

# State Trauma Advisory Board 2016 Annual Report



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## State Trauma Advisory Board

Listed below are the dedicated professionals and citizens who serve the State of Arizona as members of the State Trauma Advisory Board and the Trauma and EMS Performance Improvement Standing Committee by giving their time, expertise, and invaluable guidance to the Arizona trauma system. On behalf of the Arizona Department of Health Services and the citizens of Arizona, we thank them for their many contributions.

**Bentley J. Bobrow, MD, Chairman**

Medical Director  
Bureau of EMS and Trauma System - Phoenix, AZ

**Bill Ashland, RN**

Regional EMS Council - Northern Region Representative  
Flagstaff Medical Center - Flagstaff, AZ

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

**Judy Baum, PT, MSHA**

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

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Society of Trauma Nurses Representative  
Banner University Medical Center - Phoenix, AZ

**Herman Butler**

Tribal Health Organization Representative  
Tuba City EMS Field Office - Tuba City, AZ

**Franco Castro-Marin, MD**

National Organization of Emergency Physicians Representative  
Scottsdale Emergency Associates - Scottsdale, AZ

**Bill Daniell**

Statewide Ambulance Association Representative  
Mesa Fire and Medical Department- Mesa, AZ

**Jeff Farkas, NREMT-P**

Statewide Fire District Association Representative  
Timber Mesa Fire and Medical District - Show Low, AZ

**Iman Feiz-Erfan, MD**

Statewide Neurosurgical Society Representative  
Maricopa Medical Center - Phoenix, AZ

**Garth Gemar, MD**

National Association of Retired Persons Representative  
Rural/Metro-Southwest Ambulance, Glendale Fire Dept.,  
Surprise Fire Dept. and Banner Healthcare, AZ

**Philip Johnson, MD**

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

**Debbie Johnston, Vice President, Policy Development**

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

**Jennefer Kieran, MD, FACS**

Federal Indian Health Services Organization Representative  
Phoenix Indian Medical Center - Phoenix, AZ

**Daniel Millon**

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

**David Notrica, MD, FACS, FAAP**

Statewide Pediatric Organization Representative  
Phoenix Children's Hospital - Phoenix, AZ

**Scott Petersen, MD, Vice Chair**

American College of Surgeons Representative  
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Regional EMS Council - Western Region Representative  
Executive Director of WACEMS - Yuma, AZ

**Roy Ryals, CEP**

Regional EMS Council – Central Region Representative  
Southwest Ambulance - Mesa, AZ

**Chris Salvino, MD, MS, FACS**

Trauma Center Representative - Havasu Regional Medical  
Center - Lake Havasu City, AZ

**Jeffrey Schaff, RN, CEN**

Regional EMS Council - Southeastern Region Representative  
Banner University Medical Center - Tucson, AZ

**Jordan Smith, MD**

National Association of Orthopaedic Trauma Representative  
University of Arizona - Tucson, AZ

**Andrew Tang, MD, FACS**

Trauma Center Representative  
Banner University Medical Center - Tucson, AZ

**Laurie Wood, RN**

Urban Advanced Life Support Base Hospital not a Trauma  
Center Representative  
Banner Thunderbird Medical Center - Glendale, AZ

## Trauma and EMS Performance Improvement Standing Committee Membership

### **Chris Salvino, MD, MS, FACS**

Chair  
Havasu Regional Medical Center - Lake Havasu City, AZ

### **Bill Ashland, RN**

Vice Chair/State Designated Level I Trauma Center Trauma Program Manager  
Flagstaff Medical Center - Flagstaff, AZ

### **Brian Bowling, BS, FP-C**

Air Ambulance Premier EMS Agency—  
Quality Improvement Officer  
Native Air Ambulance - Tempe, AZ 85282

### **Gail Bradley, MD**

Medical Direction Commission Liaison  
Peoria, Sun City, and Goodyear Fire Departments - EMS  
Medical Director

### **Robert Corbell, EMT-P**

EMS Registry Group Member  
Northwest Fire District  
Tucson, AZ

### **Paul Dabrowski, MD**

Trauma Surgeon  
Banner University Medical Center-Phoenix, AZ

### **Robert Djergaian, MD**

Rehabilitation Specialist  
Banner University Medical Center -Phoenix, AZ

### **Josh Gaither, MD**

EMS Researcher (AEMRC)  
Banner University Medical Center Base Hospital-Tucson,  
AZ

### **Garth Gemar, MD**

EMS Medical Director of a Premier EMS Agency  
Rural/Metro-Southwest Ambulance, Glendale Fire Dept.,  
Surprise Fire Dept. and Banner Healthcare - Phoenix, AZ

### **Pamela Goslar, PhD**

IPAC Representative  
St. Joseph's Hospital & Medical Center  
Phoenix, AZ

### **Michelle Guadnola, RN**

State Designated Level I Trauma Center Trauma Program  
Representative  
St. Joseph's Hospital & Medical Center - Phoenix, AZ

### **Rebecca Haro, NREMT-P**

EMS Council Liaison  
Sun City West Fire District - Phoenix, AZ

### **Darlene Herlinger, RN, MSN**

Prehospital EMS Coordinator (SAEMS/AEMS)  
Banner University Medical Center-South Campus  
Tucson, AZ

### **Ralph Zane Kelly, DO**

State Designated Level III Trauma Center Program Manager  
Tuba City Regional Health Care Corporation - Tuba City,  
AZ

### **Summer Magoteaux, RN**

Pediatric Representative (MD or RN)  
Maricopa Medical Center - Phoenix, AZ

### **Jill McAdoo, RN**

Ground Ambulance or First Responder Premier EMS Agency  
– Quality Improvement Officer (NAEMS/WACEMS), Life  
Line Ambulance Service, Prescott AZ

### **Mary McDonald, RN, BSN**

Prehospital EMS Manager – (SAEMS/AEMS)  
Tucson Fire Department - Tucson, AZ

### **Eric Merrill, EMT-P**

Ground Ambulance or First Responder Premier EMS  
Agency, Quality Improvement Officer (SAEMS/AEMS)  
Rio Verde Fire Department-Rio Verde, AZ

### **Heather Miller**

Western Arizona Council of Emergency Services  
Kingman Regional Medical Center-Kingman, AZ

### **Melissa Moyer, CSTR**

Representative of the Trauma Registry Users Group  
John C. Lincoln North Mountain Hospital  
Phoenix, AZ

### **Pam Noland, RN**

State Designated Level IV Trauma Center Program Manager  
Northern Cochise Community Hospital  
Willcox, AZ

### **Jeffrey Schaff, RN, CEN**

ACS Verified Level I Trauma Program Manager  
Banner University Medical Center - Tucson, AZ

### **Danielle Stello, RN**

Prehospital EMS Coordinator - Base Hospital (NAEMS/  
WACEMS)  
Havasu Regional Medical Center, Lake Havasu City, AZ

### **Tiffany Strever, RN**

State Designated Level I Trauma Center – Trauma Program  
Representative - West Valley Hospital – Goodyear, AZ

### **Dale Woolridge, MD**

Injury Researcher  
University of Arizona Department of Emergency Medicine  
Tucson, AZ

# Annual Report to the Director

## Introduction & Highlights

Trauma remains a significant public health problem in Arizona, the details of which are included in this report. In 2015, Arizona's trauma centers treated 43,351 people, including 22,142 (52%) under the age of 45 and 4,747 (11%) under the age of 15.

Arizona's proportion of mortality is at or below the national average on four of the six leading mechanisms of injury measurements. This is a testament to the quality of Arizona's trauma system. Even so, 965 (2.27%) people died from their injuries in 2015, including 393 deaths for people under the age of 45 years, and 28 deaths under the age of 15 years.

Overall, the top six causes of traumatic injuries in Arizona are; Falls (37%), Motor Vehicle Traffic related injury (33%), Struck By/Against (8%), Other Land Transport (7%), Cut/Pierce (4%), and Firearm (3%). While vehicle restraint use has been found to save lives, it was least practiced among people aged 5 to 44 years.

Arizona's Native American population suffers disproportionately from injury compared to all other race and ethnicities; 3,976 were treated at Arizona's trauma centers (1,385 per 100,000). Because an unknown number of Native Americans received trauma care in neighboring states, this number is likely an underestimate of the injury rate.

Trauma also exacts an enormous financial burden on the state. Trauma center charges in 2015 were \$1.6 B., and the median charge to care for a trauma patient was \$22,026. The average reimbursement rate for trauma care in Arizona was 16.4% for this reporting period.

Drug and alcohol use continue to be prevalent and are both strongly correlated with injury. Among young adults aged 18 to 24, 23% and 22% were found to be under the influence of drugs and alcohol, respectively. Among teens aged 15 to 17, 13% and 6% were found to be under the influence of drugs and alcohol, respectively.

## **State Trauma System Development**

**Trauma Center Growth:** Two new Level III Trauma Centers received provisional designation in 2015. Canyon Vista Medical Center in Sierra Vista was designated in May and Havasu Regional Medical Center in Lake Havasu City was designated in November. As of September 13, 2016, there are ten Level I Trauma Centers, seven Level III Trauma Centers, and twenty-two level IV Trauma Centers in Arizona.

**Revised Resources for the Optimal Care of the Injured Patient:** Trauma Centers that chose to be designated via a verification assessment by the American College of Surgeons must meet criteria outlined in the American College of Surgeon's, "Resources for the Optimal Care of the Injured Patient." A long-anticipated revision of this document was released in 2014, and many of Arizona's Trauma Centers have been working hard to prepare for these new standards.

**Rule Updates:** In late 2015, the Department of Health Services received approval from the Governor's office to move forward with a limited update to the trauma system rules. An invitation to participate in the rule making process was distributed to Arizona's trauma stakeholder community on September 12, 2016. The Office of Administrative Council has set a target of October 2017 to complete the process.

### **Public Health Reports**

**Arizona Injury and Trauma Mortality Report:** This report highlights a 29% reduction in the trauma mortality rate between the years 2006 and 2014 and a 16% decrease in the injury mortality rate over the same period. This positive change may be "due to improvements in clinical care, engineering of safer roads and cars, injury prevention initiatives, and the expansion of trauma centers into rural Arizona."

## Looking Forward

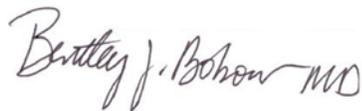
**Technical Assistance:** Bureau of EMS and Trauma System staff prioritize technical assistance to rural trauma centers. Because a significant number of rural hospitals are now Level IV Trauma Centers, Bureau staff now focuses on supporting key regional hospitals that have expressed interest in Level III Trauma Center designation.

Three of four rural regions now have rural Level III Trauma Centers - Tuba City Regional Health Care Corporation in the north, Havasu Regional Medical Center in the west, and Canyon Vista Medical Center in the south. The Bureau is optimistic that one or two more facilities that are rural will join the Level III ranks.

**Conclusion:** In the past 8 years, Arizona has seen a dramatic decline in its injury and trauma death rate. While we still lag behind the nation, our progress suggests that our efforts are paying dividends. These past years, our focus has not been on individual Trauma Centers. Instead, the focus has been placed on the trauma system as a whole, working collaboratively with other trauma stakeholders to assure that injured Arizonans, and visitors to our state, received optimal, timely care.

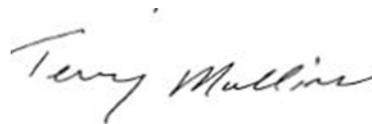
Our system growth has been extraordinary, and our current rules are inadequate for a system of this size. Over the next year, we have the opportunity to create a regulatory framework that will support our continued efforts to further reduce the burden of injury in Arizona.

