critical phases of flight no matter what the clinical situation is with the patient including looking outside of the aircraft on the opposite of the pilot.

6. Landings - non-airport/hospital
   a. All agencies ensure crew members are trained and proficient in landing in the environments to which the crew members provide care.

   b. Hospital
      - Cold off-loads only unless extenuating circumstances – patient/pilot condition or ground conditions, etc. "cold off-loads are routine unless circumstances dictate otherwise".
      - For rare situation with hot off-loads at the hospital, hospital staff shall not approach the helicopter "unless requested by the flight medical crew" "unless deemed necessary by flight crew and flight crew escorts hospital staff to helicopter".

7. LZ Training – STAB and EMS Council (through STAB recommendations) develop a CE approved curricula regarding on line LZ Training for usage by EMS, hospitals and DPS.

III MEDICAL - RECOMMENDATIONS

1. Standby & Launch – Only dispatch, law enforcement and medical personnel can put on stand by or launch a helicopter; unless extenuating circumstances exist.
2. Cancellation – Only medical personnel on scene can cancel a helicopter (standby<->landing); unless extenuating circumstances exist.
3. Field Triage - Arizona Trauma Field Triage Decision Scheme (Draft Version 7/09) should be used with the following modification:
   i. Insert Maryland Field Decision Scheme (Revised Version 7/09) under each "Yes" box that refers to helicopter into its "respective" location in the Arizona Trauma Field Decision Scheme document (see Appendix C – the grey boxes are the inserted Maryland language)

IV FUTURE ADDITIONAL CONSIDERATIONS THAT MERIT EVALUATION

STAB should consider a working group/s to evaluate one or all of the below topics in more detail:

1. SAFETY, OPERATIONS AND COST CONTAINMENT

   a. Ambulance vs. Helicopter – Overall there appears to be a lack of ambulance options for transfer in parts of Arizona; especially rural areas. This reason may be multi-factorial including taking a local ambulance (typically fire department)

out of service, CON (ambulances are required to have local CONs and helicopters have no CON requirements) and other reasons. The group recognizes that helicopters have a role in Arizona especially with sicker patients; but flying very benign patients that could go by ground due to lack of ground option is expensive. How can this be improved?

2 MEDICAL

a. Consider regionalization of dispatch and flight following.

b. Consider the usage of the Revised Trauma Score as a Research and Evaluation tool required for all field personnel. The raw data is theoretically being captured now by Trauma One. Theoretically, the RTS could be the main decision tool for future decision of mode of transport.

c. Consider creating trauma interfacility mode of transport decision guidelines.

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

Trauma

Four-Year Trends in Arizona
2005-2008

Prepared by:
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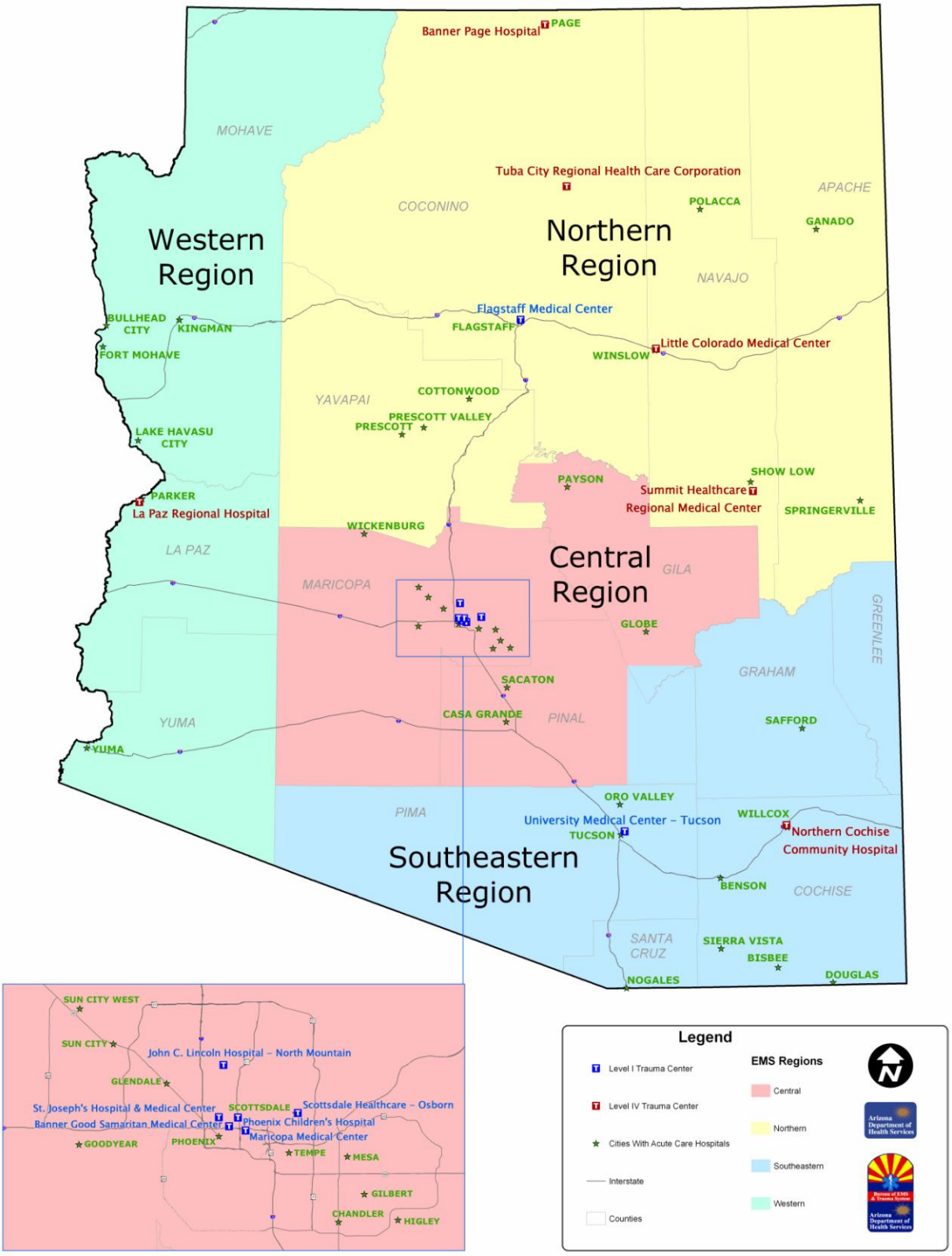
Data sources: Arizona State Trauma Registry, 2008
Arizona Hospital Discharge Database, 2008

EMS Regions and Trauma Centers



EXECUTIVE SUMMARY
2005-2008

- There were a total of 96,102 trauma patients reported to the Arizona State Trauma Registry during the years 2005-2008. The overall mortality rate for Arizona trauma patients has decreased from 3.7% in 2005 to 3.0% in 2008.

- Of the total 96,102 trauma cases, pediatric patients (aged 0-14 years) accounted for 23,918 cases, while geriatric patients (aged 65 years and older) accounted for 8,031 cases.

- Males accounted for the majority of trauma patients across all age groups.

- Overall, motor vehicle crashes were the predominant mechanism of injury each year. However, firearm injuries remain the most lethal mechanism of injury with a 14.1% overall mortality rate. Motor vehicle traffic related pedestrian injury had the second highest mortality rate at 7.9%, and motor vehicle traffic related other injuries third at 6.5%.

- In 2008, of the 25,733 total trauma cases, the number of patients who died due to traumatic injury was 768 with the highest fatality rate among those patients aged 85 years and older.

- The 15-17 year olds continue to have the highest trauma rates per 100,000 residents.

- One out of every four motor vehicle crash victim who was 21-44 years of age was either positive for alcohol or drugs, and one out of every five teenagers (15-17 years of age) was positive for drugs.

- Of the 96,102 Arizona trauma patients, 6,280 (6.5%) were victims of motorcycle crashes and 5,434 of these (86.6%) were male. For motorcycle crash victims between the ages of 15 and 24, there is a higher rate of testing positive for drugs than alcohol. One out of every four between the ages of 18 and 24 tested positive for drugs.

- Of the 6,280 motorcycle crash victims, 49% were wearing a helmet.

- Of the 38,054 Arizona trauma patients who were victims of a motor vehicle crash, 62.1% were using some form of passenger restraint. Restraint use among teens 15-17 years of age represent less than half the frequency as the reference population. Those testing positive for alcohol or drugs are 70% and 60%, respectively, less likely to use restraints as compared to those who tested negative.

- Mode of transportation to a Trauma Center: During 2005-2008, of the 67,105 trauma patients transported from the scene of injury to a facility participating in the ASTR, 16,086 were transported by air ambulance (24%) and 51,019 were transported by ground ambulance. Of all patients transported by air ambulance, 52% had an Injury Severity Score of < 9, which is indicative of a mild injury and 43% of these patients were discharged home from the emergency department or from the hospital within 24 hours.

Arizona Trauma System
2005-2008

ACKNOWLEDGEMENT

The Arizona Department of Health Services' Bureau of Emergency Medical Services and Trauma System (Bureau) wishes to acknowledge the hard work and dedication of the many individuals involved in the Arizona Trauma System and working to improve patient outcomes. We would especially like to thank the Trauma Centers, Trauma Directors, Trauma Managers and Trauma Registrars for contributing and working hard to continuously improve the data collection processes in order to evaluate traumatic injuries in Arizona.

This report summarizes data compiled from the Arizona State Trauma Registry (ASTR) for the 2005-2008 calendar years. This report is not representative of all trauma patients statewide as it does not include deaths at the scene or patients treated exclusively at non-reporting hospitals.

TRAUMA RATES BY COUNTY - SUMMARY

During the years 2005-2008, 96,102 trauma patients were treated at Arizona Trauma Centers. More than half of the patients (54%) were injured in Maricopa County. Pima County had the second highest number of injured patients (17%); no other county comprised more than 7% of the total patients injured. When looking at the county-specific trauma rates per 100,000 Arizona residents for the year 2008, Yuma County has the highest rate followed by Gila County. Mohave County has the lowest trauma rate, reflecting the likelihood of transfer to an out-of-state Trauma Center.

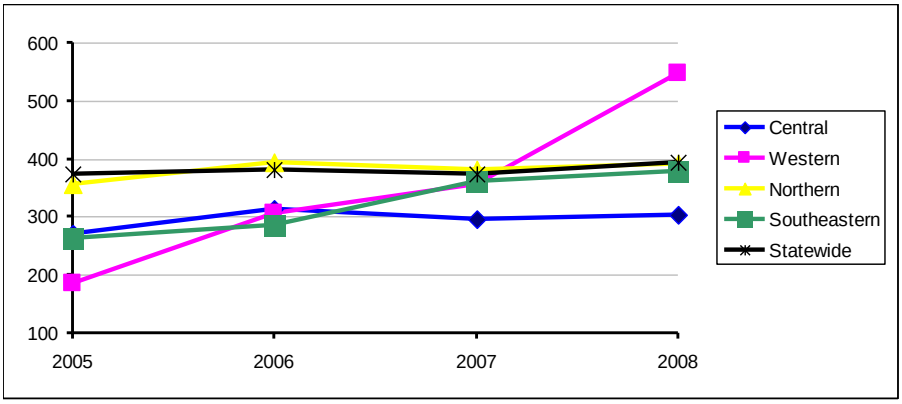
Table 1: County-specific Trauma Rates per 100,000 Arizona Residents, ASTR 2005-2008

County	2005	2006	2007	2008
Statewide	374	380	373	394
Apache	190	205	197	257
Cochise	148	183	260	301
Coconino	637	684	762	613
Gila	529	646	753	922
Graham	121	201	259	321
Greenlee	169	362	436	469
La Paz	335	470	395	367
Maricopa	259	306	286	291
Mohave	21	13	10	13
Navajo	436	417	361	467
Pima	289	306	383	391
Pinal	396	339	338	343
Santa Cruz	197	230	301	372
Yavapai	196	266	225	265
Yuma	332	578	697	1,103

TRAUMA RATES BY REGION

Figure 1 depicts the trauma rate per 100,000 residents by EMS region. The large increase in the Western Region may be related to improved data capture at a large reporting facility in that region. The year-to-year increase will be more meaningful in subsequent years if the trend stabilizes. The statewide rate reflects missing data from all four regions.