On behalf of the State Trauma Advisory Board, September 15, 2016



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Bentley J. Bobrow, Chair  
Bureau Medical Director



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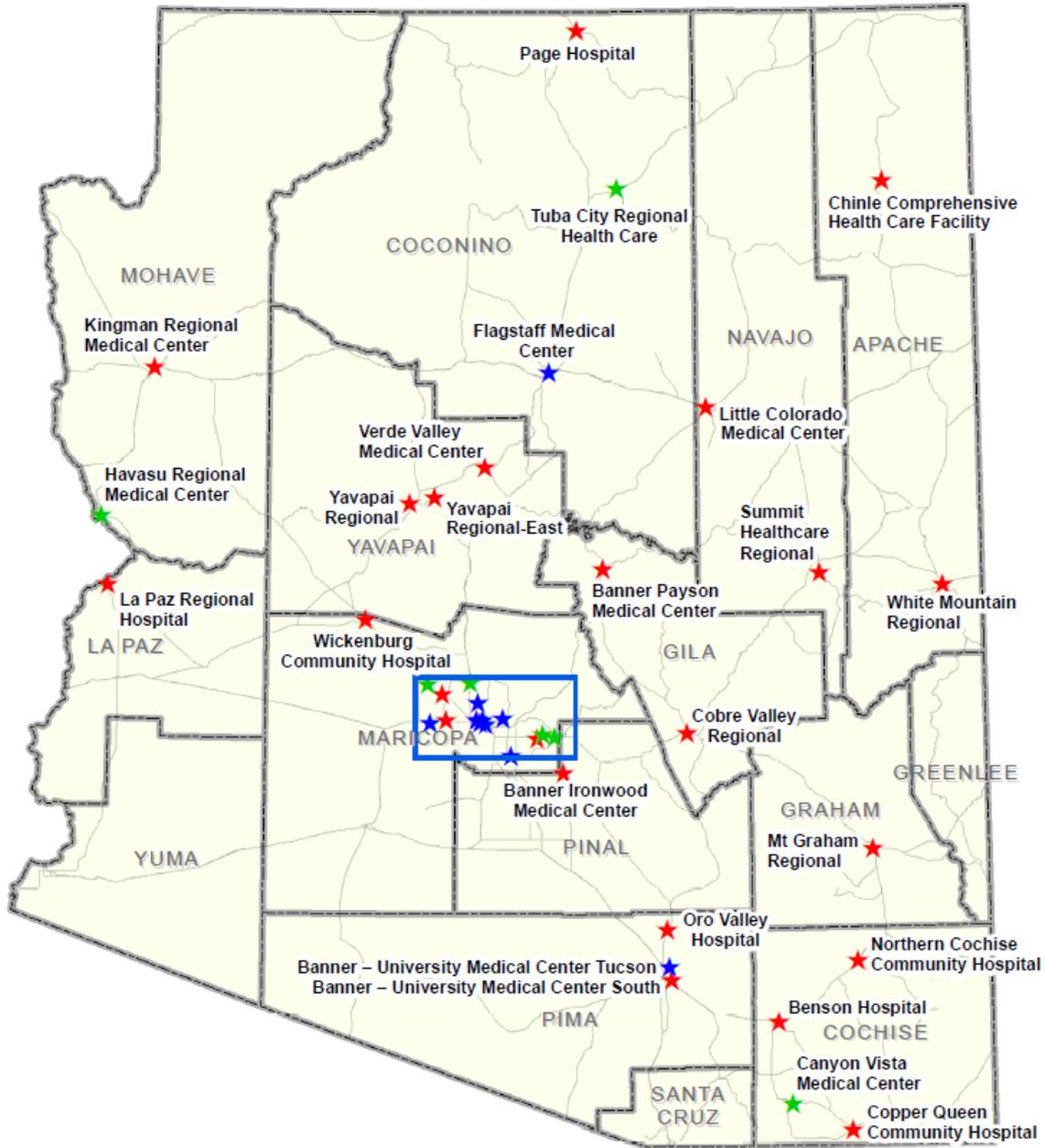
Terry Mullins  
Bureau Chief

## Arizona State Designated Trauma Centers

Health Care Institution	Address	Effective Date	Expiration Date
<b>Level I Trauma Centers</b>			
Abrazo West Campus	13677 W. McDowell Road, Goodyear, AZ 85395	10/1/15	6/30/18
Banner - University Medical Center Phoenix	925 E. McDowell Rd., Phoenix, AZ 85006	11/19/14	11/18/17
Banner University Medical Center – Tucson Campus	1501 N. Campbell Ave., Tucson, AZ 85724	11/11/15	11/11/17
Dignity Health, dba Chandler Regional Medical Center	1955 W. Frye Rd., Chandler, AZ 85224	10/1/15	07/1/18
Flagstaff Medical Center	1200 N. Beaver St., Flagstaff, AZ 86001	05/27/14	05/27/17
HonorHealth John C. Lincoln Medical Center	250 E. Dunlap Ave., Phoenix, AZ 85020	04/24/14	04/24/17
HonorHealth Scottsdale Osborn Medical Center	7400 E. Osborn, Scottsdale, AZ 85251	10/25/14	10/25/17
Maricopa Medical Center	2601 E. Roosevelt, Phoenix, AZ 85008	12/20/15	12/19/17
Phoenix Children’s Hospital	1919 E. Thomas Rd., Phoenix, AZ 85016	08/31/16	08/31/18
St. Joseph’s Hospital & Medical Center	350 W. Thomas Rd., Phoenix, AZ 85013	11/20/13	11/20/16
<b>Level III Trauma Centers</b>			
Banner Baywood Medical Center	6644 E. Baywood Ave., Mesa, AZ 85206	02/25/15	02/25/17
Banner Del E. Webb Medical Center (Provisional Designation)	14502 W. Meeker Blvd, Sun City West, AZ 85375	02/01/16	08/01/17
Canyon Vista Medical Center (Provisional Designation)	5700 E. Highway 90, Sierra Vista, AZ 85635	05/1/15	11/1/16
Havasu Regional Medical Center (Provisional Designation)	101 Civic Center Ln., Lake Havasu City, AZ 86403	11/11/15	5/11/17
HonorHealth Deer Valley Medical Center	19829 N. 27 <sup>th</sup> Ave., Phoenix, AZ 85027	06/09/14	4/08/17
Mountain Vista Medical Center	1301 S. Crismon Rd., Mesa, AZ 85209	7/23/14	7/26/16
Tuba City Regional Health Care Corp.	P.O. Box 600, 167 Main St., Tuba City, AZ 86045	4/07/15	12/10/17
<b>Level IV Trauma Centers</b>			
Banner Boswell Medical Center	10401 W. Thunderbird Blvd., Sun City, AZ 85351	12/17/15	12/17/18
Banner Estrella Medical Center	9201 W. Thomas Road, Phoenix, AZ 85037	08/30/15	08/30/18
Banner Gateway Medical Center	1900 N. Higley Road, Gilbert, AZ 85234	01/02/16	01/02/19
Banner Ironwood Medical Center	37000 N. Gantzel Rd., San Tan Valley, AZ 85140	10/11/15	10/11/18
Banner Page Hospital	501 N. Navajo, Page, AZ 86040	11/05/14	11/05/17
Banner Payson Medical Center	807 S. Ponderosa Street, Payson, AZ 85541	11/22/13	11/22/16
Banner University Medical Center – South Campus	2800 E. Ajo Way, Tucson, AZ 85713	08/13/13	08/13/16

Health Care Institution	Address	Effective Date	Expiration Date
<b>Level IV Trauma Centers</b>			
Chinle Comprehensive Health Care Facility	P.O. Drawer PH, Chinle, AZ 86503	09/09/13	09/09/16
Cobre Valley Regional Medical Center	5880 S. Hospital Dr., Globe, AZ 85501	11/26/15	11/26/18
Copper Queen Community Hospital	101 Cole Ave., Bisbee, AZ 85603	12/01/15	12/01/18
Kingman Regional Medical Center	3269 Stockton Hill Rd., Kingman, AZ 86409	10/15/15	10/15/18
La Paz Regional Hospital	1200 W. Mohave Rd., Parker, AZ 85344	06/02/15	06/02/18
Little Colorado Medical Center	1501 N. Williamson Blvd, Winslow, AZ 86047	6/22/15	6/22/18
Mt. Graham Regional Medical Center	1600 S. 20 <sup>th</sup> Ave., Safford, AZ 85546	03/20/14	03/20/17
Northern Cochise Community Hospital	901 W. Rex Allen Dr., Willcox, AZ 85643	12/04/14	12/04/17
Oro Valley Hospital	1551 East Tangerine Road, Oro Valley, AZ 85755	4/18/16	4/18/19
Summit Healthcare Regional Medical Center	2200 Show Low Lake Rd., Show Low, AZ 85901	08/12/14	08/12/17
Verde Valley Medical Center	269 S. Candy Ln., Cottonwood, AZ 86326	08/18/14	08/18/17
White Mountain Regional Medical Center	118 S. Mountain Ave., Springerville, AZ 85938	06/18/15	06/18/18
Wickenburg Community Hospital	520 Rose Ln., Wickenburg, AZ 85390	08/08/14	08/08/17
Yavapai Regional Medical Center – West Campus	1003 Willow Creek Road, Prescott, AZ 86301	01/10/14	01/10/17
Yavapai Regional Medical Center – East Campus	7700 E. Florentine, Prescott Valley, AZ 86314	6/24/14	6/24/17

# DESIGNATED ARIZONA TRAUMA CENTERS



**Trauma Centers**

- ★ Level I
- ★ Level III
- ★ Level IV

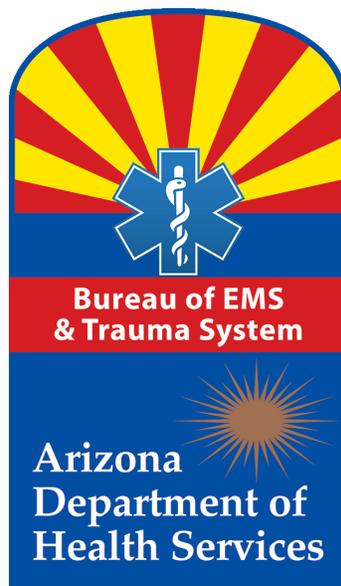



Map Date: January 2016

Data Source:  
Bureau of EMS & Trauma System  
Arizona Department of Health

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

# **State Trauma Advisory Board 2016 Annual Report**



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## Acknowledgements

The Arizona Department of Health Services' Bureau of Emergency Medical Services and Trauma System (BEMSTS) wishes to acknowledge the continued hard work and dedication of all the individuals involved in working to understand, prevent, and treat traumatic injury.

Special thanks are extended to the members of the State Trauma Advisory Board, Trauma and EMS Performance Improvement Committee, participating trauma centers, medical directors, program managers, and registrars. Their dedication to continuously improving data collection makes it possible to fully evaluate and advance Arizona's trauma system.

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## Purpose and Methods

### **Purpose:**

The purpose of this report is to describe Arizona's trauma system through the Arizona State Trauma Registry (ASTR). The ASTR is dedicated to capturing information on severely injured patients in Arizona and collects data from all state designated trauma centers, as well as participating non-designated hospitals.

### **Methods:**

In 2015, the ASTR captured 42,351 cases of traumatic injury from forty-two (42) participating healthcare facilities including ten (10) Level I trauma centers, seven (7) Level III trauma centers, twenty-three (23) Level IV trauma centers, and two (2) non-designated hospitals.

All Level I trauma centers in Arizona are located in urban areas of the state, including eight in Maricopa County, one in Coconino County and one in Pima County. Level III and Level IV trauma centers are located primarily in rural areas of the state.

Arizona's Trauma System is divided into four distinct regions based on Arizona's 15 counties: Western (Mohave, La Paz and Yuma Counties), Northern (Yavapai, Coconino, Navajo and Apache Counties), Southeastern (Pima, Santa Cruz, Graham, Cochise and Greenlee Counties) and Central (Maricopa, Gila and Pinal Counties). The table below depicts the distribution of trauma centers by region:

**Table 1: Trauma center designation and distribution by region**

Injury Region	Level I	Level III	Level IV	Non-Designated	Total
Western	0	1	4	1	5
Northern	1	1	7	0	9
Southeastern	1	1	5	0	8
Central	8	3	8	1	20
Statewide	10	6	24	2	42

Level I and III trauma centers are required to submit the full ASTR data set while Level IV trauma centers and non-designated facilities have the option to submit either the full or reduced data set. The ASTR contains a validation tool that checks more than 800 state and national rules. Validation is run at the hospital and at the state level. Inconsistencies are flagged and returned to hospitals for review or correction. In addition to this check, a statewide Inter Rater Reliability assessment is performed each year.

This report analyzed cases for patients with an Emergency Department/Hospital Arrival Date between January 1, 2015, and December 31, 2015. Population denominators were derived from the Arizona Health Status and Vital Statistics database and death records were derived from the Vital Statistics Information Management System – Electronic Death Registry System (EDR). When comparing to national trauma data, the ASTR was restricted by admission, transfer, and outcome status in order to match the inclusion criteria of the National Trauma Data Bank (NTDB).<sup>1</sup> The 2015 data were compared with the 2013 and 2014 two-year median as opposed to the five-year median used in the 2014 annual report. Each year the number of designated trauma centers in Arizona has increased. From 2013 to 2015, there was not much change in the total number of designated trauma centers making it meaningful to compare the 2015 data with the two-year median.

<sup>1</sup> <http://www.facs.org/trauma/ntdb/pdf/ntdb-annual-report-2012.pdf>

All trauma rates were calculated per 100,000 Arizona residents using the 2015 population denominators from the Arizona Health Status and Vital Statistics database. A 95% Confidence Interval (CI) was calculated along with all rate estimates. CIs provide a range of values that describe the uncertainty surrounding an estimate and may be used to assess statistical significance. When comparing trauma rates within a table, if the range of the CIs for two rates do not overlap, the rates are considered statistically significant ( $p < 0.05$ ). If the range of the CIs do overlap, then the difference is not significant.

**Example:**

<b>Group</b>	<b>Rate per 100,000 (95% CI)</b>
A	437 (430, 443)
B	435 (425, 444)
C	871 (841, 902)

In the table above, there is no statistically significant difference in rate between group A and group B. This is because the CIs for groups A and B share a range of values (430-443). There is however, a statistically significant difference in rate between group A and group C and between group B and group C. In both cases, the ranges of the CIs do not overlap.

Analyses were performed using SAS Version 9.4 (SAS Institute, Cary, NC).

**Geo-Population:**

Arizona is 400 miles long and 310 miles wide, with a total area of 114,006 square miles. Arizona’s topography is a blend of deserts, mountains, and plateaus. Arizona’s population increased by 1.4% from 2014 to 2015, and the number of individuals living in Arizona in 2015 totaled 6,758,251<sup>2</sup>. Arizona is divided into 15 counties, the urban counties (Maricopa, Pima, Pinal, and Yuma) make-up 84.4% of the population, the remaining counties (Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Mohave, Navajo, Santa Cruz, and Yavapai) account for 15.6% of the population. There are twenty-two (22) federally recognized American Indian tribes in Arizona with a total population of 287,001 in 2015.

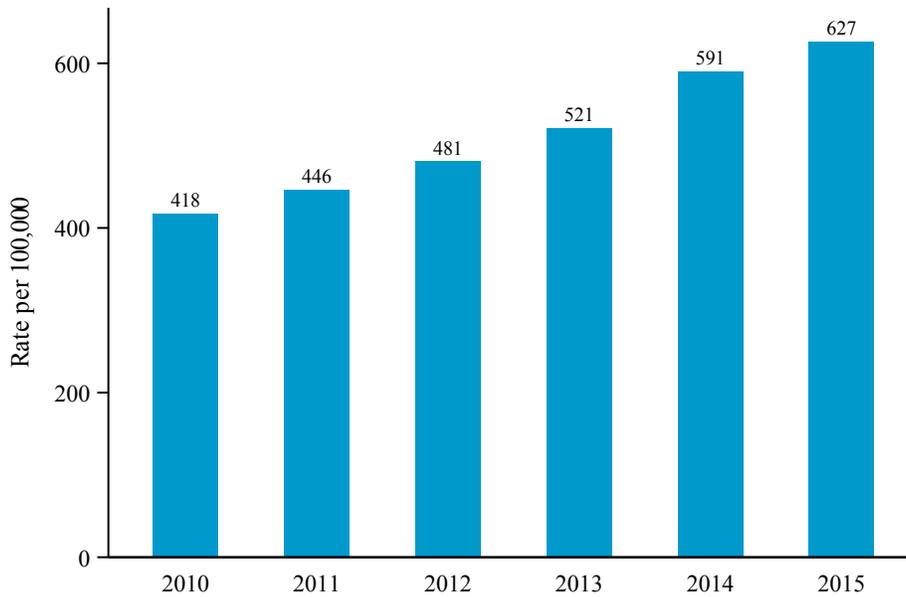
<sup>2</sup> <http://azdhs.gov/plan/menu/info/pop/index.php>

## Trauma Patient Demographics

In 2015, a total of 42,351 trauma cases were reported to the Arizona State Trauma Registry; Arizona’s trauma rate was 627 per 100,000 Arizona residents.

Since 2010, the rate of traumatic injury has increased from 418 to 627 traumas per 100,000 Arizona residents. This increase may be due in part to the maturation of Arizona’s trauma system and the increasing number of designated trauma centers.

**Figure 1: Trauma rate per 100,000 Arizona residents by year**



Data source: Arizona State Trauma Registry 2010-2015

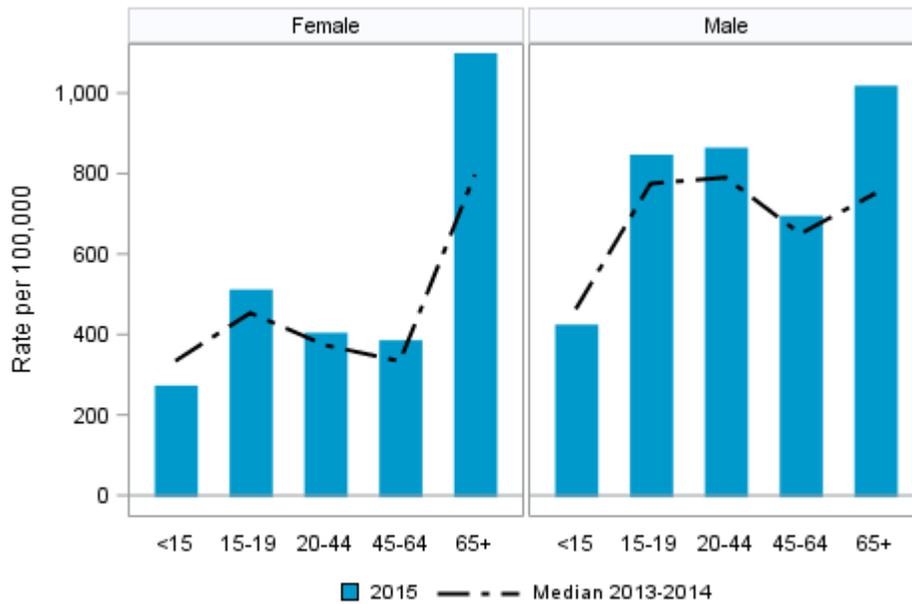
**Table 2: Trauma rate per 100,000 Arizona residents by year**

Year	Total Trauma cases	Rate per 100,000 (95%CI)
2010	26,688	418 [413, 423]
2011	28,721	446 [441, 451]
2012	31,246	481 [475, 486]
2013	34,275	521 [515, 526]
2014	39,373	591 [585, 596]
2015	42,351	627 [621, 633]

In 2015, Males had significantly higher trauma rates than Females in all age categories except 65+.

Overall, the rates of traumatic injury in 2015 were higher than the two-year median with the exception of the <15 age category.

**Figure 2: Gender & age-specific trauma rate per 100,000 Arizona residents**



Data source: Arizona State Trauma Registry 2013-2015

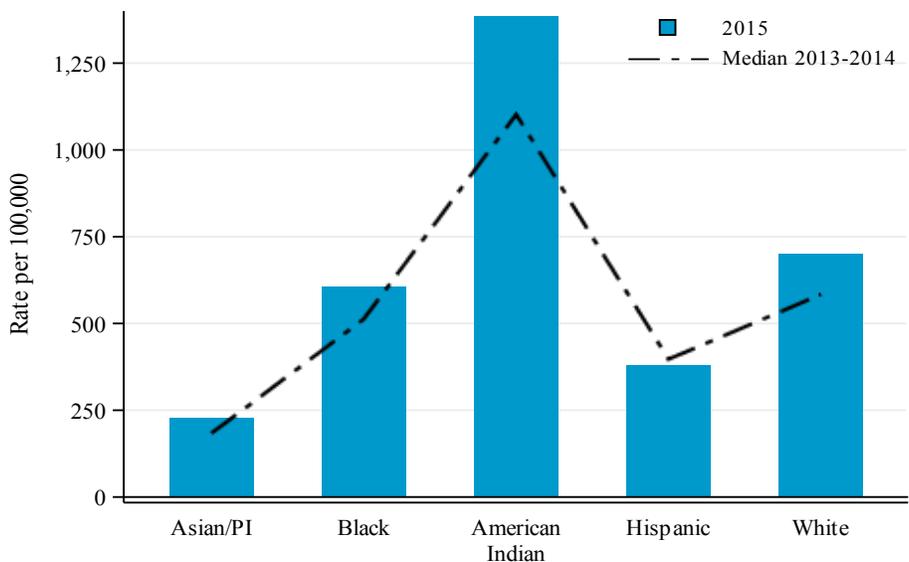
**Table 3: Gender & age-specific trauma rate per 100,000 Arizona residents**

Gender	Age	Total Trauma Cases	Rate per 100,000 (95%CI)
Female	Total	16,994	500 [492, 507]
	<15	1,814	273 [260, 286]
	15-19	1,137	512 [482, 542]
	20-44	4,409	404 [392, 416]
	45-64	3,251	386 [372, 399]
	65+	6,383	1,099 [1,072, 1,126]
Male	Total	25,356	755 [746, 764]
	<15	2,933	425 [409, 440]
	15-19	1,986	847 [810, 884]
	20-44	9,862	864 [847, 881]
	45-64	5,537	695 [677, 714]
	65+	5,038	1,018 [990, 1,047]

CI= Confidence interval

The rate of traumatic injury among American Indian/Alaskan Natives was two times higher than that of Whites. Asian/Pacific Islanders, Blacks, and Hispanics had lower trauma rates as compared to Whites.

**Figure 3: Race-specific trauma rate per 100,000 Arizona residents**



Data source: Arizona State Trauma Registry 2013-2015

**Table 4: Race-specific trauma rate per 100,000 Arizona residents**

Race/ethnicity	Total Trauma Cases	Rate per 100,000 (95%CI)
Asian/PI	533	228 [209, 247]
Black	1,866	606 [579, 634]
American Indian	3,976	1,385 [1,342, 1,428]
Hispanic	7,857	380 [371, 388]
White	27,093	702 [693, 710]

CI= Confidence interval, PI=Pacific Islander

For more information on trauma rates among Arizona American Indians please visit: <http://www.azdhs.gov/bems/data/quality-assurance-reports.php?pg=county-regional>

## Injury Characteristics: Mechanism of Injury

**Table 5: Mechanism-specific trauma and mortality proportion, ASTR 2015**

In 2015, the top six mechanisms of traumatic injury were Fall, Motor Vehicle Traffic, Struck by/Against, Other Transport, Cut/Pierce and Firearm.

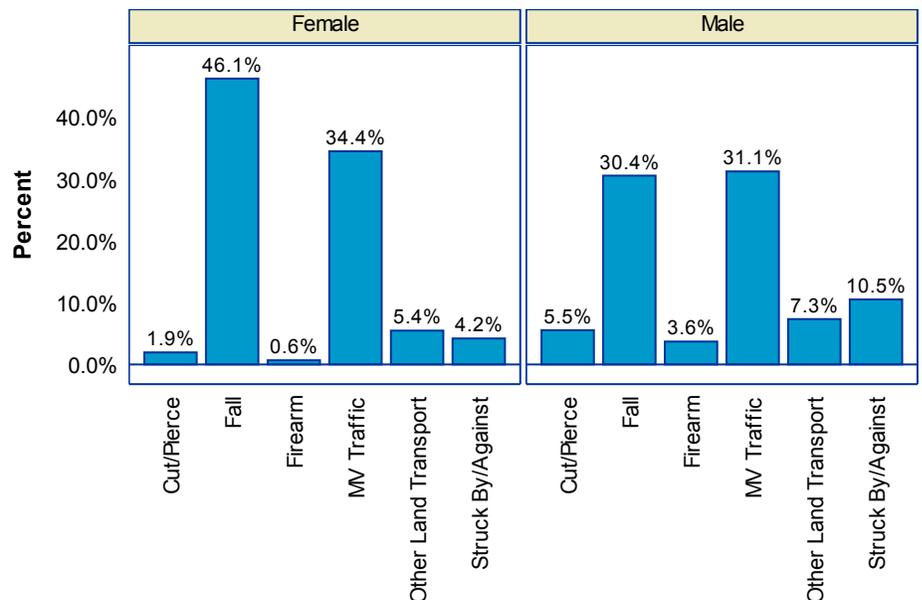
The overall trauma mortality was 2.27%. The mechanisms with the highest mortality proportions were Suffocation (18.6%), Firearm (16.7%), and Drowning (16.1%).