Figure 1: Region-specific Trauma Rates per 100,000 Arizona Residents, ASTR 2005-2008

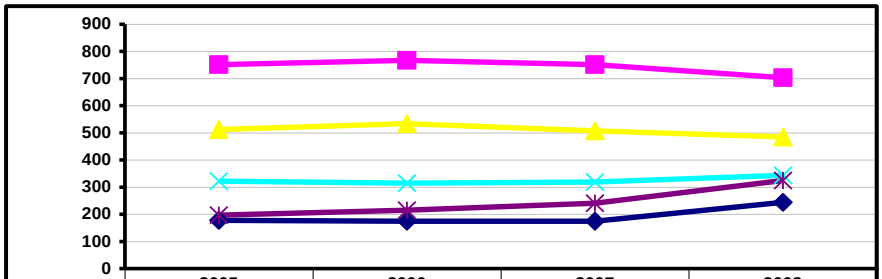


TRAUMA RATES BY AGE

Figure 2 shows the trauma rates per 100,000 residents by age group. For 2005 to 2008, 15-19 year olds have the highest trauma rate. For adults (15-64 years) there is a slight decrease in the rate from 2007 to 2008 which may be related to a change in motor vehicle traffic crashes.

The increase in the trauma rate among the pediatric age group (<15 years) from 2007 to 2008 may be related to the addition of a free-standing pediatric Level I Trauma Center. Additionally, the increase in the geriatric age group (>64 years) rate from 2007 to 2008 may be related to changes in trauma registry inclusion criteria.

Figure 2: Age-specific Trauma Rates per 100,000 Arizona Residents, ASTR 2005-2008

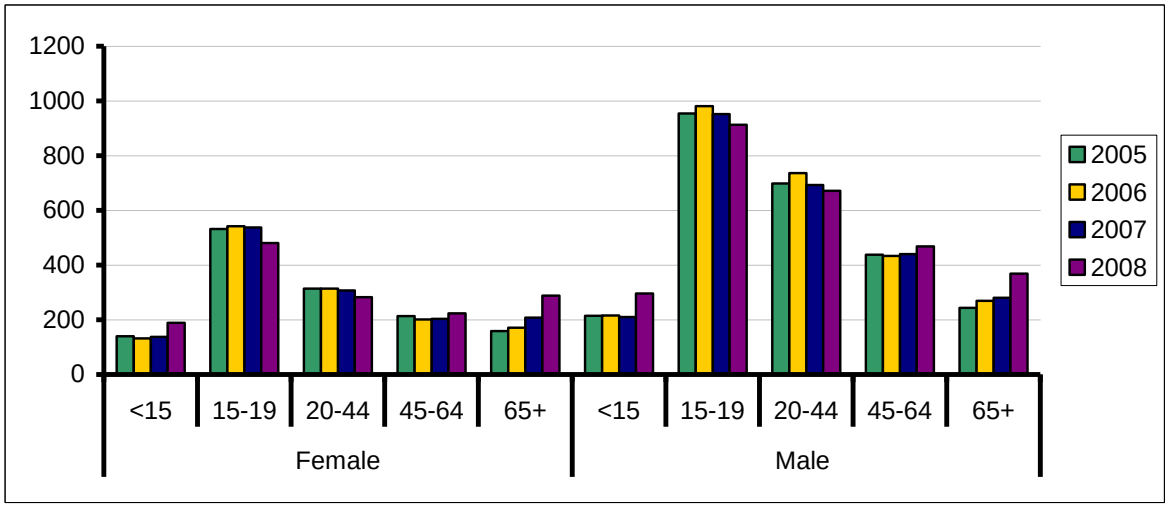


	2005	2006	2007	2008
<15	178	174	175	244
15-19	751	768	752	703
20-44	512	534	507	484
45-64	322	315	319	343
65+	196	215	241	324

TRAUMA RATES BY AGE AND GENDER

Figure 3 depicts age and gender specific trauma rates per 100,000 residents. Across all the age groups, males have a higher trauma rate. Among the 15-19 year olds, the trauma rate is nearly doubled for males. The increase in the rate for those over 65 years of age may be related to changes in the inclusion criteria. In 2008, patients who had a same-level fall are now included in the data if they had other injuries.

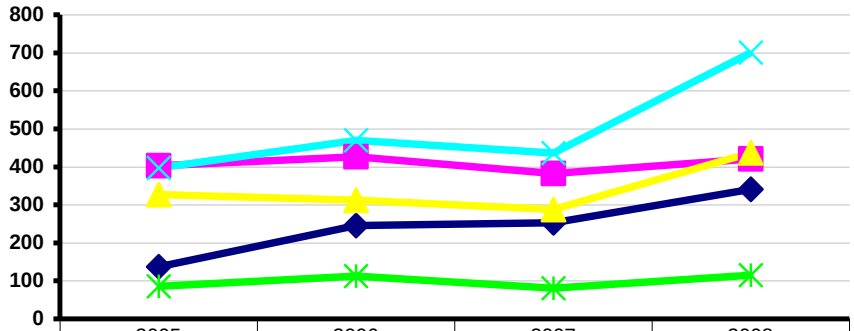
Figure 3: Age and Gender Specific Trauma Rates per 100,000 Arizona Residents, ASTR 2005-2008



TRAUMA RATES BY ETHNICITY

Figure 4 depicts the trauma rate per 100,000 residents based upon ethnicity. The American Indian/Alaska Native population has the highest trauma rate, followed by the Hispanic population. Asian Pacific Islanders have the lowest trauma rate per 100,000 residents. A significant increase in trauma is seen in the American Indian/Alaska Native category for 2008.

Figure 4: Race-specific Trauma Rates per 100,000 Arizona Residents, ASTR 2005-2008



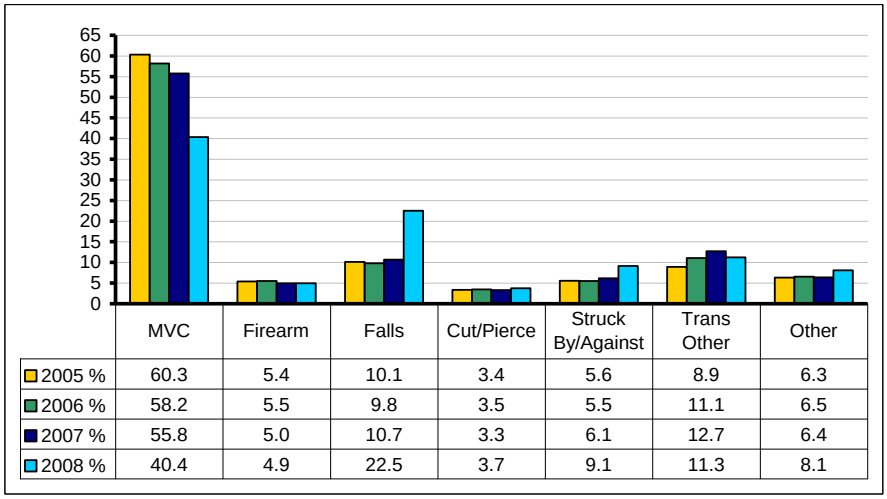
	2005	2006	2007	2008
White Non-hispanic	137	246	253	341
Hispanic	403	427	383	421
African American	327	312	288	437
American Indian/ Alaska Native	397	469	437	700
Asian Pacific Islander	86	112	81	115

TRAUMA RELATED MECHANISM OF INJURY BY AGE-GROUPS

Pediatric Trauma Patients

Figure 5 represents the 23,918 pediatric patients (age 0-14 years). While there is a steady decline in motor vehicle crashes (MVC) over the years, it remains the predominant mechanism of injury for this age group. The increase in injuries sustained as a result of falls in 2008 may be related to the changes in inclusion criteria.

Figure 5: Mechanism of Injury Among Pediatric Trauma Patients, ASTR 2005-2008

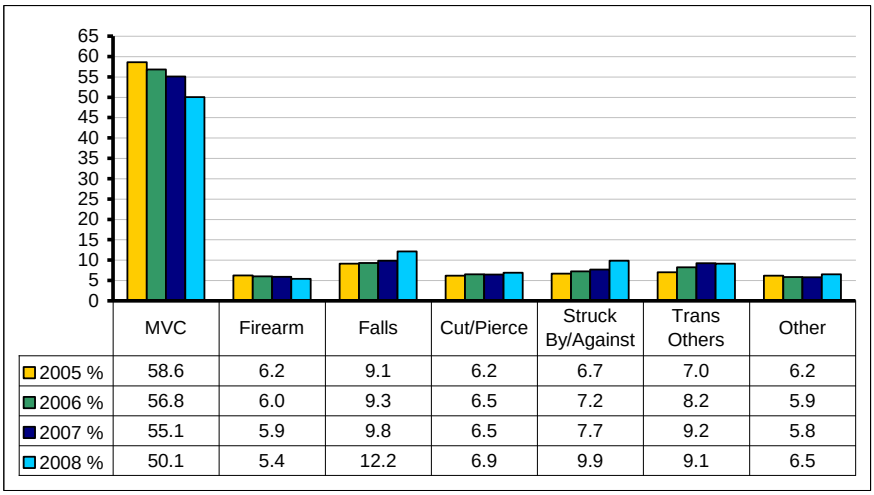


	MVC	Firearm	Falls	Cut/Pierce	Struck By/Against	Trans Other	Other
2005 %	60.3	5.4	10.1	3.4	5.6	8.9	6.3
2006 %	58.2	5.5	9.8	3.5	5.5	11.1	6.5
2007 %	55.8	5.0	10.7	3.3	6.1	12.7	6.4
2008 %	40.4	4.9	22.5	3.7	9.1	11.3	8.1

Adult Trauma Patients

Figure 6 represents the 64,118 adult trauma patients (15-64 years) by mechanism of injury. Of note is the decrease in MVC's which may be related to fewer miles driven as well as other traffic safety measures that took effect between 2007 and 2008. The increase in falls may be related to changes in the inclusion criteria.

Figure 6: Mechanism of Injury Among Adult (15-64 years) Trauma Patients, ASTR 2005-2008

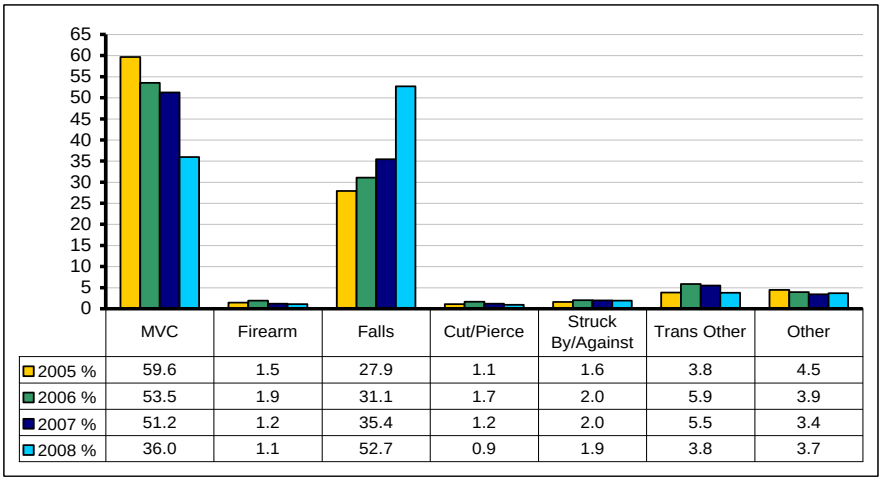


	MVC	Firearm	Falls	Cut/Pierce	Struck By/Against	Trans Others	Other
2005 %	58.6	6.2	9.1	6.2	6.7	7.0	6.2
2006 %	56.8	6.0	9.3	6.5	7.2	8.2	5.9
2007 %	55.1	5.9	9.8	6.5	7.7	9.2	5.8
2008 %	50.1	5.4	12.2	6.9	9.9	9.1	6.5

Geriatric Trauma Patients

Figure 7 represents the 8,031 geriatric trauma patients (> 65 years). Interestingly, MVC's have historically been the predominate mechanism of injury, but is replaced by falls in 2008. The steady decrease in MVC related injuries over the years may be attributed to fewer miles driven and traffic safety measures that took effect between 2007 and 2008. The increase in falls may be related to changes in the inclusion criteria.

Figure 7: Mechanism of Injury Among Adult (15-64 years) Trauma Patients, ASTR 2005-2008



	MVC	Firearm	Falls	Cut/Pierce	Struck By/Against	Trans Other	Other
2005 %	59.6	1.5	27.9	1.1	1.6	3.8	4.5
2006 %	53.5	1.9	31.1	1.7	2.0	5.9	3.9
2007 %	51.2	1.2	35.4	1.2	2.0	5.5	3.4
2008 %	36.0	1.1	52.7	0.9	1.9	3.8	3.7

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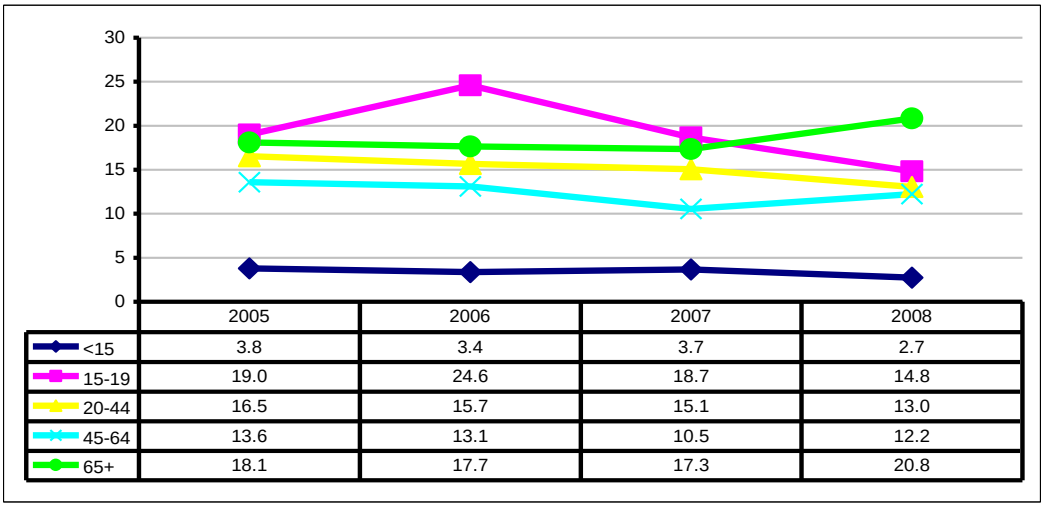
MVC	Motor vehicle crash
Other Trans	Includes railroad, water transport, off-road vehicles, etc.
Other	Suffocation, drowning, fire/burn, machinery, natural environment, overexertion, other non-specified.

TRAUMA RELATED MORTALITY

The overall statewide mortality rate for Arizona trauma patients during 2005-2008 was 3.4% (3,230 deaths among 96,102 patients). The overall statewide mortality rate has decreased 3.7% in 2005 to 3.0% in 2008.

Figure 8 depicts the mortality rate per 100,000 residents by age group. In 2005, the mortality rate is highest among the 15-19 year olds. In 2008, the mortality rate among the > 65 year olds is highest.

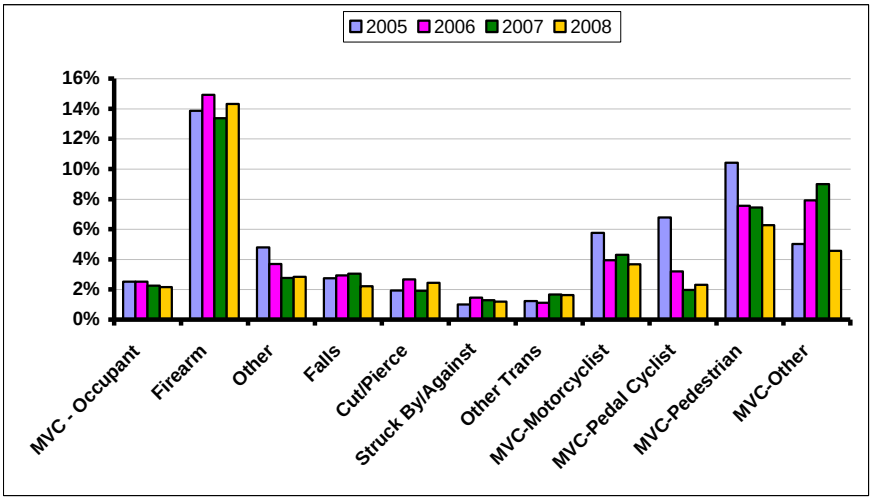
Figure 8: Age-specific Trauma Related Mortality Rates per 100,000 Arizona Residents, ASTR 2005-2008



	2005	2006	2007	2008
<15	3.8	3.4	3.7	2.7
15-19	19.0	24.6	18.7	14.8
20-44	16.5	15.7	15.1	13.0
45-64	13.6	13.1	10.5	12.2
65+	18.1	17.7	17.3	20.8

Figure 9 depicts trauma related mortality by mechanism of injury. The mechanism of injury with the highest mortality rate (14.1%) was firearm injuries. The mechanism of injury with the next highest mortality rate was motor vehicle traffic related pedestrian crashes (7.9%) followed by motor vehicle traffic related other injuries (6.5%).

Figure 9: Trauma Related Mortality by Mechanism of Injury, ASTR 2005-2008



COMPARING ASTR 2008 WITH THE 2008 NATIONAL TRAUMA DATA BANK (NTDB)

Table 2: Incidents and Case Fatality Rate by Mechanism of Injury: Comparing ASTR 2008 with NTDB 2008

	ASTR 08		NTDB 08		ASTR 08		NTDB 08	
	Number	Percent	Number	Percent	Deaths	Case Fatality Rate	Deaths	Case Fatality Rate
Motor Vehicle Traffic	11,795	45.84	171,527	33.87	329	2.79	8,409	4.90
Firearm	1,237	4.81	26,464	5.23	177	14.31	4,096	15.48
Poisoning	8	0.03	252	0.05	2	25.00	10	3.97
Falls	4,916	19.10	163,504	32.28	110	2.24	5,818	3.56
Suffocation	45	0.17	443	0.09	8	17.78	101	22.80
Drowning	19	0.07	311	0.06	1	5.26	42	13.50
Fire/flame	40	0.16	5,953	1.18	2	5.00	361	6.06
Hot object/substance	20	0.08	5,950	1.17	0	0.00	35	0.59
Cut/pierce	1,396	5.42	24,335	4.80	34	2.44	511	2.10
Struck by, against	2,261	8.79	37,262	7.36	27	1.19	531	1.43
Machinery	114	0.44	5,775	1.14	4	3.51	94	1.63
Pedal cyclist, other	532	2.07	8,159	1.61	5	0.94	92	1.13
Pedestrian, other	69	0.27	1,797	0.35	3	4.35	121	6.73
Transport, other	2,327	9.04	28,813	5.69	38	1.63	725	2.52
Natural/environmental, other	68	0.26	1,548	0.31	1	1.47	40	2.58
Bites and Stings	105	0.41	2,114	0.42	1	0.95	12	0.57
Overexertion	28	0.11	1,290	0.25	0	0.00	4	0.31
Other specified and classifiable	182	0.71	8,473	1.67	6	3.30	366	4.32
Other specified, Not elsewhere classifiable	145	0.56	2,565	0.51	2	1.38	56	2.18
Unspecified	316	1.23	6,237	1.23	13	4.11	254	4.07
Adverse effects, Drugs	0	0.00	110	0.02	0	0.00	5	4.55
Adverse effects, Medical care	0	0.00	95	0.02	0	0.00	2	2.11
Missing	110	0.43	3,475	0.69	5	4.55	128	3.68
Total	**25,733**		**506,452**		**768**	**2.98**	**21,813**	**4.31**

The National Trauma Data Bank aggregates data from participating Trauma Centers across the US. The Bureau acknowledges that a direct comparison of Arizona information to the NTDB is impossible. As the ASTR increases the number of cases and the number of participating facilities, a more meaningful comparison will be possible.

Table 3: Incidents and Case Fatality rate by Age: Comparing ASTR 2008 and NTDB 2008

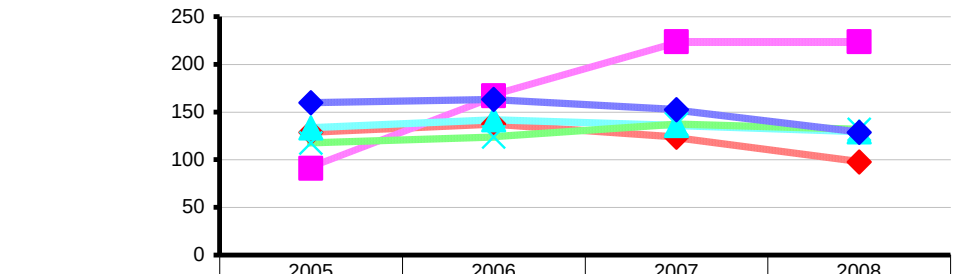
Age	ASTR 08		NTDB 08		ASTR 08		NTDB 08	
	Number	Percent	Number	Percent	Deaths	Case Fatality Rate	Deaths	Case Fatality Rate
<1 year	359	1.4	5,975	1.18	12	3.34	171	2.86
1-4	982	3.82	16,493	3.26	6	0.61	330	2.00
5-9	971	3.77	16,799	3.32	9	0.93	202	1.20
10-14	1,179	4.58	20,484	4.04	12	1.02	312	1.52
15-19	3,179	12.35	49,112	9.70	67	2.11	1,772	3.61
20-24	3,282	12.75	52,544	10.37	95	2.89	2,049	3.90
25-34	4,349	16.9	71,634	14.14	117	2.69	2,760	3.85
35-44	3,512	13.65	64,949	12.82	88	2.51	2,362	3.64
45-54	3,121	12.13	65,499	12.93	106	3.40	2,623	4.00
55-64	2,043	7.94	44,219	8.73	78	3.82	2,002	4.53
65-74	1,246	4.84	30,587	6.04	57	4.57	1,847	6.04
75-84	1,002	3.89	38,058	7.51	80	7.98	2,878	7.56
>85	508	1.97	28,016	5.53	41	8.07	2,297	8.20
Missing	0		2,083	0.41	0	0.00	208	9.99
Total	**25,733**		**506,452**		**768**	**2.98**	**21,813**	**4.31**

Trauma Related Motor Vehicle Occupant Crashes
ASTR 2005-2008: (N=38,054)

Of the 96,102 Arizona trauma patients, 38,054 (39.6%) were victims of a motor vehicle crash (MVC). There has been a 10.1% overall decrease in the MVC rate during 2005 to 2008.

Figure 10 depicts the MVC rate per 100,000 residents by region. The increase in the trauma rate in the Western Region for 2007 and 2008 coincides with a change in registry practice for a reporting facility in that region.