Mechanism	Count	Percent	Deaths	Mortality Proportion
Overall	42,351	100.00%	965	2.27%
Fall	15,580	36.78%	252	1.61%
MV Traffic	13,758	32.48%	373	2.71%
Struck By/Against	3,377	7.97%	19	0.56%
Other Land Transport	2,787	6.58%	33	1.18%
Cut/Pierce	1,733	4.09%	28	1.61%
Firearm	1,053	2.48%	176	16.71%
Other Pedal Cyclist	983	2.32%	5	0.50%
Other Specified	610	1.44%	7	1.14%
Not Specified	524	1.23%	28	5.34%
Natural/Environmental	449	1.06%	2	0.44%
Not Elsewhere Classifiable	308	0.72%	4	1.29%
Machinery	240	0.56%	0	0.00%
Other Pedestrian	212	0.50%	4	1.88%
Hot Object/Scald	157	0.37%	0	0.00%
Other Transport	145	0.34%	1	0.68%
Overexertion	125	0.29%	1	0.80%
Fire/Flame	119	0.28%	5	4.20%
Suffocation	118	0.27%	22	18.64%
Drowning	31	0.07%	5	16.12%
Poisoning	24	0.05%	0	0.00%
Not documented	18	0.04%	0	0.00%

**Figure 4: Gender-specific trauma proportion by top 6 mechanisms**

Almost half of all traumas among females were falls.

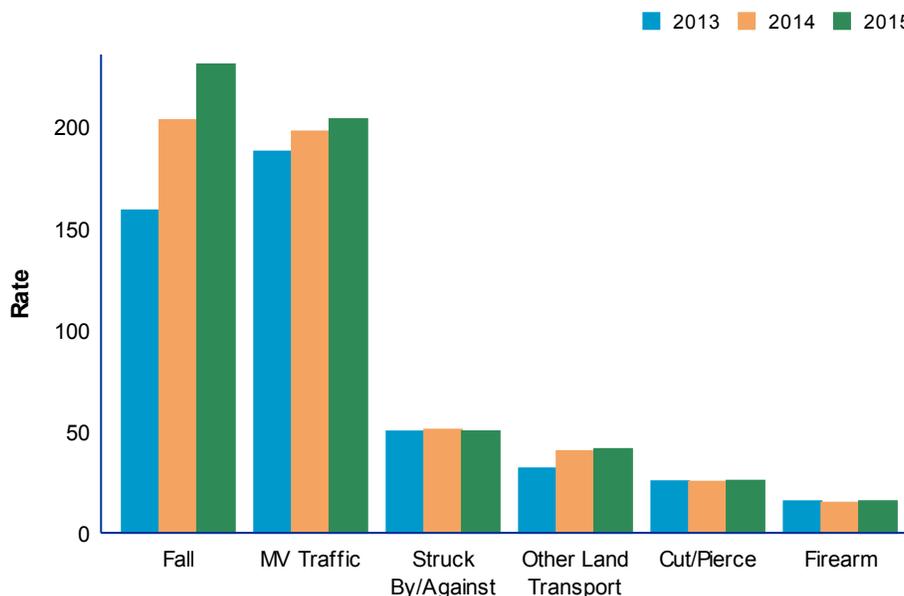
Females had higher rates of Fall and Motor Vehicle Traffic trauma as compared to Males, while Males had higher rates of Cut/Pierce, Firearm and Stuck By/Against.



Data source: Arizona State Trauma Registry 2015

In 2015, Falls and Motor Vehicle Traffic made up 70% of traumatic injuries in Arizona. From 2013 to 2015, the rate of Fall related trauma increased from 159 to 231 per 100,000 Arizona residents and the rate of Motor Vehicle Traffic related trauma increased from 188 to 204 per 100,000 Arizona residents.

**Figure 5: Trauma rate per 100,000 Arizona residents by top 6 mechanism of injury and year**



Data source: Arizona State Trauma Registry 2013-2015

**Table 6: Trauma rate per 100,000 Arizona residents by top 6 mechanism of injury and year**

Year	Mechanism of injury	Total Trauma Cases	Rate per 100,000 (95%CI)
2013	Fall	10,443	159 [156, 162]
	MV Traffic	12,349	188 [184, 191]
	Struck By/Against	3,283	50 [48, 52]
	Other Land Transport	2,087	32 [30, 33]
	Cut/Pierce	1,670	25 [24, 27]
	Firearm	1,022	16 [15, 16]
2014	Fall	13,541	203 [200, 207]
	MV Traffic	13,169	198 [194, 201]
	Struck By/Against	3,385	51 [49, 52]
	Other Land Transport	2,682	40 [39, 42]
	Cut/Pierce	1,678	25 [24, 26]
	Firearm	990	15 [14, 16]
2015	Fall	15,580	231 [227, 234]
	MV Traffic	13,758	204 [200, 207]
	Struck By/Against	3,377	50 [48, 52]
	Other Land Transport	2,787	41 [40, 43]
	Cut/Pierce	1,733	26 [24, 27]
	Firearm	1,053	16 [15, 17]

CI= Confidence interval

## Injury Characteristics: Intent of Injury

In 2015, 88% of Arizona’s traumas were Unintentional, 9% were Homicide/Assault and 2% were Suicide/Self-Inflicted.

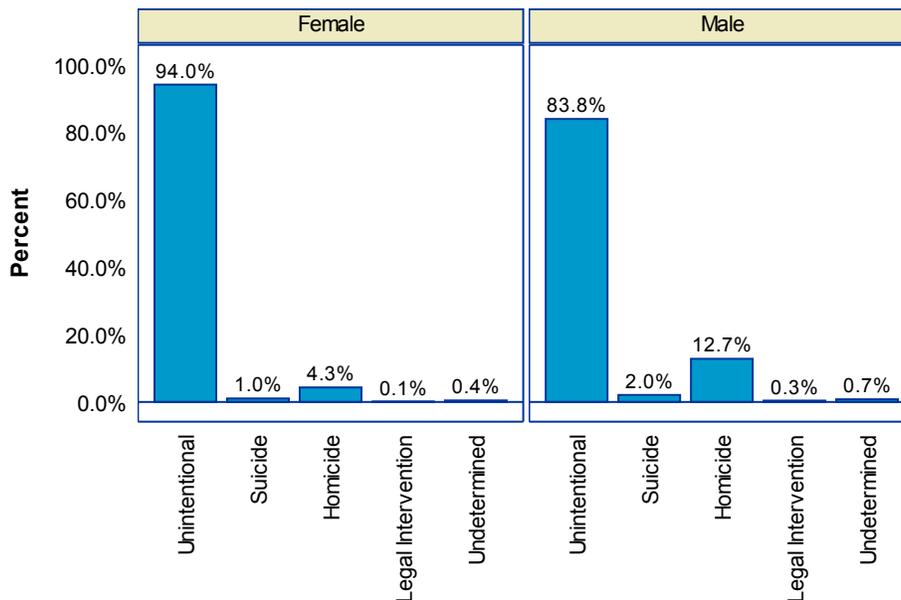
Legal Intervention\*, and Suicide/Self-Inflicted traumas had the highest mortality proportions.

**Table 7: Intent-specific trauma and mortality proportion, ASTR 2015**

Intent	Count	Percent	Deaths	Mortality Proportion
Overall	42,351	100.00%	965	2.27%
Unintentional	37,260	87.97%	709	1.90%
Homicide/Assault	3,976	9.38%	109	2.74%
Suicide/Self-Inflicted	702	1.65%	113	16.09%
Undetermined	277	0.65%	14	5.05%
Legal Intervention	118	0.27%	20	16.94%
Not documented	18	0.04%	0	0.00%

The distribution of trauma, by intent, was similar between Males and Females; however, Females had a slightly higher proportion of Unintentional traumas while Males had a higher proportion of intentional traumas such as Homicide/Assault and Suicide/Self-Inflicted.

**Figure 6: Gender-specific trauma proportion by intent**

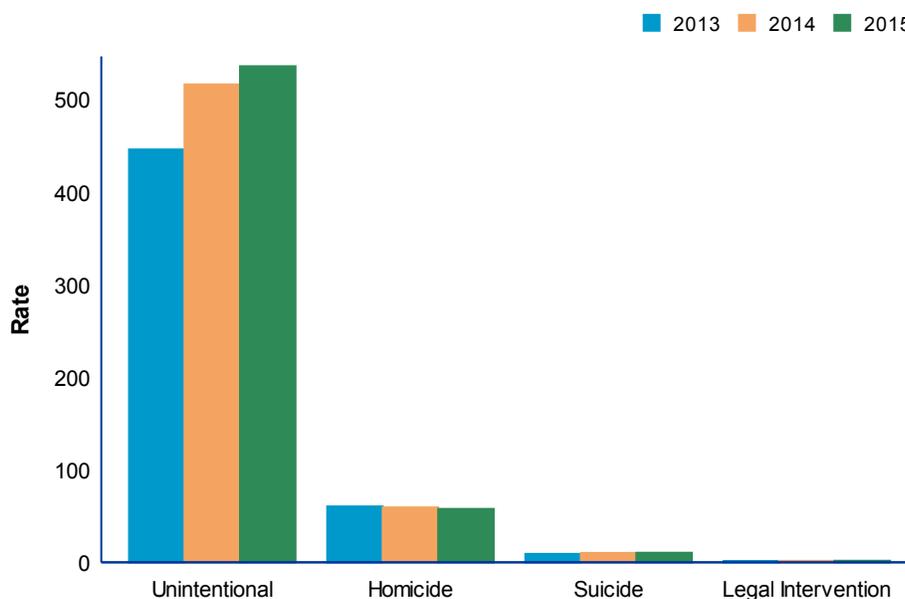


Data source: Arizona State Trauma Registry 2015

\*Legal Intervention: injury to a person caused by police or other law enforcement officer while in the line of duty

The rate of Unintentional trauma has increased from 446 per 100,000 in 2013, to 535 per 100,000 in 2015. The rates of Homicide, Suicide, and Legal Intervention have not changed significantly since 2013.

**Figure 7: Trauma rate per 100,000 Arizona residents by intent of injury and year**



Data source: Arizona State Trauma Registry 2013-2015

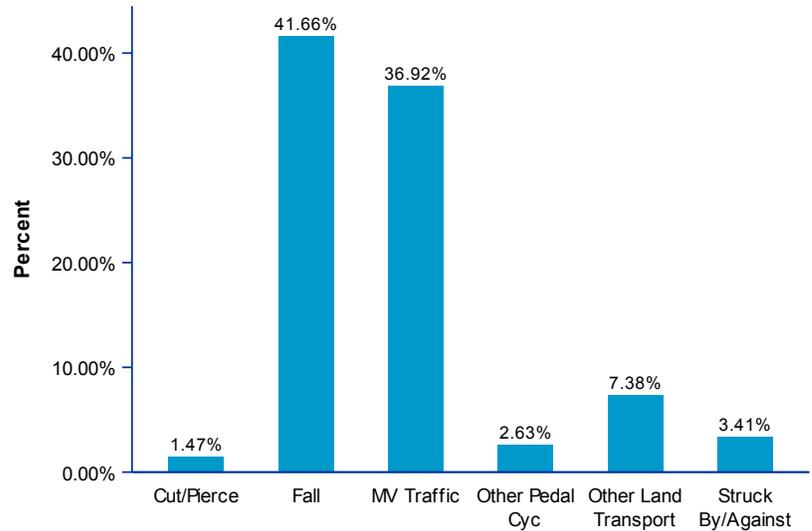
**Table 8: Trauma rate per 100,000 Arizona residents by intent of injury and year**

Year	Intent of injury	Total Trauma Cases	Rate per 100,000 (95%CI)
2013	Unintentional	29,319	446 [440, 451]
	Homicide/Assault	3,971	60 [58, 62]
	Suicide/Self-Inflicted	601	9 [8, 10]
	Legal Intervention	100	2 [1, 2]
2014	Unintentional	34,384	516 [510, 521]
	Homicide/Assault	3,952	59 [57, 61]
	Suicide/Self-Inflicted	677	10 [9, 11]
	Legal Intervention	107	2 [1, 2]
2015	Unintentional	36,179	535 [530, 541]
	Homicide/Assault	3,897	58 [56, 59]
	Suicide/Self-Inflicted	700	10 [10, 11]
	Legal Intervention	117	2 [1, 2]

CI= Confidence interval

Falls and Motor Vehicle Traffic made-up nearly 80% of all Unintentional trauma in Arizona.