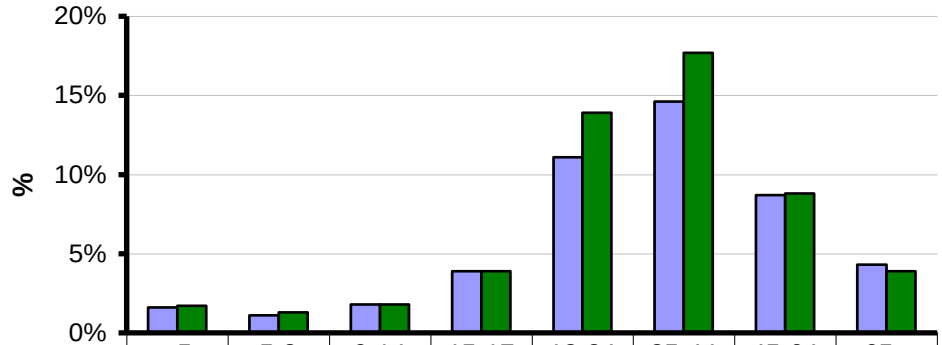
Figure 10: Motor Vehicle Occupant Crash Rates per 100,000 Arizona Residents by Region, ASTR 2005-2008



	2005	2006	2007	2008
Central	129	138	123	98
Western	91	167	224	224
Northern	133	142	136	129
Southeastern	118	124	137	132
Statewide	160	163	153	129

Of the 38,054 MVC victims during 2005-2008, 53% were males. The distribution of male to female is similar across all age groups except males were predominantly the victims in the 18-44 age group.

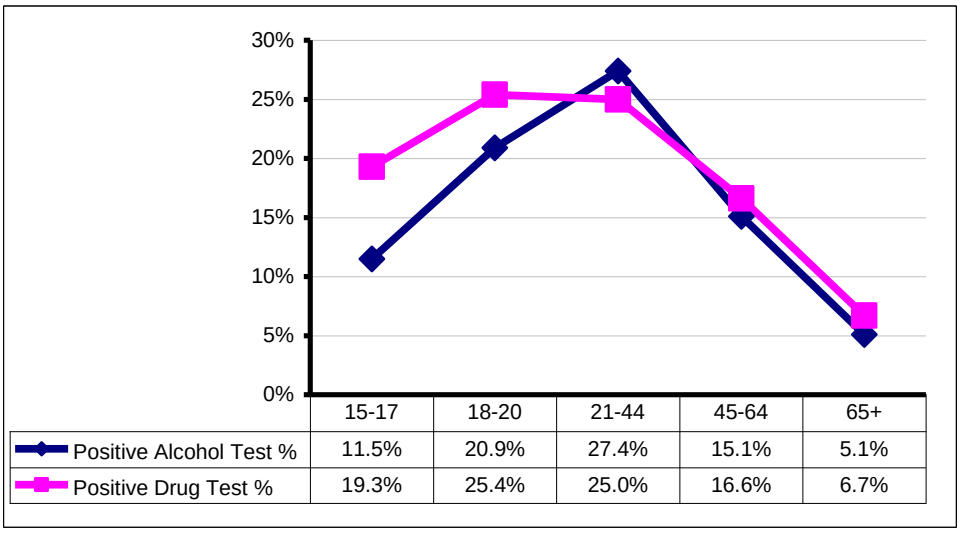
Figure 11: Age and Gender of Motor Vehicle Crash Occupants: ASTR 2005-2008



	<5	5-8	9-14	15-17	18-24	25-44	45-64	65+
Female	1.6%	1.1%	1.8%	3.9%	11.1%	14.6%	8.7%	4.3%
Male	1.7%	1.3%	1.8%	3.9%	13.9%	17.7%	8.8%	3.9%

Figure 12 depicts positive alcohol and drug screenings by age group for those injured in an MVC. Patients under 15 years were excluded from this analysis. One out of every four victims of an MVC who was 21-44 years old was either positive for alcohol or drugs. One out of every five teenagers (15-17 years old) was positive for drugs. These data elements are new to the ASTR (2008) and may be an underestimate of the actual numbers.

Figure 12: Positive Alcohol and Drug Screening Results for Adults (age >=15 years) Motor Vehicle Crash Occupants by Age, ASTR 2005-2008



	15-17	18-20	21-44	45-64	65+
Positive Alcohol Test %	11.5%	20.9%	27.4%	15.1%	5.1%
Positive Drug Test %	19.3%	25.4%	25.0%	16.6%	6.7%

MOTOR VEHICLE CRASH AND RESTRAINT USE:

Figure 13 depicts the use of passenger restraints for those involved in an MVC by region. Of the 38,054 Arizona trauma patients who were victims of an MVC, 62.1% were using some form of passenger restraint.

Figure 13: Passenger Restraint Use (%) Among Motor Vehicle Crash Occupants by Region, ASTR 2005-2008

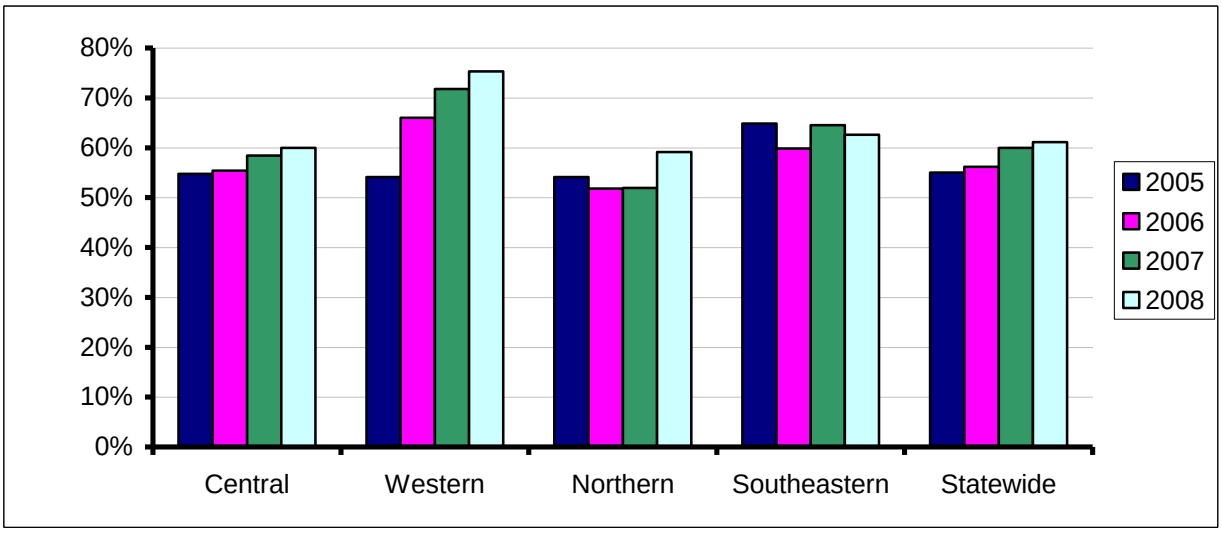
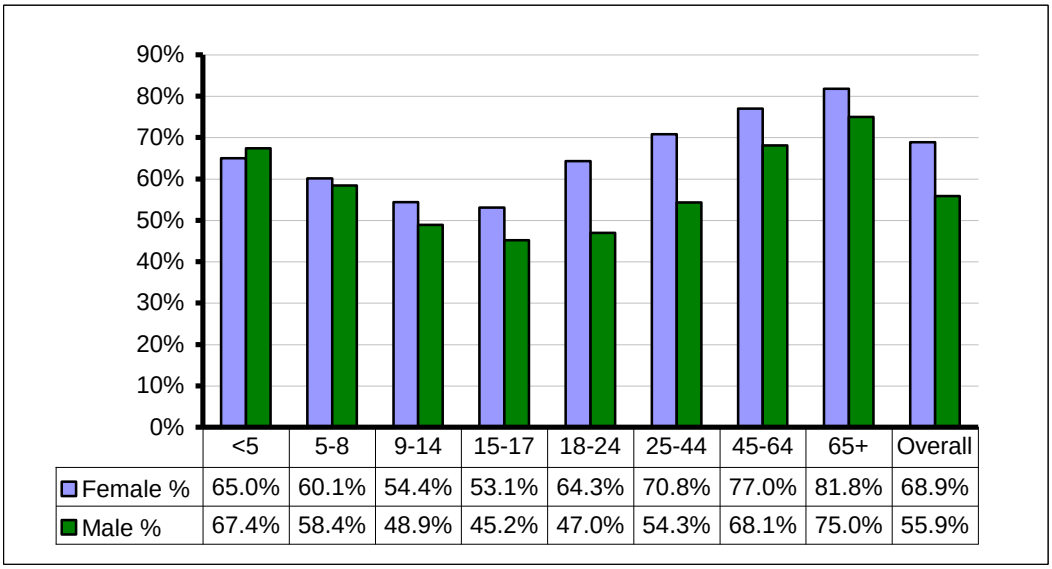


Figure 14 demonstrates that females are more likely to be restrained than males. The use of restraints increases after the high risk teenage years (15-17 years old) for both genders.

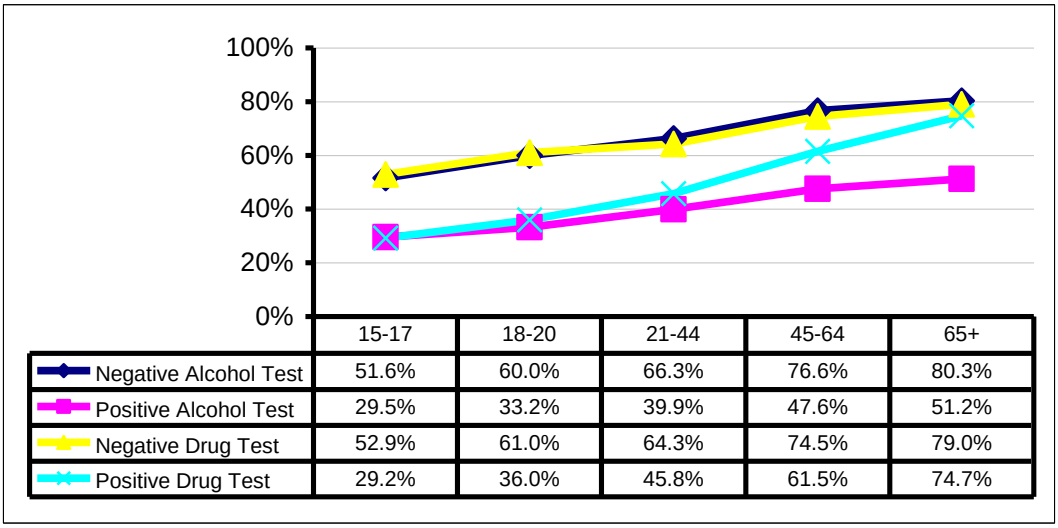
Figure 14: Passenger Restraint Use (%) Among Motor Vehicle Crash Occupants by Age and Gender, ASTR 2005-2008



	<5	5-8	9-14	15-17	18-24	25-44	45-64	65+	Overall
Female %	65.0%	60.1%	54.4%	53.1%	64.3%	70.8%	77.0%	81.8%	68.9%
Male %	67.4%	58.4%	48.9%	45.2%	47.0%	54.3%	68.1%	75.0%	55.9%

Figure 15 shows that across all age groups, MVC occupants who have tested positive for alcohol or drugs are less likely to use restraints.

Figure 15: Adult (>=15 Years) Motor Vehicle Crash Occupants with Alcohol or Drug Screening Result and Restraint Use by Age, ASTR 2005-2008



	15-17	18-20	21-44	45-64	65+
Negative Alcohol Test	51.6%	60.0%	66.3%	76.6%	80.3%
Positive Alcohol Test	29.5%	33.2%	39.9%	47.6%	51.2%
Negative Drug Test	52.9%	61.0%	64.3%	74.5%	79.0%
Positive Drug Test	29.2%	36.0%	45.8%	61.5%	74.7%

Table 4 describes the independent risk factors for passenger restraint use; with males age 25-44 serving as the reference point. The teenage population (15-17 years) uses passenger restraints less than half as frequently as the reference population. Females are 1.8 times more likely to be restrained than males.

Hispanics and American Indian/Alaska Natives were significantly less likely to use restraints while Asian/Pacific Islanders were almost twice more likely to use restraints as compared to the White-Non-Hispanic reference group.

Those testing positive for alcohol or drugs are 70% and 60%, respectively, less likely to use restraints as compared to those who tested negative.

Table 4: Independent Risk Factors for Car Restraint Use Among Motor Vehicle Crash Occupants, ASTR 2005-2008

Risk Factors	Odds Ratio	95% CI
Age (Reference- 25-44 yrs)	1.0	-
<15	**0.9**	0.8-0.9
15-17	**0.6**	0.5-0.6
18-24	**0.7**	0.7-0.8
45-64	**1.6**	1.5-1.7
65+	**2.3**	2.1-2.5
Gender (Reference– Male)		
Female	**1.8**	1.7-1.8
Ethnicity (Reference- White-Non-Hispanic)	1.00	-
Hispanic	**0.6**	0.6-0.7
Asian/ Pacific Islander	**1.8**	1.4-2.4
African American	1.0	0.9-1.2
American Indian/ Alaska Native	**0.3**	0.3-0.4
Blood Alcohol Test [a] (Reference –Negative)	1.0	
Positive	**0.3**	0.2-0.3
Drug Screening Test [a] (Reference –Negative)	1.0	
Positive	**0.4**	0.4-0.5

CI= Confidence Interval
Significant results are presented in bold
[a] Alcohol and drug analysis was done for occupants age >14 years

Table 5 demonstrates that those who did not use passenger restraints had significantly longer ICU and hospital lengths of stay than those who used restraints. Mortality and injury severity for the non-restraint group was significantly higher when compared with the restraint group. Hospital charges were also significantly greater for the non-restraint group.

Table 5: Outcomes by Restraint Use Among Motor Vehicle Crash Occupants, ASTR 2005-2008

Outcomes	Restraint Use (N=22,056)	No Restraint Use (N=13,459)	P-value
Discharge Disposition			
Expired	1.1%	3.8%	<0.0001
ISS (Mean)	6.0	9.6	<0.0001
GCS (Mean)	14.7	13.7	<0.0001
ICU Length of Stay (Mean)	0.8	1.6	<0.0001
Total Length of Stay (Mean)	2.6	3.8	<0.0001
Total Charges (Median)	$12,425	$18,716	<0.0001

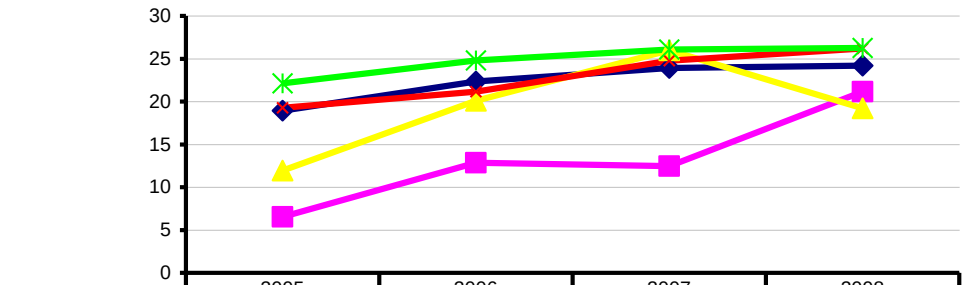
ISS – Injury Severity Score
ICU – Intensive Care Unit
GCS – Glasgow Coma Scale
P value of <0.05 considered to be significant.

Trauma Related Motorcycle Crashes
ASTR 2005-2008: (N=6,280)

Of the 96,102 Arizona trauma patients, 6,280 (6.5%) were victims of motorcycle crashes (MCC).

Figure 16 depicts the MCC rate per 100,000 residents. The Central and Southeastern Regions have similar MCC rates. The Western Region has the lowest reported MCC rate. The increase in MCC rates from 2007 to 2008 for the Western Region may be related to changes in registry practice.

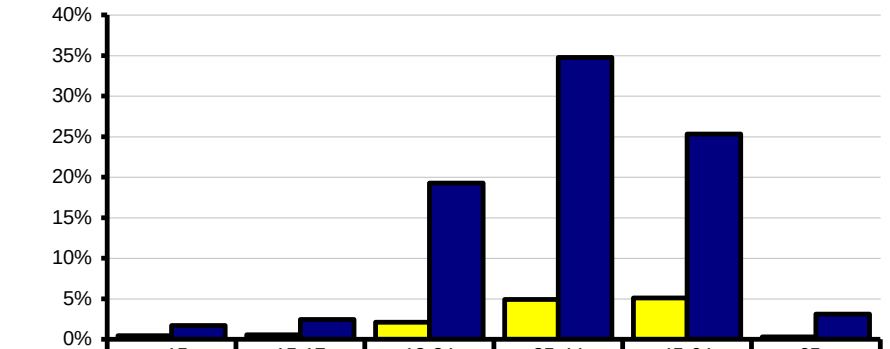
Figure 16: Motorcycle Crash Rates per 100,000 Arizona Residents by Region, ASTR 2005-2008:



	2005	2006	2007	2008
Central	18.9	22.4	23.9	24.2
Western	6.5	12.9	12.5	21.2
Northern	11.9	20.1	26.0	19.2
Southeastern	19.3	21.2	24.8	26.2
Statewide	22.1	24.8	26.1	26.3

Figure 17 depicts the 6,280 Arizona trauma patients who were victims of a MCC. Of these, 5,434 (86.6%) were male. The majority of these males were between ages 25 and 44 (34.8% of all patients), 45 to 64 (25.3% of all patients), and 18-24 (19.3% of all patients).

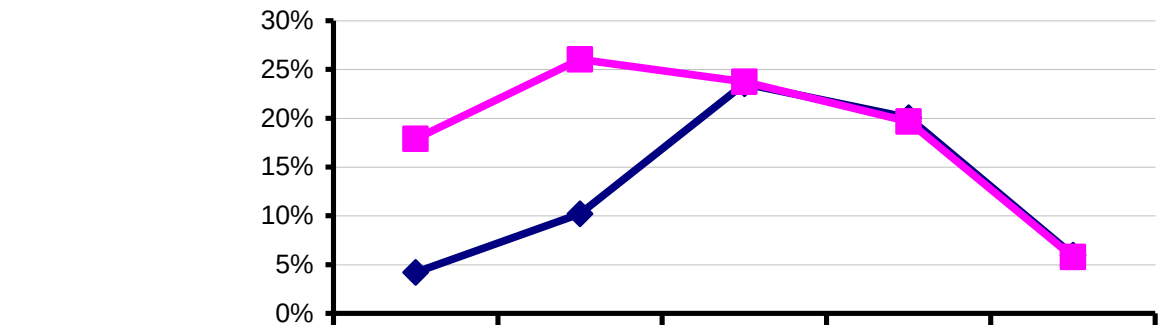
Figure 17: Age and Gender of Motorcycle Crashes, ASTR 2005-2008



	<15	15-17	18-24	25-44	45-64	65+
Female	0.5%	0.6%	2.1%	4.9%	5.1%	0.3%
Male	1.7%	2.5%	19.3%	34.8%	25.3%	3.1%

Figure 18 depicts MCC victims with a positive alcohol or drug screenings by age group. Patients under 15 years were excluded from this analysis. For MCC victims between the ages of 15 and 24 there is a higher rate of testing positive for drugs than alcohol. One out of every four victims of a MCC who was 18-24 years old tested positive for drugs. These data elements are new to the ASTR (2008) and may be an underestimate of the actual numbers.

Figure 18: Alcohol and Drug Screening Results for Adult (>=15 years) Motorcycle Crash by Age, ASTR 2005-2008



	15-17	18-24	25-44	45-64	65+
Positive Alcohol Test	4.2%	10.2%	23.5%	20.0%	6.0%
Positive Drug Test	17.9%	26.0%	23.7%	19.7%	5.8%

MOTORCYCLE CRASH AND HELMET USE:

Of the 6,280 Arizona trauma patients who were victims of a MCC, 49% were wearing a helmet. Figure 19 depicts the use of helmets among MCC riders by region.

Figure 19: Helmet Use (%) Among Motorcycle Crash by Region, ASTR 2005-2008

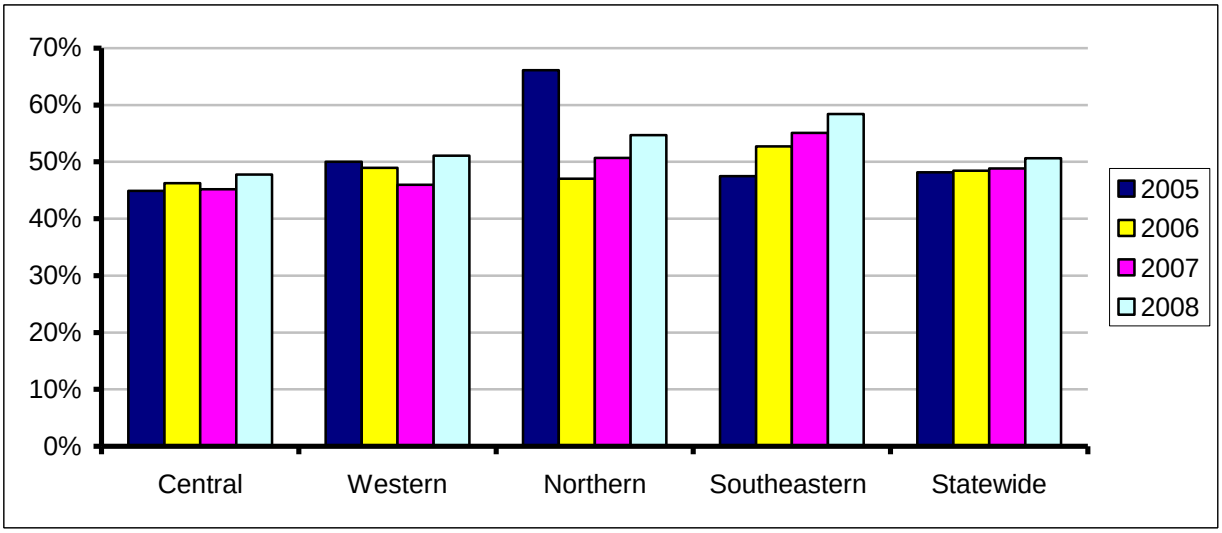
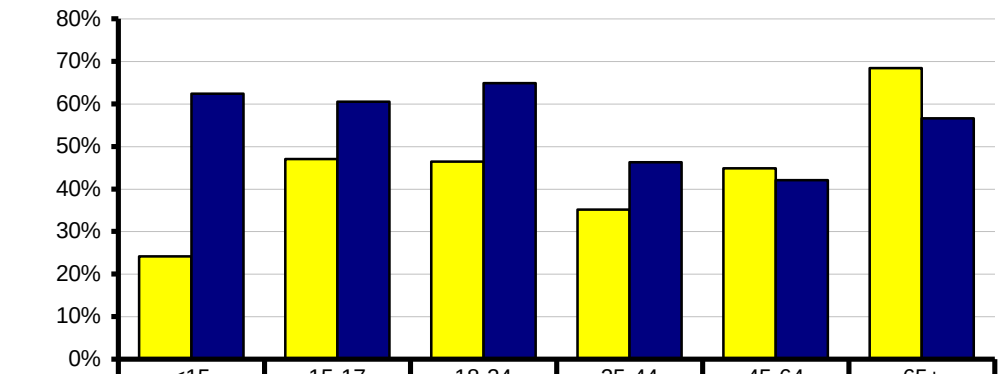


Figure 20 depicts that the overall rate of helmet use is higher among males (48.0%) than females (39.7%). For males, helmet use is lowest in the 45-64 age group, while among females, the <15 age group had the lowest use.