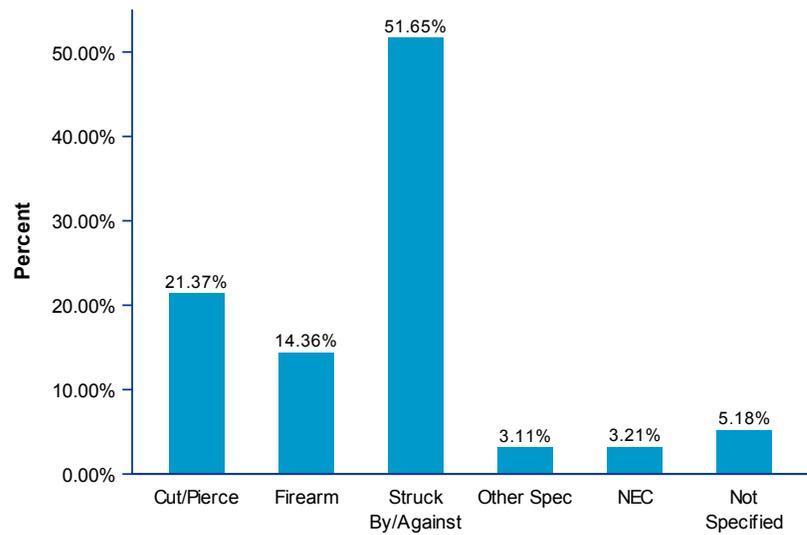
**Figure 8: Top six mechanisms of Unintentional trauma (n=36,179)**



Data source: Arizona State Trauma Registry 2015

More than half of Homicide/ Assault trauma were Struck By/ Against, followed by Cut/Pierce and Firearm.

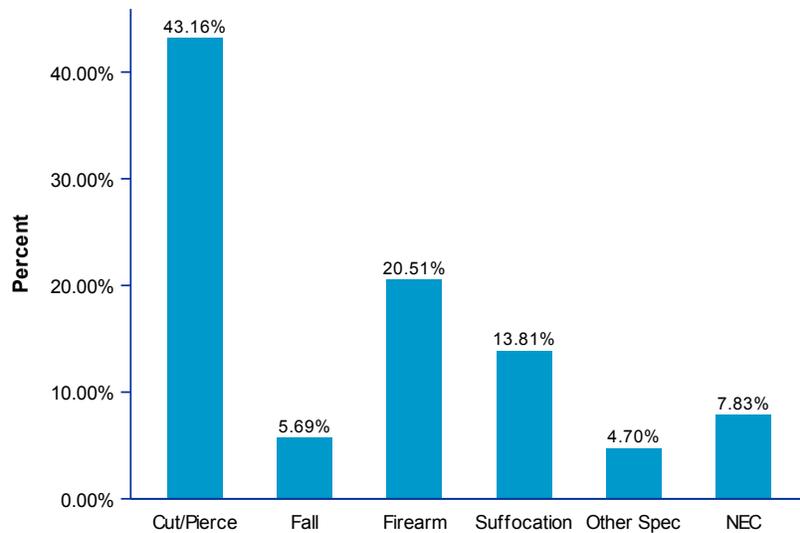
**Figure 9: Top six mechanisms of Homicide/Assault trauma (n=3,897)**



Data source: Arizona State Trauma Registry 2015 NEC: Not Elsewhere Classifiable

Cut/Pierce made-up the largest proportion of Suicide/Self-Inflicted trauma in Arizona, followed by Firearm and Suffocation.

**Figure 10: Top six mechanisms of Suicide/Self-inflicted trauma (n=700)**



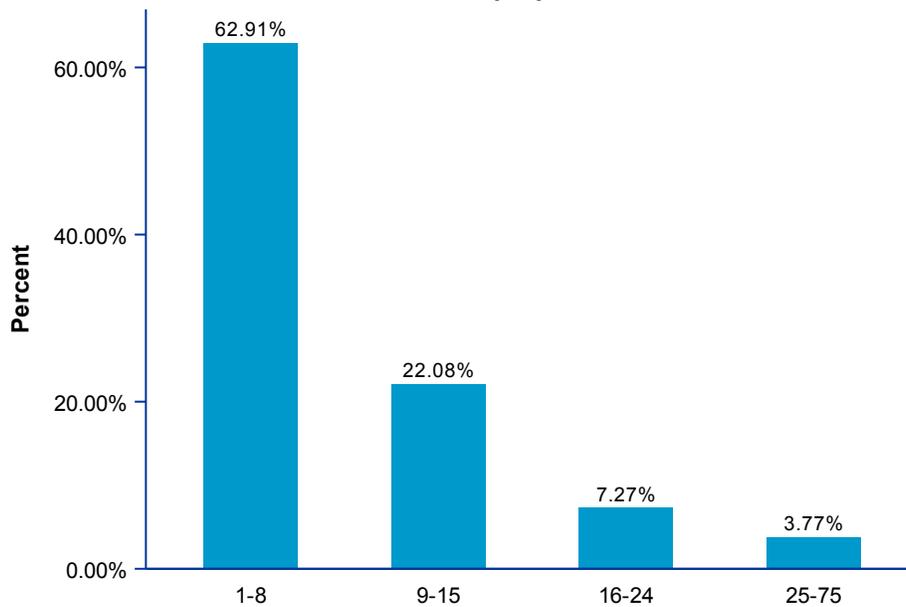
Data source: Arizona State Trauma Registry 2015 NEC: Not Elsewhere Classifiable

## Injury Characteristics: Injury Severity Score

The Injury Severity Score (ISS) is a system for numerically stratifying injury severity. The ISS ranges in value from 1 to 75, with a higher score indicating greater injury severity and increased risk of death. This report categorizes ISS 1-8 as Minor, 9-15 as Moderate, 16-24 as Serious, 25-75 as Severe.

In 2015, the majority of trauma patients had an ISS between 1 and 8, indicating Minor severity. Mortality increased significantly from 3.3% among Serious trauma to 32% among Severe trauma.

**Figure 11: Trauma proportion, by Injury Severity Score**



Data source: Arizona State Trauma Registry 2015

**Table 9: Trauma and mortality proportion by Injury Severity Score**

Injury Severity Score	Count	Percent	Deaths	Mortality Proportion
1-8	26,647	62.91%	146	0.54%
9-15	9,354	22.08%	163	1.74%
16-24	3,083	7.27%	102	3.30%
25-75	1,597	3.77%	515	32.24%
*Missing/NA/ND	1,670	3.94%	39	2.33%

## Trauma Mortality

Of the 42,351 trauma cases reported to the ASTR, 965 (2.27%) were fatal.

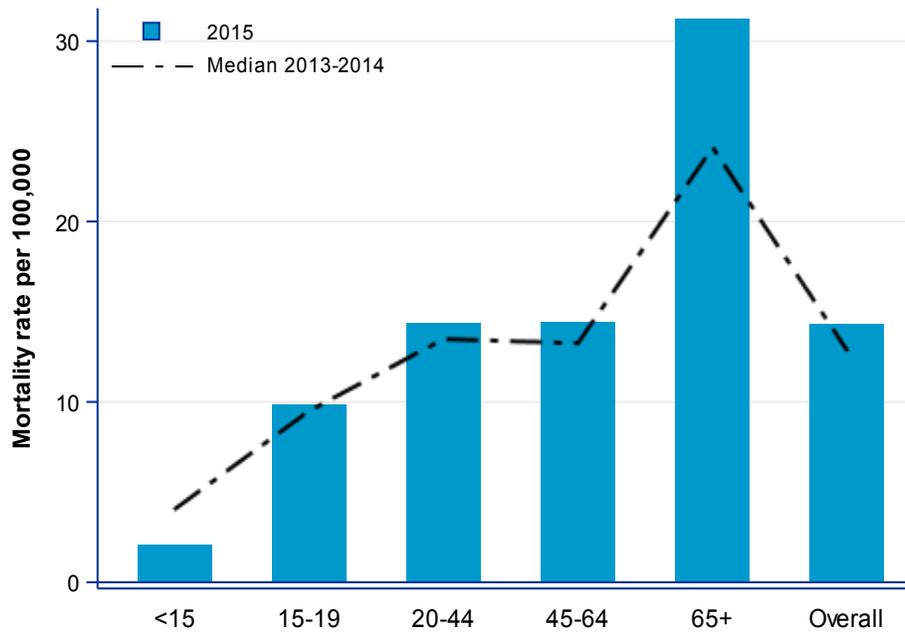
Patients 75 to 84 years of age had the highest mortality proportion, while those 10 to 14 years of age had the lowest mortality proportion.

**Table 10: Age-specific trauma and mortality proportion, ASTR 2015**

Age	Count	Percent	Deaths	Mortality Proportion
Total	42,351	100.00%	965	2.27%
<1	440	1.03%	3	0.68%
1-4	1,326	3.13%	16	1.20%
5-9	1,350	3.18%	5	0.37%
10-14	1,631	3.85%	4	0.24%
15-19	3,123	7.37%	45	1.44%
20-24	3,824	9.02%	84	2.19%
25-34	6,081	14.35%	137	2.25%
35-44	4,367	10.31%	99	2.26%
45-54	4,478	10.57%	120	2.67%
55-64	4,310	10.17%	116	2.69%
65-74	4,080	9.63%	125	3.06%
75-84	4,052	9.56%	126	3.10%
85+	3,289	7.76%	85	2.58%

Older adults (65+) had the highest trauma mortality rate, while pediatrics (< 15) had the lowest trauma mortality rate.

**Figure 12: Age-specific trauma mortality rate per 100,000 Arizona residents**



Data source: Arizona State Trauma Registry 2013-2015

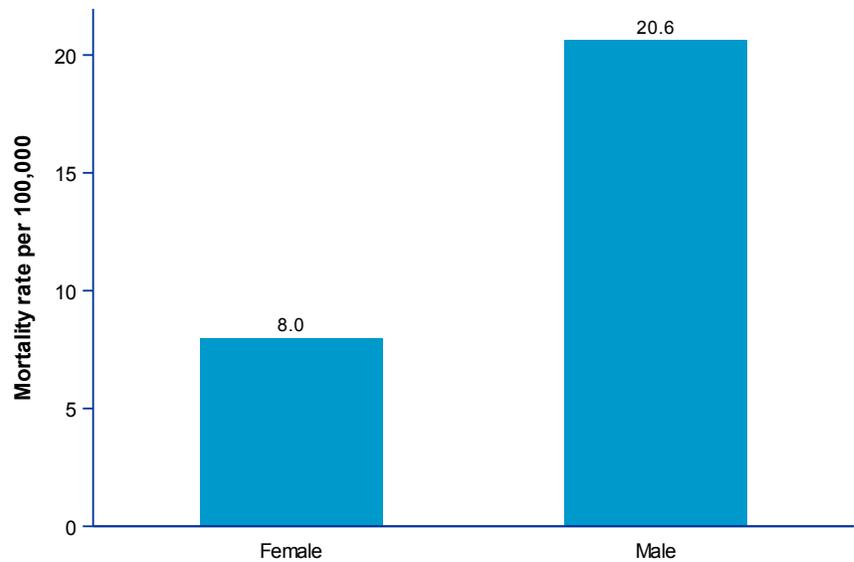
**Table 11: Age-specific trauma mortality rate per 100,000 Arizona residents**

Age	Total Trauma Deaths	Rate per 100,000 (95%CI)
<15	28	2 [1, 3]
15-19	45	10 [7, 13]
20-44	320	14 [13, 16]
45-64	236	14 [13, 16]
65+	336	31 [28, 35]
Overall	965	14 [13, 15]

CI= Confidence interval

**Figure 13: Gender-specific trauma mortality rate per 100,000 Arizona residents**

The trauma mortality rate among Males was more than twice as high as the trauma mortality rate among Females.