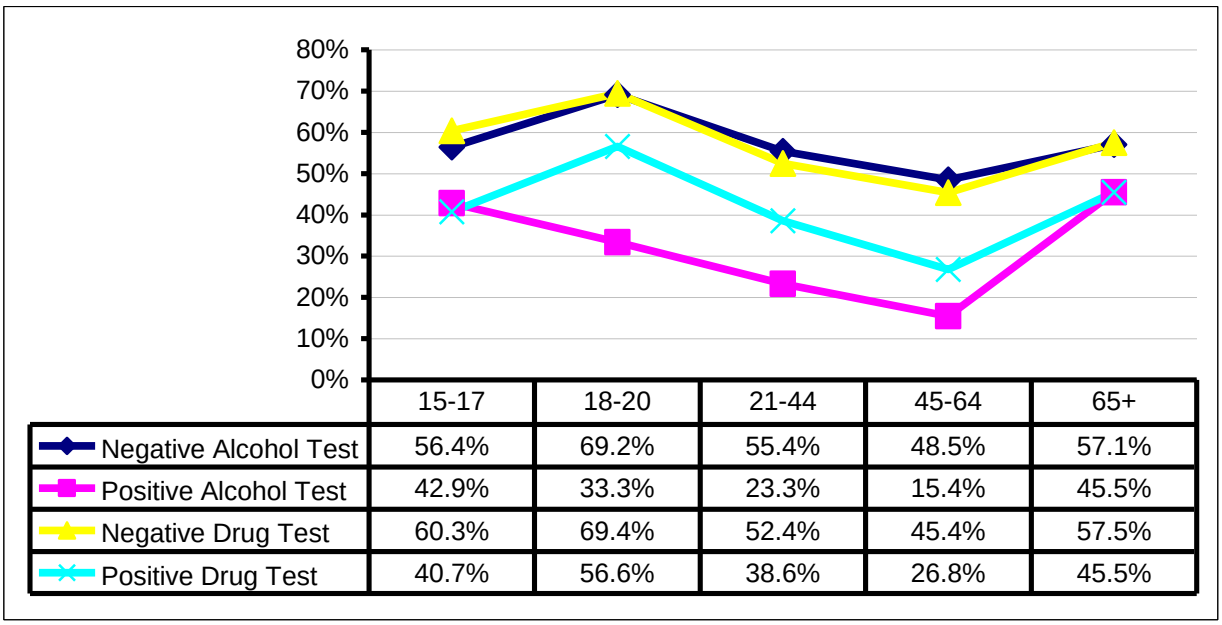
Figure 20: Helmet Use (%) Among Motorcycle Crash by Age and Gender, ASTR 2005-2008



	<15	15-17	18-24	25-44	45-64	65+
Female	24.2%	47.1%	46.5%	35.1%	44.9%	68.4%
Male	62.4%	60.5%	64.9%	46.3%	42.1%	56.6%

The rate of helmet use is similar among victims of a MCC who tested negative for either alcohol or drugs for the same age groups (Figure 21). Overall helmet use was 54.9% among those who tested negative for alcohol and 52.2% among those who tested negative for drugs. Helmet use decreased to 21.7% among those who tested positive for alcohol and 37.5% among those who tested positive for drugs.

Figure 21: Adult (>=15 Years) Motorcycle Crash with Alcohol or Drug Screening Result and Helmet Use by Age, ASTR 2005-2008



	15-17	18-20	21-44	45-64	65+
Negative Alcohol Test	56.4%	69.2%	55.4%	48.5%	57.1%
Positive Alcohol Test	42.9%	33.3%	23.3%	15.4%	45.5%
Negative Drug Test	60.3%	69.4%	52.4%	45.4%	57.5%
Positive Drug Test	40.7%	56.6%	38.6%	26.8%	45.5%

Table 6 describes the independent risk factors for helmet use among the victims of a MCC. The population of 15-17 year olds and 18-24 year olds use helmets more often compared to the 25-44 year old reference group. Females are less likely to use helmets compared to males.

Hispanics were significantly less likely to use restraints while Asian/Pacific Islanders were three times more likely to use restraints compared to the White-Non-Hispanic reference group. Further, those testing positive for alcohol or drugs are 80% and 40%, respectively, less likely to use a helmet compared to those who tested negative.

Table 6: Independent Risk Factors for Helmet Use Among Motorcycle Crash Victims, ASTR 2005-2008

Risk Factors	Odds Ratio	95% CI
Age (Reference- 25-44 yrs)	1.0	
<15	1.4	0.9-2.0
15-17	**1.7**	1.3-2.3
18-24	**2.1**	1.8-2.4
45-64	0.9	0.8-1.0
65+	**1.7**	1.3-2.2
Gender (Reference– Male)	1.0	
Female	**0.7**	0.6-0.8
Ethnicity (Reference- White-Non-Hispanic)	1.00	-
Hispanic	**0.7**	0.6-0.8
Asian/ Pacific Islander	**3.3**	1.3-8.2
African American	1.5	1.0-2.1
American Indian/ Alaska Native	0.7	0.4-1.2
Blood Alcohol Test (Reference –Negative) [a]	1.0	
Positive	**0.2**	0.1-0.3
Drug Screening Test (Reference –Negative) [a]	1.0	
Positive	**0.6**	0.5-0.6

CI= Confidence Interval
Significant results are presented in bold.
[a] Alcohol and drug analysis was done for occupants age >14 years

MCC victims with no helmet had a significantly higher mortality rate compared to the helmeted group. The non-helmeted group had significantly more severe injuries compared to the helmeted group. The non-helmeted group also had more ICU days and a longer length of stay compared to helmeted motorcyclists. Non-helmeted MCC victims sustained a head injury 50.5% of the time compared to 28.4% for helmeted victims.

Table 7: Outcomes by Helmet Use Among Motorcycle Trauma Crash Occupants, ASTR 2005-2008

Outcomes	Helmet Use (N=2,945)	No Helmet Use (N=3,052)	P-value
Discharge Disposition			
Expired	3.2%	5.6%	<0.0001
ISS (Mean)	10.4	12.1	<0.0001
GCS (Mean)	14.2	13.5	<0.0001
ICU Length of Stay (Mean)	1.5	2.1	<0.0001
Total Length of Stay (Mean)	4.3	4.9	<0.0001
Total Charges (Median)	$20,141	$25,834	<0.0001
Head Injury	28.4%	50.5%	<0.0001

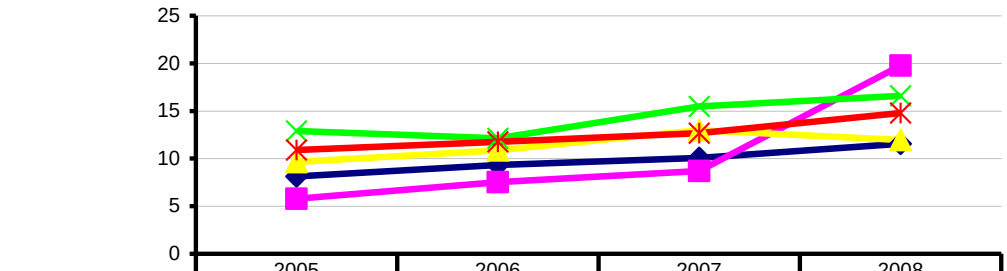
ISS – Injury Severity Score
ICU – Intensive Care Unit
GCS – Glasgow Coma Scale
P value of <0.05 considered to be significant.

Trauma Related Pedal-cycle Crashes
ASTR 2005-2008: (N=3,174)

Of the 96,102 Arizona trauma patients qualifying for the 2005-2008 Trauma Registry, 3,174 (3.3%) were victims of a pedal-cycle crash (PCC).

Figure 22 depicts the PCC rates per 100,000 residents. The Southeastern Region had the highest rate followed by the Northern Region. The increase in PCC rates from 2007 to 2008 for the Western Region may be related to changes in registry practice.

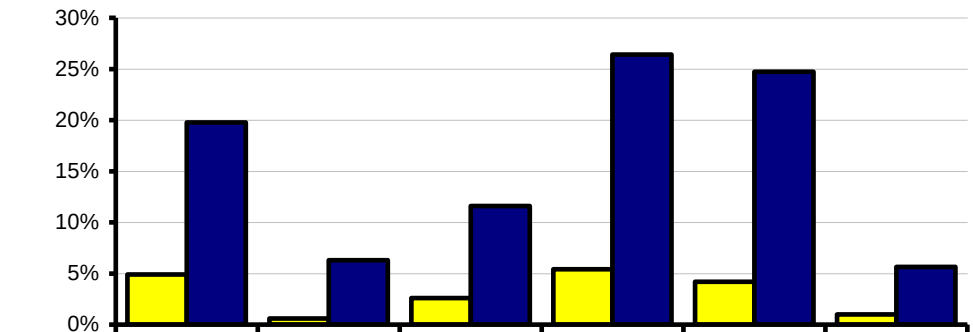
Figure 22: Trauma Related Pedal-cycle Crashes, ASTR 2005-2008 (N=3,174)
Pedal-cycle Crash Rates per 100,000 Arizona Residents by Region, ASTR 2005-2008:



	2005	2006	2007	2008
Central	8.1	9.3	10.1	11.5
Western	5.8	7.5	8.7	19.8
Northern	9.6	10.9	13.0	12.0
Southeastern	12.9	12.1	15.5	16.6
Statewide	10.9	11.8	12.7	14.8

Of the 3,175 Arizona trauma patients who were victims of a PCC, 2,582 (81.8%) were males predominantly between the ages of 25-64. The most common age group among female PCC victims was 25-44 (5.4% of all patients).

Figure 23: Age and Gender of Pedal-cycle Crashes, ASTR 2005-2008



	<15	15-17	18-24	25-44	45-64	65+
Female	4.9%	0.6%	2.6%	5.4%	4.2%	1.0%
Male	19.8%	6.3%	11.6%	26.4%	24.7%	5.6%

PEDAL-CYCLE CRASH AND HELMET USE:

Helmet use among male (26.6%) and female (26.3%) victims of a PCC was similar. The pediatric population had a very low rate of helmet use compared to other age groups, 11.2% females and 12.5% males. Helmet use among males increases steadily with age.

Figure 24: Helmet Use (%) Among Pedal-cycle Crashes by Age and Gender, ASTR 2005-2008

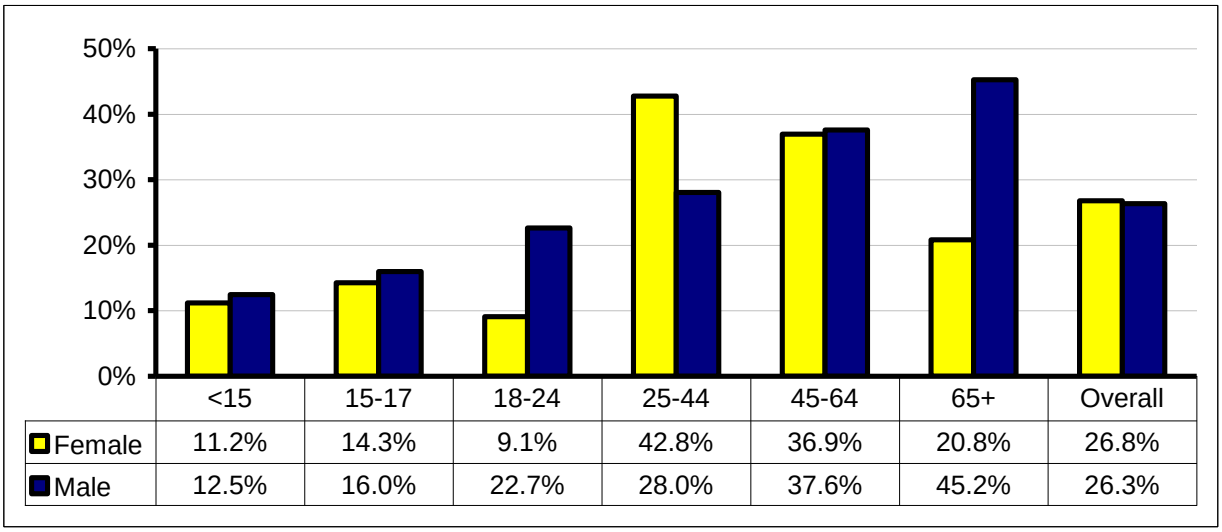


Table 8 describes outcomes by helmet use among pedal-cycle crash occupants. There was a significant difference in the rate of head injury and hospitalization charges between the helmeted and non-helmeted group for all patients.