**Table 12: Gender-specific trauma mortality rate per 100,000 Arizona residents**

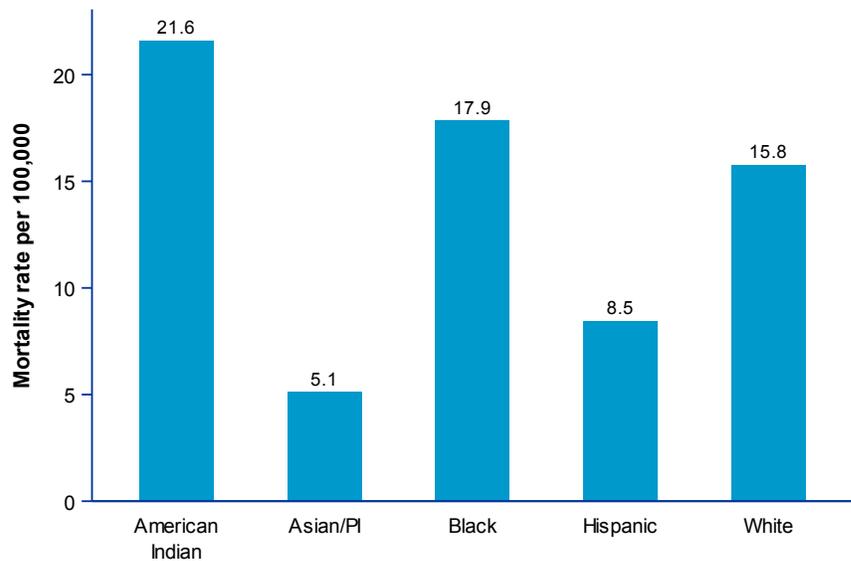
Gender	Total Trauma Deaths	Rate per 100,000 (95%CI)
Female	272	8 [7, 9]
Male	693	21 [19, 22]

Data Source: Arizona State Trauma Registry, 2015 CI= Confidence interval

**Figure 14: Race-specific trauma mortality rate per 100,000 Arizona residents**

American Indian/Alaska Natives had the highest trauma mortality rate in Arizona.

Although Blacks had a lower trauma rate than Whites (Figure 3), they had higher trauma mortality.



**Table 13: Race-specific trauma mortality rate per 100,000 Arizona residents**

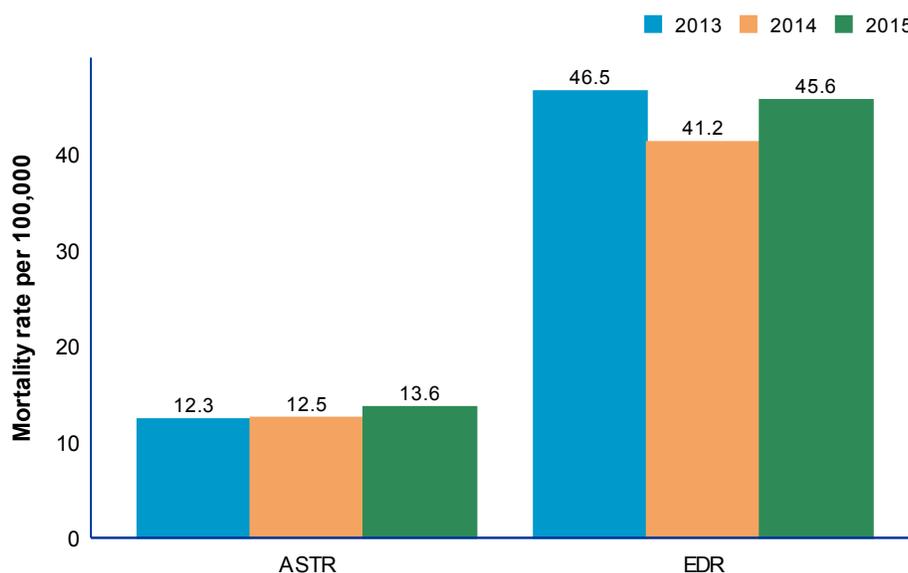
Race/ethnicity	Total Trauma Deaths	Rate per 100,000 (95%CI)
American Indian	62	22 [16, 27]
Asian/PI	12	5 [2, 8]
Black	55	18 [13, 23]
Hispanic	175	8 [7, 10]
White	609	16 [15, 17]

Data Source: Arizona State Trauma Registry, 2015 CI= Confidence interval

## Trauma Center Deaths vs. Statewide Trauma Deaths: ASTR and EDR 2013-2015

The Electronic Death Registry (EDR) captures all deaths in the state of Arizona, including those that occur outside of the hospital, while the deaths in ASTR are limited to those that occur at designated trauma centers and participating hospitals.

**Figure 15: Age-adjusted trauma mortality rate per 100,000 Arizona residents by year: Trauma center deaths vs. Statewide trauma deaths**



Data sources: Arizona State Trauma Registry 2013-2015, Arizona Electronic Death Registry, 2013-2015

**Table 14: Age-adjusted trauma mortality rate per 100,000 Arizona residents by year: Trauma center deaths vs. Statewide trauma deaths**

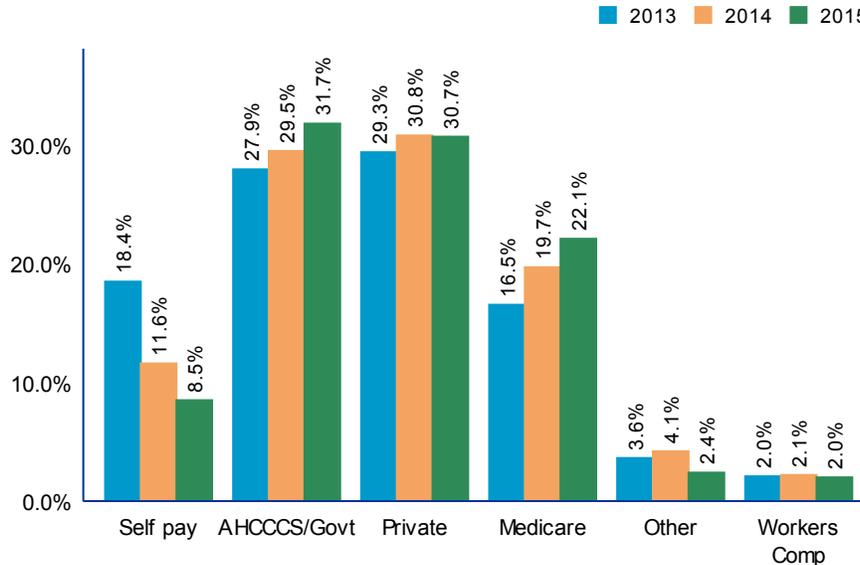
Data source	Year	Total Trauma Deaths	Rate per 100,000 (95%CI)
ASTR	2013	828	12.3 [11.5, 13.2]
	2014	871	12.5 [11.7, 13.3]
	2015	965	13.6 [12.8, 14.5]
EDR	2013	3,159	46.5 [44.9, 48.1]
	2014	2,905	41.2 [39.7, 42.7]
	2015	3,268	45.6 [44.0, 47.1]

CI= Confidence interval

## Trauma Charges

Since 2013, the proportion of hospital trauma care billed to government and private payers has increased while self-pay has decreased (dropping from 18.4% in 2013 to only 8.5% in 2015).

**Figure 16: Primary payment source of traumatic injuries by year**



Data source: Arizona State Trauma Registry 2013-2015, Other includes: No fault auto, Not billed, and Other insurance

**Table 15: Trauma charges and reimbursement by primary payer source**

Primary payer	Total Charges	Median Charges	Total Reimbursement	Reimbursement Percent
AHCCCS/Government	\$572,452,601	\$20,863	\$63,899,959	11.1%
Medicare	\$395,038,753	\$25,093	\$59,786,260	15.1%
Not documented	\$766,319	\$12,361	\$35,262	4.6%
Other	\$29,267,573	\$16,359	\$2,812,115	9.6%
Private	\$537,603,624	\$23,010	\$132,507,571	24.6%
Self pay	\$100,230,618	\$19,056	\$5,424,062	5.4%
Workers Comp	\$31,941,586	\$22,711	\$10,494,024	32.8%
	<b>\$1,667,301,074</b>	<b>\$22,026</b>	<b>\$274,959,253</b>	<b>16.4%</b>

AHCCCS = Arizona Health Care Cost Containment System

Trauma charges in 2015 totaled over \$1.6 billion, with a reimbursement rate of only 16.4%. Workers Compensation and Private insurance had the highest reimbursement rates, while self-pay had the lowest. AHCCCS/Government had the highest total charges, and Medicare had the highest median charges.

From 2013 to 2015, the overall trauma reimbursement rate increased from 15.3% to 16.4%.

**Table 16: Trauma charges and reimbursement by year**

Year	Total Charges	Median Charges	Total Reimbursement	Reimbursement Percent
2013	\$1,483,095,430	\$24,144	\$227,865,343	15.3%
2014	\$1,602,920,471	\$23,497	\$261,156,506	16.2%
2015	\$1,667,301,074	\$22,026	\$274,959,253	16.4%

Motor Vehicle Traffic trauma and Falls made-up 72% of total trauma charges in 2015. The mechanisms with the highest median charges were Drowning, Non-traffic Pedestrian, and Firearm. Reimbursement rates were low regardless of injury mechanism.

**Table 17: Trauma charges and reimbursement by mechanism of injury**

Mechanism	Total Charges	Median Charges	Total Reimbursement	Reimbursement Percent
MV Occupant	\$655,407,048	\$23,451	\$102,761,620	15.60%
Fall	\$551,011,780	\$22,494	\$93,593,288	16.90%
Other Land Transport	\$102,123,428	\$21,413	\$19,828,035	19.40%
Struck By/Against	\$93,174,828	\$18,237	\$14,295,200	15.30%
Firearm	\$65,527,405	\$27,238	\$10,494,553	16.00%
Cut/Pierce	\$52,690,487	\$21,635	\$8,218,053	15.50%
Other Pedal Cyclist	\$29,601,951	\$17,963	\$5,650,353	19.00%
Other Spec	\$29,363,312	\$17,227	\$4,714,115	16.00%
Not Specified	\$24,300,508	\$24,224	\$3,640,169	14.90%
Natural/Environmental	\$13,841,844	\$18,643	\$2,293,349	16.50%
Other Pedestrian	\$11,656,972	\$27,631	\$1,766,440	15.10%
Not Elsewhere Classifiable	\$9,533,820	\$21,595	\$1,731,162	18.10%
Machinery	\$5,658,055	\$19,518	\$1,583,931	27.90%
Other Transport	\$5,401,454	\$16,040	\$1,026,761	19.00%
Fire/Flame	\$4,895,776	\$9,866	\$584,170	11.90%
Suffocation	\$4,348,196	\$18,846	\$551,634	12.60%
Overexertion	\$3,574,317	\$18,247	\$903,195	25.20%
Drowning	\$2,499,554	\$28,959	\$645,826	25.80%
Hot Object/Scald	\$2,106,575	\$7,435	\$547,320	25.90%
Poisoning	\$176,380	\$9,468	\$35,112	19.90%
Missing	\$407,384	\$20,555	\$94,966	23.30%
	<i>\$1,667,301,074</i>	<i>\$22,026</i>	<i>\$274,959,253</i>	<i>16.4%</i>

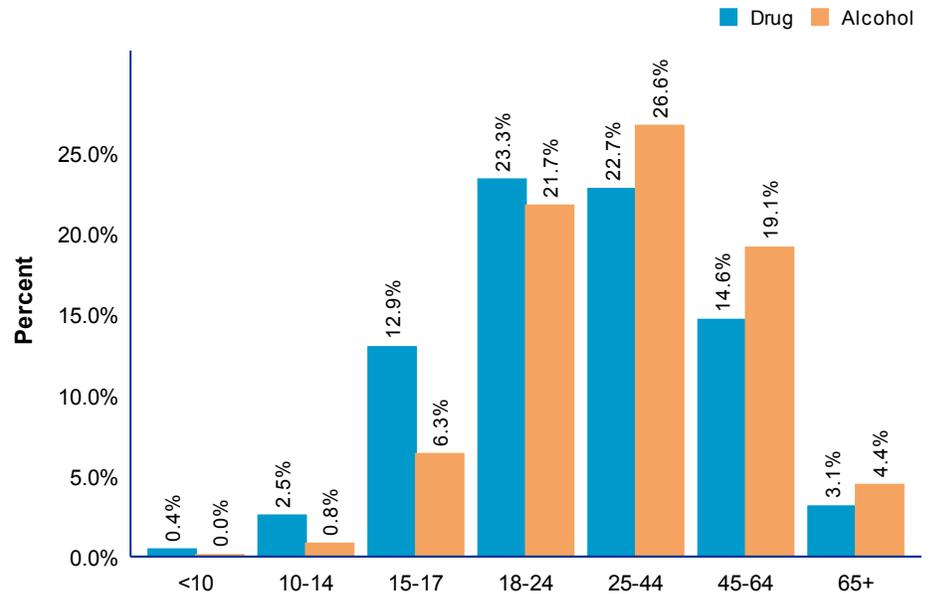
## Trauma Risk Factors: Drug & Alcohol

In 2015, 13% (n=5,466) of all trauma patients had confirmed or suspected drug use and 15% (n=6,190) had confirmed or suspected alcohol use at the time of trauma.

**Figure 17: Age-specific trauma proportion by drug and alcohol use**

18-24 year olds and 25-44 year olds had the highest proportions of trauma involving Drug and/or Alcohol use.

Among those less than 25 years old, the proportion of trauma involving Drug use was higher than the trauma involving Alcohol use.

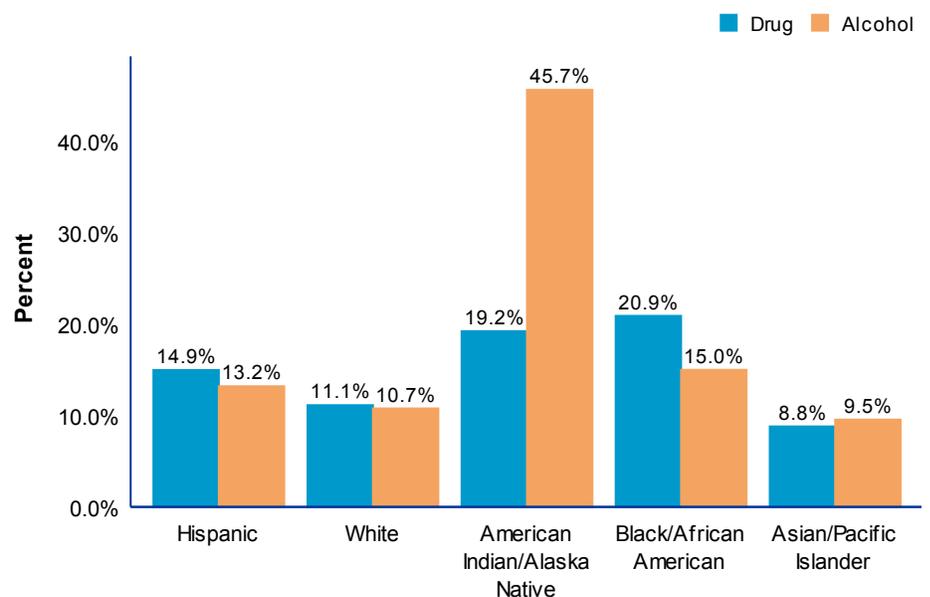


Data source: Arizona State Trauma Registry 2015

**Figure 18: Race-specific trauma proportion by drug and alcohol use**

American Indian/Alaska Natives had the highest proportion of trauma involving Alcohol use, while Blacks had the highest proportion of trauma involving Drug use.

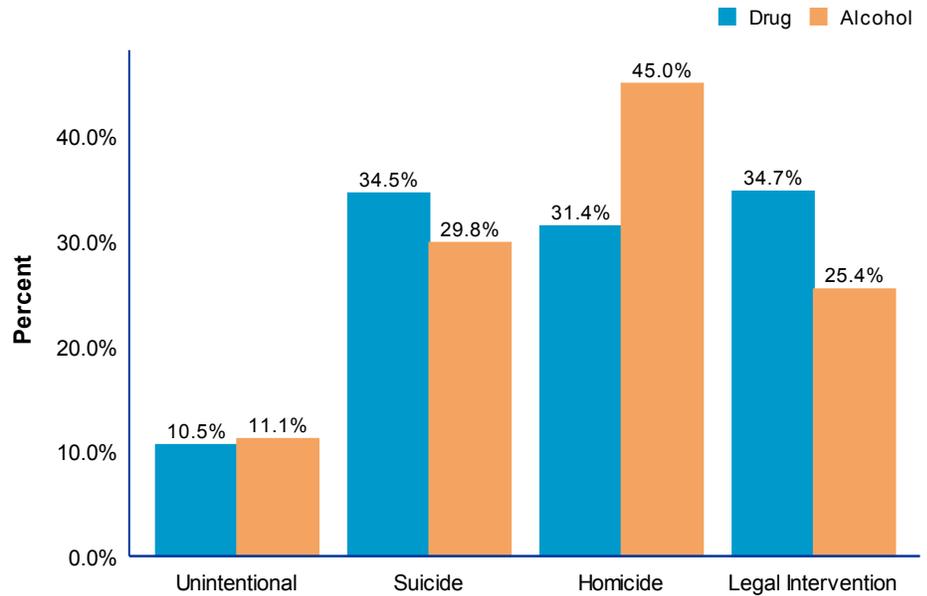
Almost half of all traumas among American Indian/Alaska Natives involved Alcohol use. Trauma involving Drug use was also high among American Indian/Alaska Natives, as well as Blacks.



Data source: Arizona State Trauma Registry 2015

**Figure 19: Intent-specific trauma proportion by drug and alcohol use**

Suicide/Self-Inflicted and Legal Intervention had a higher proportion of trauma involving Drug use, while Homicide/Assault had a higher proportion of trauma involving Alcohol use.

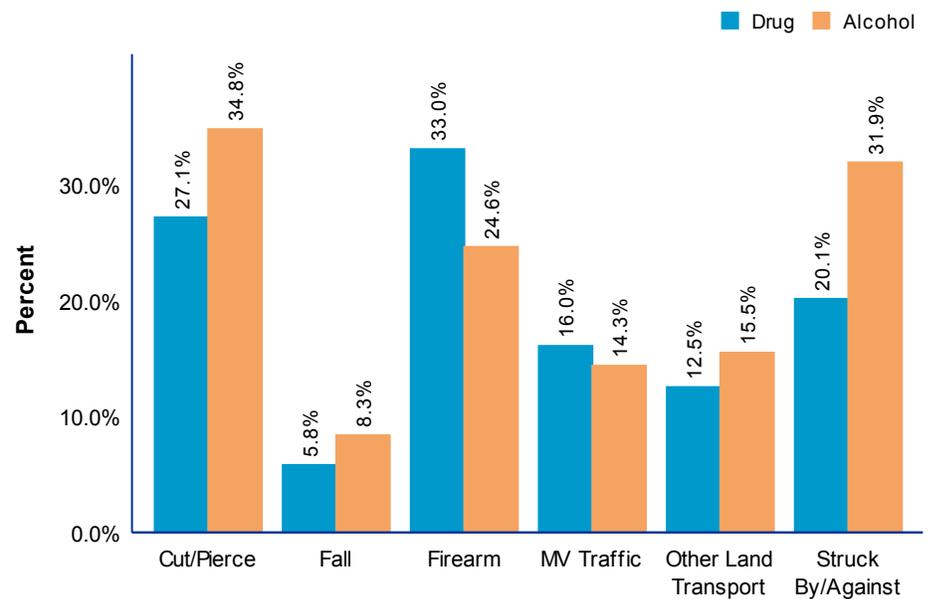


Data source: Arizona State Trauma Registry 2015

**Figure 20: Mechanism-specific trauma proportion by drug and alcohol use**

Firearm had the highest proportion of trauma involving Drug use, while Cut/Pierce had the highest proportion of trauma involving Alcohol use.

Firearm and Motor Vehicle Traffic had a higher proportion of trauma involving Drug use.



Data source: Arizona State Trauma Registry 2015

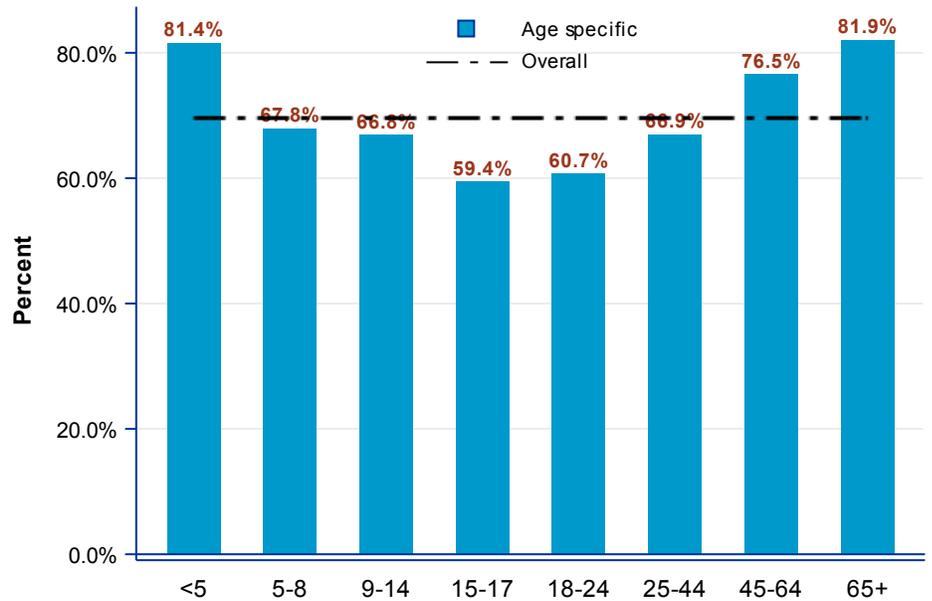
# Trauma Risk Factors: Safety Equipment

## Motor Vehicle Traffic Occupants (n = 9,868)

In 2015, 70% of Motor Vehicle Traffic occupants involved in traumas were using some form of safety restraint (Lap Belt, Shoulder Belt, or Child Car Seat) at the time of the accident.

The age categories with the lowest restraint use were 15-17 and 18-24.

**Figure 21: Age-specific proportion of restraint use among Motor Vehicle Traffic occupants**



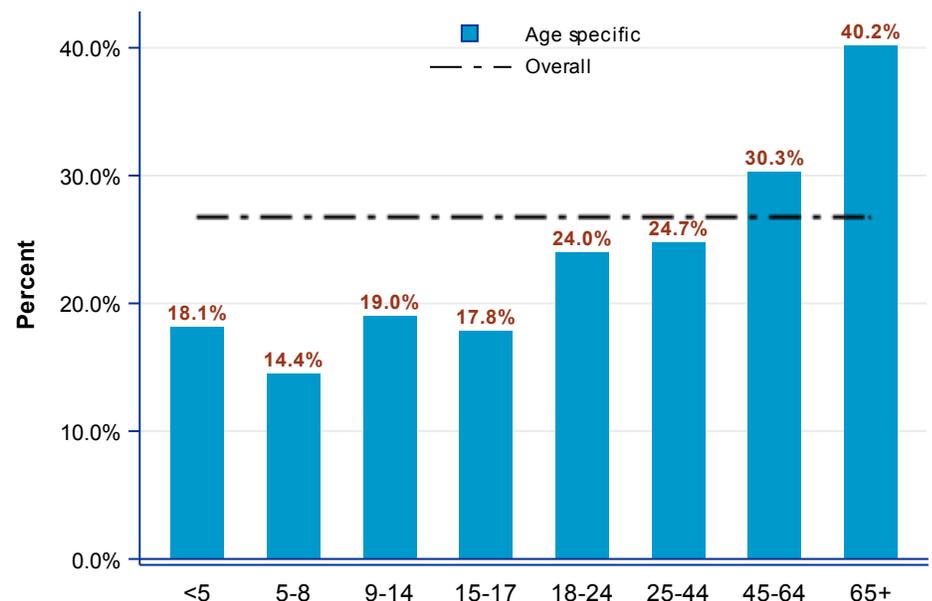
Data source: Arizona State Trauma Registry 2015

## Pedal-Cyclists (n = 1,528)

Overall, helmet use among pedal-cyclists was low; only 26.7% of pedal-cyclists were wearing a helmet when involved in a trauma.

The proportion of helmet use increases after age 45.