Table 8: Outcomes by Helmet Use Among Pedal-cycle Crash Occupants, ASTR 2005-2008

Outcomes	Helmet Use (N=696)	No Helmet Use (N=1,939)	P-value
Discharge Disposition			
Expired	1.9%	1.4%	>0.05
ISS (Mean)	9.0	8.1	<0.01
GCS (Mean)	14.5	14.3	<0.01
ICU Length of Stay (Mean)	1.0	0.9	>0.05
Total Length of Stay (Mean)	2.8	2.8	>0.05
Total Charges (Median)	$14,269	$16,887	<0.05
Head Injury % (all)	**42.3**	**46.9**	0.05
Head Injury % (Age<15)	**33.8**	**45.3**	0.05

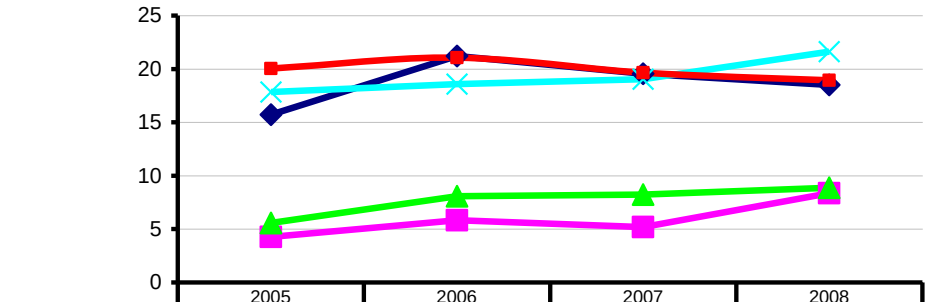
ISS – Injury Severity Score
ICU – Intensive Care Unit
GCS – Glasgow Coma Scale
P value of <0.05 considered to be significant.

Trauma Related Firearm Injuries
ASTR 2005-2008: (N=5,028)

Of the 96,102 Arizona trauma patients, 5,028 (5.2%) were firearm injuries.

Figure 25 shows the regional difference in firearm injury rates. The Northern and Western Regions are low compared to the rest of the state.

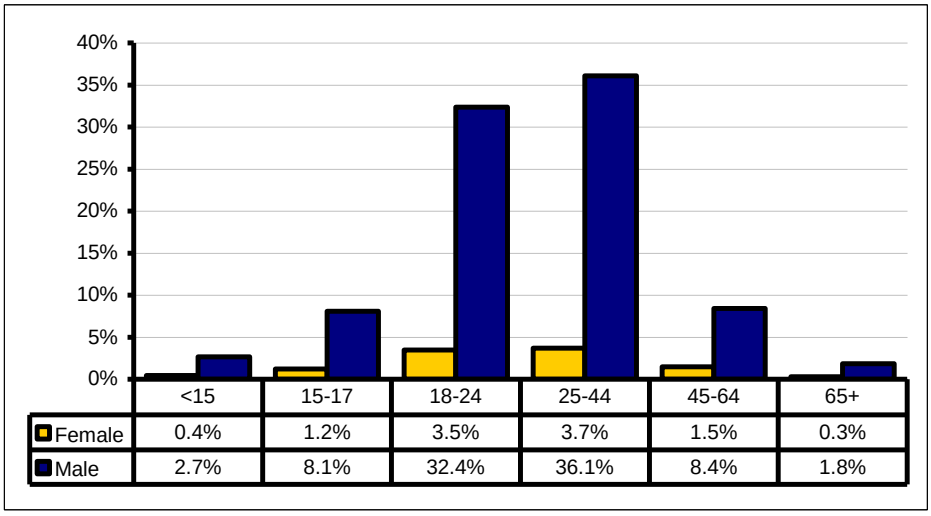
Figure 25: Trauma Related Firearm Injury Rates per 100,000 Arizona Residents by Region, ASTR 2005-2008



	2005	2006	2007	2008
Central	16	21	20	19
Western	4	6	5	8
Northern	6	8	8	9
Southeastern	18	19	19	22
Statewide	20	21	20	19

Of the 5,028 Arizona trauma patients who were victims of firearm injuries, 4,490 (89.3%) were males, the majority between the ages of 18 and 44. The most common age group among women was 25-44.

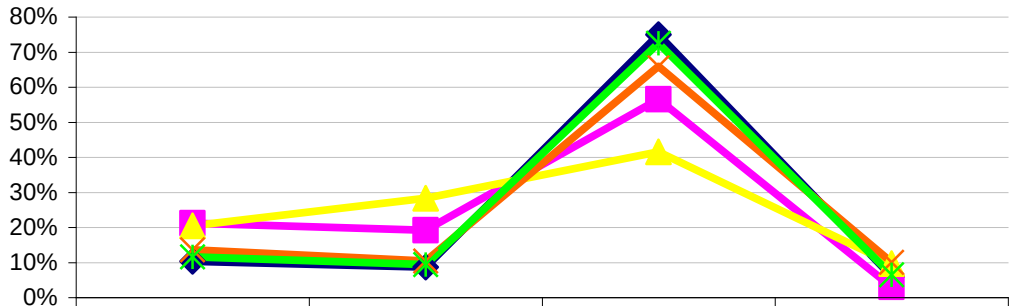
Figure 26: Age and Gender of Trauma Related Firearm Injuries, ASTR 2005-2008



	<15	15-17	18-24	25-44	45-64	65+
Female	0.4%	1.2%	3.5%	3.7%	1.5%	0.3%
Male	2.7%	8.1%	32.4%	36.1%	8.4%	1.8%

Of the 5,028 Arizona trauma patients who were victims of firearm injuries, 3,645 (72.5%) were classified as homicide, 472 (9.4%) were suicide, and 583 (11.6%) were unintentional in nature. The Central Region had a higher rate of homicide firearm injuries, the Northern Region had a higher rate of suicide firearm injuries, and the Western Region had a higher rate of unintentional injuries when compared to other regions.

Figure 27: Type of Firearm Injuries by Region, ASTR 2005-2008

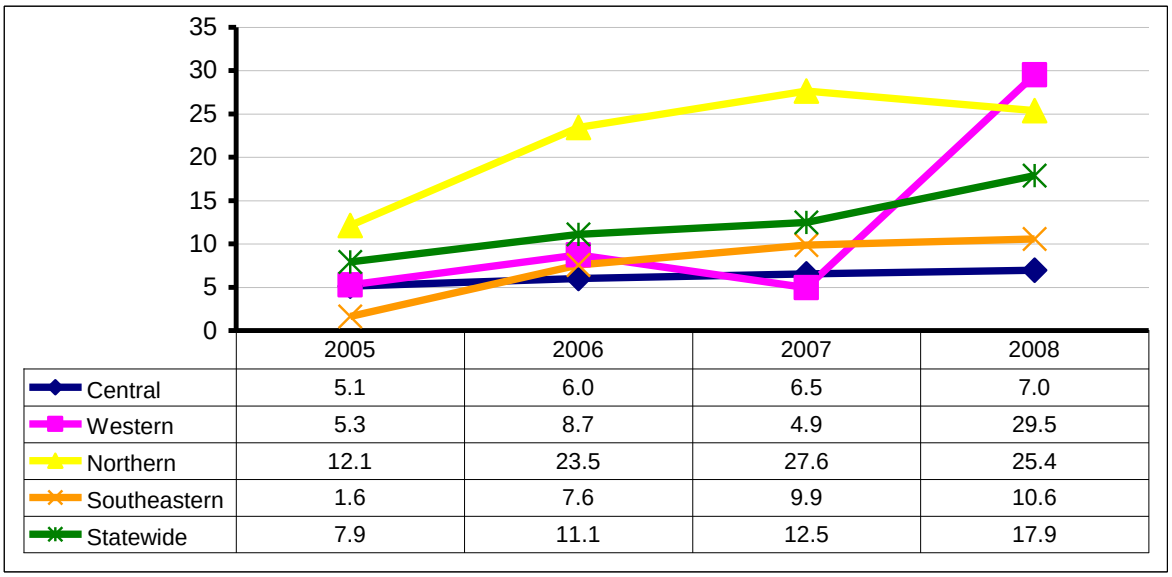


	Unintentional	Suicide	Homicide	Undetermined
Central	10.3%	8.6%	75.0%	6.0%
Western	21.2%	19.2%	56.6%	3.0%
Northern	20.5%	28.3%	41.6%	9.6%
Southeastern	13.6%	10.4%	65.9%	10.0%
Statewide	11.6%	9.4%	72.5%	6.5%

Trauma Related All Terrain Vehicle Crashes
ASTR 2005-2008: (N=3,146)

The Northern Region has consistently maintained a higher ATV injury rate compared to the rest of the state. In 2008, the increase in the Western Region may be attributable to changes in registry practice.

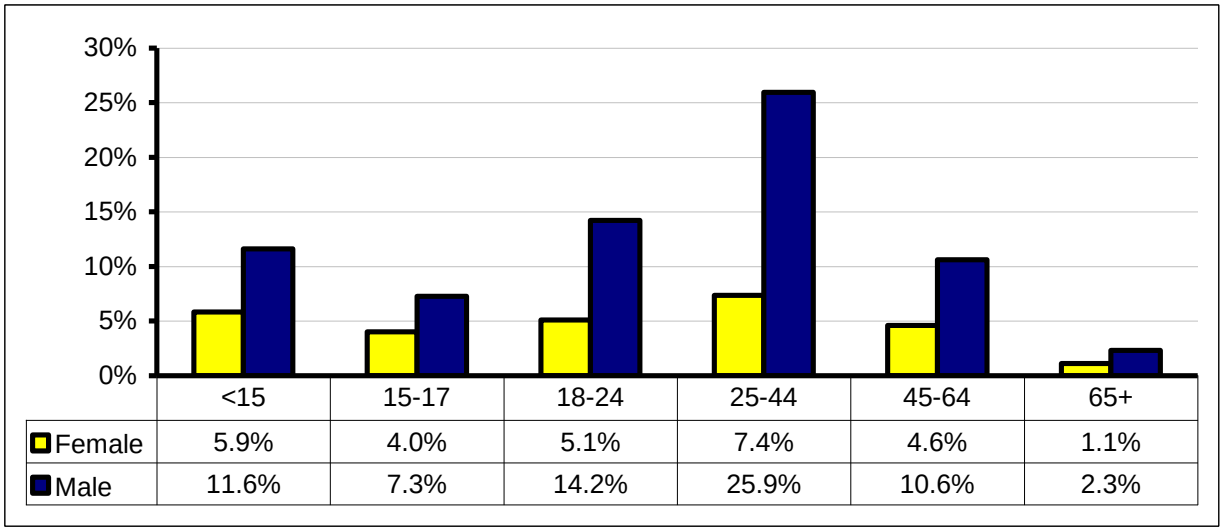
Figure 28: ATV Crash Rates per 100,000 Arizona Residents by Region, ASTR 2005-2008



	2005	2006	2007	2008
Central	5.1	6.0	6.5	7.0
Western	5.3	8.7	4.9	29.5
Northern	12.1	23.5	27.6	25.4
Southeastern	1.6	7.6	9.9	10.6
Statewide	7.9	11.1	12.5	17.9

Of the 3,146 Arizona trauma patients, 2,264 (72%) were males and the majority were between the ages of 18 and 44.

Figure 29: Age and Gender of ATV Crashes, ASTR 2005-2008



	<15	15-17	18-24	25-44	45-64	65+
Female	5.9%	4.0%	5.1%	7.4%	4.6%	1.1%
Male	11.6%	7.3%	14.2%	25.9%	10.6%	2.3%

As seen in Figure 30, females who were victims of an ATV crash were less likely than males to use a helmet. More than half of pediatric males (<15 years old) did not wear a helmet when involved in an ATV crash. The use of a helmet was lowest among the age group 65 and older for both genders.

Figure 30: Helmet Use (%) Among ATV Crash by Age and Gender, ASTR 2005-2008

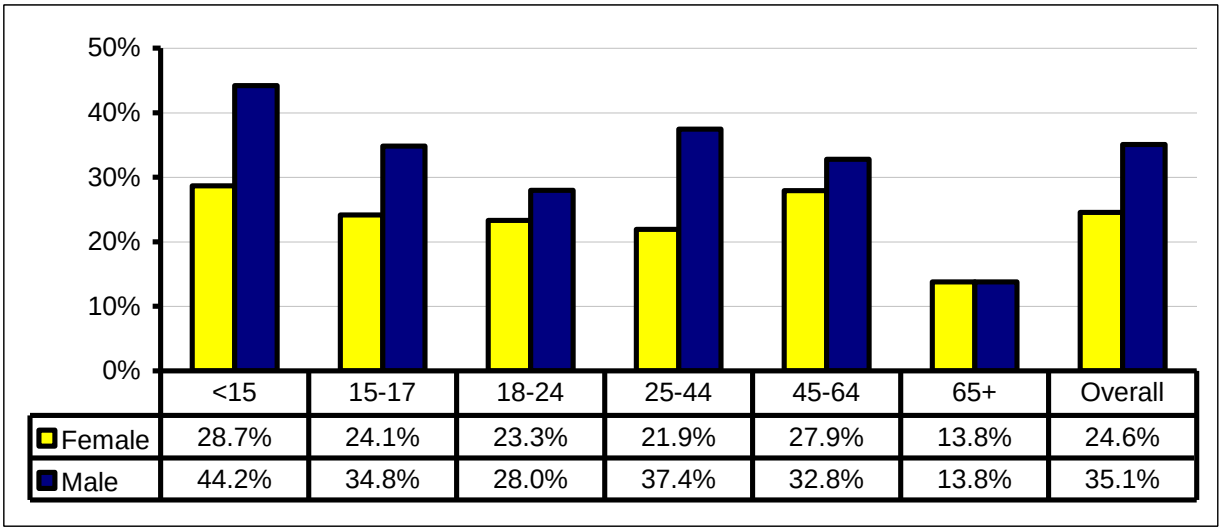


Table 9 describes outcomes among ATV crash victims by helmet use. The non-helmeted group was more likely to suffer a head injury and die than helmeted ATV crash victims.

Table 9: Outcomes by Helmet Use Among ATV Crash Occupants, ASTR 2005-2008

Outcomes	Helmet Use (N=916)	No Helmet Use (N=1,935)	P-value
Discharge Disposition			
Expired	**0.4%**	**1.5%**	**<0.05**
ISS (Mean)	9.1	9.3	>0.05
GCS (Mean)	**14.6**	**14.1**	**<0.0001**
ICU Length of Stay (Mean)	0.8	1.2	>0.05
Total Length of Stay (Mean)	4.5	3.4	>0.05
Total Charges (Mean)	$27,704	$34,928	>0.05
Head Injury	**28.9%**	**44.1%**	**<0.0001**

ISS – Injury Severity Score
ICU – Intensive Care Unit
GCS – Glasgow Coma Scale
P value of <0.05 considered to be significant.

Golden Hour by Region
ASTR 2005-2008

Golden Hour: (N= 78,245)

Inter-facility transfer patients (N=17,857) were excluded from this analysis.

Statewide, 41% of patients arrived at a Trauma Center within 60 minutes of injury. In the Central Region, only 8.7% of trauma patients from Gila County arrived at a Trauma Center within 60 minutes. In the Western Region, only 0.1% of patients from Yuma County arrived at a Trauma Center within 60 minutes. In the Northern Region, only 5.5% of patients from Apache County arrived at a Trauma Center within 60 minutes and in the Southeastern Region, only 5.7% of patients from Greenlee County arrived within 60 minutes.

The golden hour is not the only important measure. Ensuring that patients make it into the organized trauma system is vital even if it takes more than 60 minutes. In Gila County, the number of patients that reach a Trauma Center increases to 86.5%, in Apache County 88.2% and in Greenlee County 85.7% if you expand the time frame beyond 60 minutes.

TC – Trauma Center NTC – Non-Trauma Center

Table 10: STATEWIDE GOLDEN HOUR

Statewide Golden Hour										
Missing		Arrived to TC within an hour		Arrived to TC after an hour		Arrived to NTC within an hour		Arrived to NTC after an hour		Total Trauma Patients
N	%	N	%	N	%	N	%	N	%	N
21,297	27.2	32,211	41.2	20,078	25.7	3,118	4.0	1,541	2.0	78,245

Table 11: CENTRAL REGION

County of Injury	Golden Hour										Total Trauma Patients
	Missing		Arrived to TC within an hour		Arrived to TC after an hour		Arrived to NTC within an hour		Arrived to NTC after an hour		
	N	%	N	%	N	%	N	%	N	%	N
Gila	148	13.4	96	8.7	860	77.8	1	0.1	1	0.1	1,106
Maricopa	8,053	21.7	22,201	59.8	6,654	17.9	112	0.3	114	0.3	37,134
Pinal	676	19.4	1,035	29.7	1,762	50.6	2	0.1	4	0.1	3,479
Regional Total	8,877	21.3	23,332	55.9	9,276	22.2	115	0.3	119	0.3	41,719

Table 12: WESTERN REGION

County of Injury	Golden Hour										Total Trauma Patients
	Missing		Arrived to TC within an hour		Arrived to TC after an hour		Arrived to NTC within an hour		Arrived to NTC after an hour		
	N	%	N	%	N	%	N	%	N	%	N
La Paz	45	28.0	16	9.9	93	57.8	.	.	7	4.3	161
Mohave	19	40.4	10	21.3	17	36.2	.	.	1	2.1	47
Yuma	1,963	40.2	6	0.1	17	0.3	2,200	45.1	695	14.2	4,881
Regional Total	2,027	39.8	32	0.6	127	2.5	2,200	43.2	703	13.8	5,089

Table 13: NORTHERN REGION

County of Injury	Golden Hour										Total Trauma Patients
	Missing		Arrived to TC within an hour		Arrived to TC after an hour		Arrived to NTC within an hour		Arrived to NTC after an hour		
	N	%	N	%	N	%	N	%	N	%	N
Apache	13	10.2	7	5.5	105	82.7	1	0.8	1	0.8	127
Coconino	296	9.3	1,197	37.5	1,207	37.9	286	9.0	202	6.3	3,188
Navajo	104	12.5	74	8.9	465	55.8	139	16.7	52	6.2	834
Yavapai	263	17.7	241	16.2	730	49.1	171	11.5	82	5.5	1,487
Regional Total	676	12.0	1,519	27.0	2,507	44.5	597	10.6	337	6.0	5,636

Table 14: SOUTHEASTERN REGION

County of Injury	Golden Hour										Total Trauma Patients
	Missing		Arrived to TC within an hour		Arrived to TC after an hour		Arrived to NTC within an hour		Arrived to NTC after an hour		
	N	%	N	%	N	%	N	%	N	%	N
Cochise	137	20.8	66	10.0	437	66.3	12	1.8	7	1.1	659
Graham	30	16.3	17	9.2	137	74.5	.	.	.	.	184
Greenlee	10	14.3	4	5.7	56	80.0	.	.	.	.	70
Pima	2,348	19.5	4,855	40.4	4,825	40.1	.	.	.	.	12,028
Santa Cruz	65	19.6	49	14.8	217	65.6	.	.	.	.	331
Regional Total	2,590	19.5	4,991	37.6	5,672	42.7	12	0.1	7	0.1	13,272

Mode of Transportation
ASTR 2005-2008

This analysis included only those who were transported directly from the scene of injury to the reporting hospitals (67,105). Patients who presented to a Trauma Center by private vehicle were excluded as were those with missing transportation information (13,496) and those who were transferred from other hospitals (15,501).

Table 15: An Analysis of Patient Mode of Transport Stratified by Standard Trauma Scoring Systems and Discharge Status.

.	Transport	Statewide (67,105)	Central (39,517)	Western (3,679)	Northern (4,800)	Southeastern (12,223)
				% (p-value)		
ISS						
0-8	A	52.1 ****	54.2 ****	45.5 ****	45.2 ****	46.6 ****
	G	65.4	62.8	79.2	57.4	70.6
9-15	A	24.0	24.2	27.2	26.9	21.6
	G	19.9	20.9	15.5	26.4	16.0
16-24	A	12.4	12.1	12.1	14.1	13.6
	G	7.7	8.6	3.1	9.4	6.2
>24	A	11.5	9.6	15.2	13.7	18.3
	G	7.0	7.7	2.3	6.8	7.2
RTS Scene >=4						
	A	96.4 **	96.2	94.3 ****	97.5	95.9 ****
	G	96.9	96.3	98.4	98.4	97.6
RTS ED >=4						
	A	94.4 ****	94.6 ****	91.2 ****	92.2 ****	95.3 ****
	G	96.7	96.1	98.6	96.8	97.7
PS >0.90						
	A	88.1 ****	89.7 ****	81.5 ****	84.9 ****	83.9 ****
	G	92.9	92.2	97.1	90.6	93.7
Discharged from ED or Hospital within 24 hrs						
	A	43.2 ****	44.5 ****	33.5 ****	35.4****	41.8 ****
	G	56.8	52.2	72.9	50.4	66.9

* p<0.05 ** p <0.01 *** p<0.001 ****p<0.0001

A= Air transport G= Ground transport
RTS= Revised trauma score
PS= TRISS derived probability of survival
LOS= Length of stay
Missing data were excluded from analysis

Of the 67,105 patients transported from the scene of injury to a facility participating in the ASTR, 16,086 (24%) patients were transported by air ambulance and 51,019 patients were transported by ground ambulance.

Of all patients transported by air ambulance, 52% had an ISS <9, 43% were discharged home from the ED or from the hospital within 24 hours.

Of all patients transported by ground ambulance, 65% had an ISS <9, 57% were discharged home from the ED or from the hospital within 24 hours.

Table 16 suggests that there may be an increased survival rate among severely injured trauma victims transported by air ambulance. The absence of clear benefit associated with air transport for mildly injured victims (52%) raises questions about the structure of the pre-hospital transport system in Arizona.

Table 16: Mortality Rates for Patients Transported by Air and Ground Ambulance Stratified by Standard Trauma Scoring Systems

	Air	Ground
	Mortality Rate % (n)	
ISS Groups		
0-8 (40,215)	0.5%	0.4%
9-15 (13,512)	0.9%**	1.5%
16-24 (5,748)	2.9% ****	5.3%
>24 (5,231)	28.3% ****	39.2%
RTS Scene		
>=4 (54,526)	1.8% ****	1.3%
<4 (1,806)	56.9% ****	74.3%
RTS ED		
>=4 (62,981)	1.4% *	1.1%
<4 (2,505)	45.7% ****	73.6%
PS		
>0.90 (58,345)	0.3%	0.3%
<=0.90 (5,257)	29.4% ****	45.2%

* p<0.05 ** p <0.01 *** p<0.001 ****p<0.0001