**Figure 22: Age-specific proportion of helmet use among pedal-cyclists**



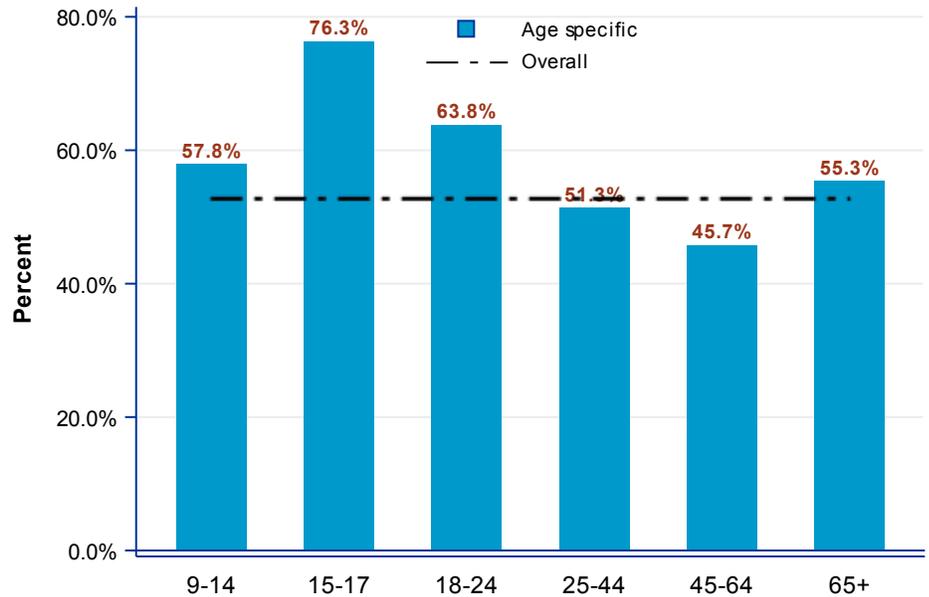
Data source: Arizona State Trauma Registry 2015

### Motorcyclists (n = 2,026)

Motorcyclists had a higher proportion of helmet use than Pedal-cyclists; 53% of Motorcyclist were wearing a helmet when involved in a trauma.

The highest proportion of helmet use was reported for the 15-17 and 18-24 age categories. The lowest proportion of helmet use was reported for the 45-64 age category.

**Figure 23: Age-specific proportion of helmet use among motorcyclists**



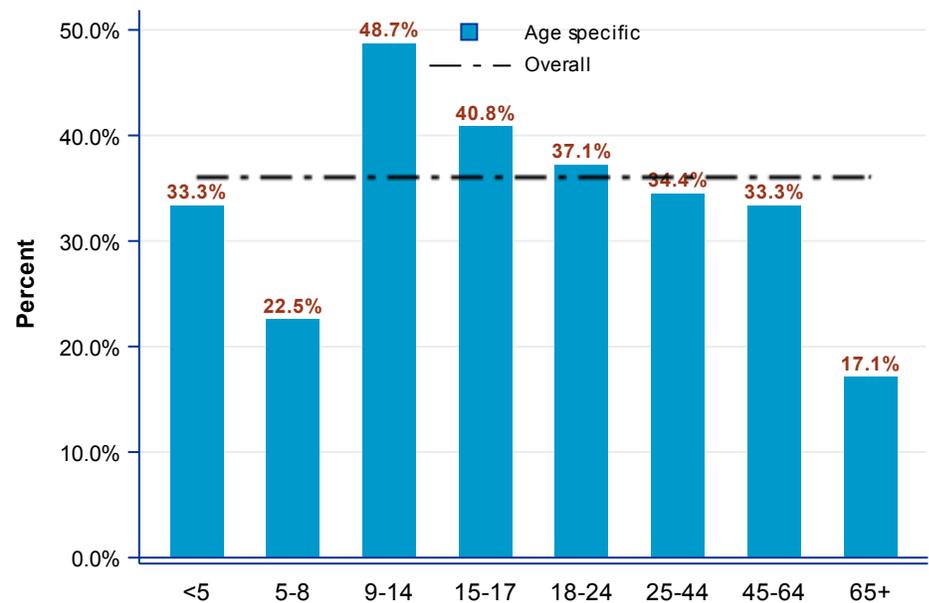
Data source: Arizona State Trauma Registry 2015

### Off-Road Vehicle Occupants (n = 1,380)

Helmet use among off-road vehicle occupants was higher than that of Pedal-cyclists but lower than Motorcyclists; 36% of off-road vehicle occupants were wearing a helmet when involved in a trauma.

The highest proportion of helmet use was reported for the 9-14 age category and the lowest proportion was reported for the 65+ age

**Figure 24: Age-specific proportion of helmet use among off-road vehicle occupants**



Data source: Arizona State Trauma Registry 2015

## Access to Trauma Care

Overall, there were 3,362 patients with an ISS >15. Of these, 31% did not have an injury time documented and were removed from this analysis.

The median injury to ED arrival time for trauma patients with an ISS > 15 was 50 minutes.

Rural injury location was associated with a longer injury to ED arrival time than Urban injury location.

The median injury to ED arrival time for inter-facility transfer patients with an ISS > 15 was 336 minutes.

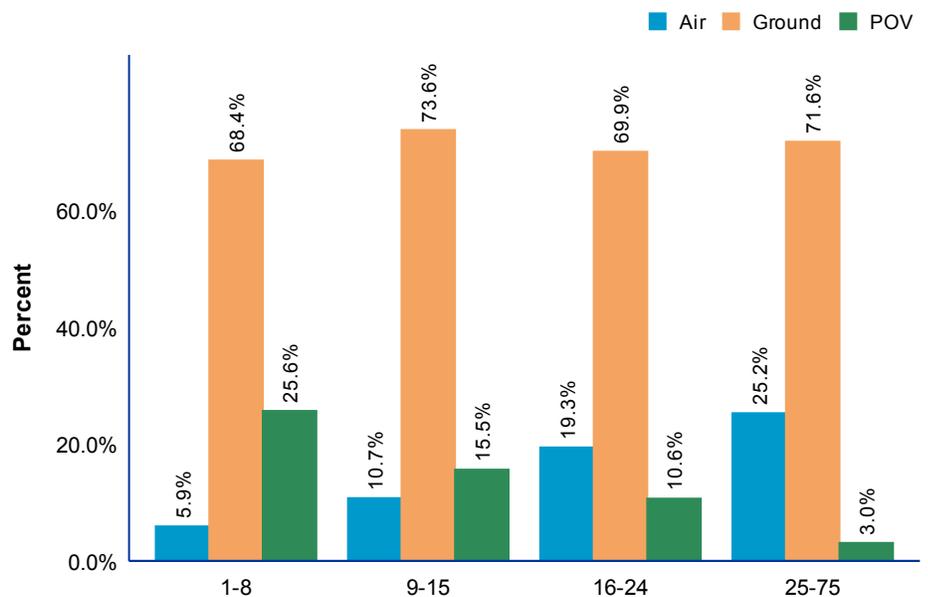
**Table 18: Injury to ED arrival time for trauma patients with an Injury Severity Score > 15: Urban vs. Rural**

Injury location	ISS>15: Injury to ED Arrival Time (Minutes)				
	N	Median time	25th percentile	75th percentile	Injury time missing (n)
<b>Rural</b>	518	86	55	124	101
<b>Urban</b>	1,796	46	34	66	947
<b>Statewide</b>	2,314	50	36	80	1,048

**Table 19: Injury to ED arrival time for inter-facility transfer patients with an Injury Severity Score > 15: Urban vs. Rural**

Injury location	Inter-facility Transfer to Level I & ISS>15: Injury to ED Arrival Time (Minutes)				
	N	Median time	25th percentile	75th percentile	Injury time missing (n)
<b>Rural</b>	252	345	250	536	88
<b>Urban</b>	475	335	239	511	303
<b>Statewide</b>	727	336	240	515	391

**Figure 25: Mode of transport to trauma center by Injury Severity Score**



The majority of patients were transported to a trauma center by ground ambulance.

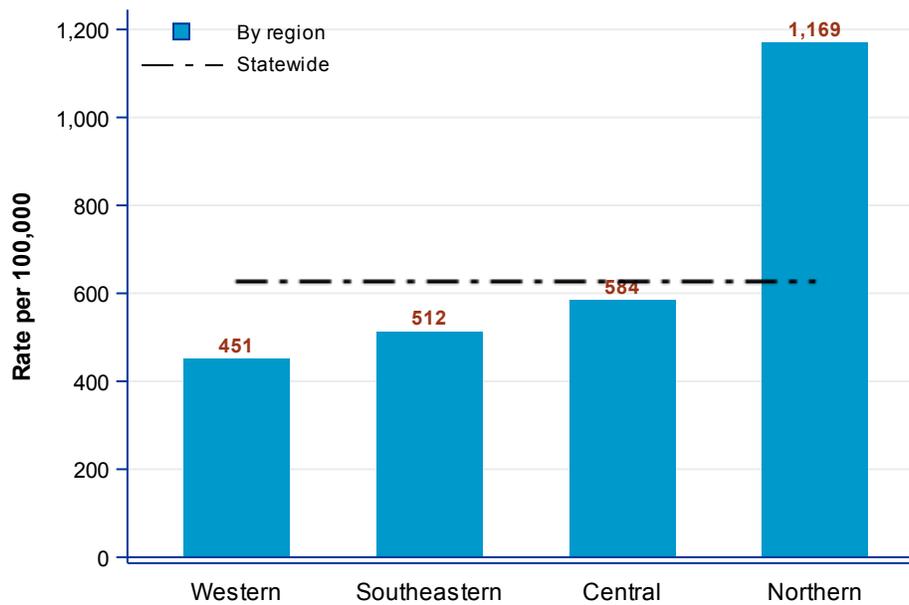
The proportion of patients transported to a trauma center by air ambulance increased with Injury Severity Score, while the proportion of patients transported by Personally Owned Vehicle (POV) decreased with Injury Severity Score.

Data source: Arizona State Trauma Registry 2015

## Region-Specific Trauma

The Northern Region had the highest trauma rate in 2015, with 1,169 traumas per 100,000 Arizona residents.

**Figure 26: Region-specific trauma rate per 100,000 Arizona residents**



Data source: Arizona State Trauma Registry 2013-2015

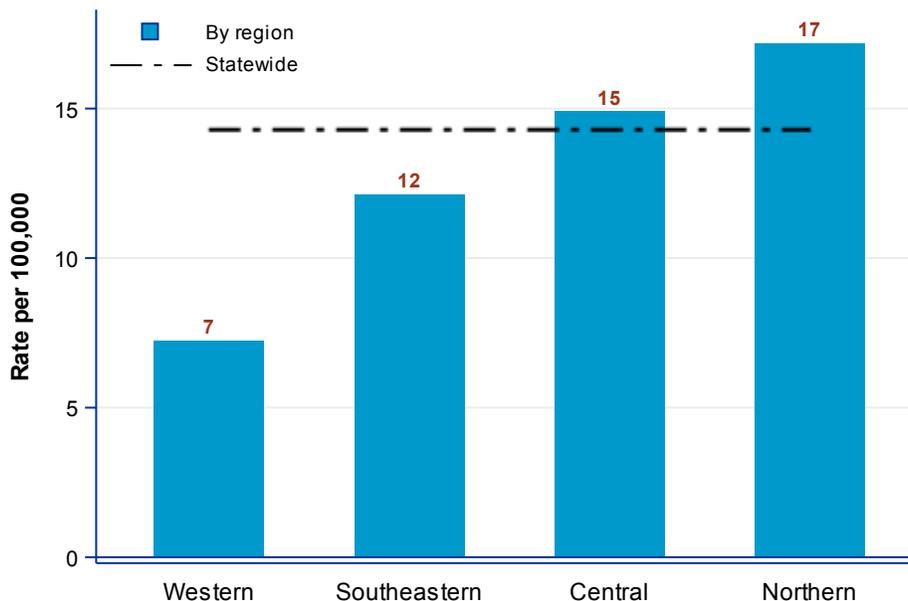
**Table 20: Region-specific trauma rate per 100,000 Arizona residents**

Injury Region	Total Trauma Cases	Rate per 100,000 (95%CI)
Western	1,992	451 [431, 471]
Northern	6,329	1,169 [1,140, 1,198]
Southeastern	6,337	512 [499, 525]
Central	26,504	584 [577, 591]
Statewide	42,351	627 [621, 633]

Yuma Regional Medical Center only submitted data to the ASTR for the year 2014.  
CI= Confidence interval

The Northern region had the highest trauma mortality rate in the state, followed by the Central and Southeastern regions.

**Figure 27: Region-specific trauma mortality rate per 100,000 Arizona residents**



Data source: Arizona State Trauma Registry 2015

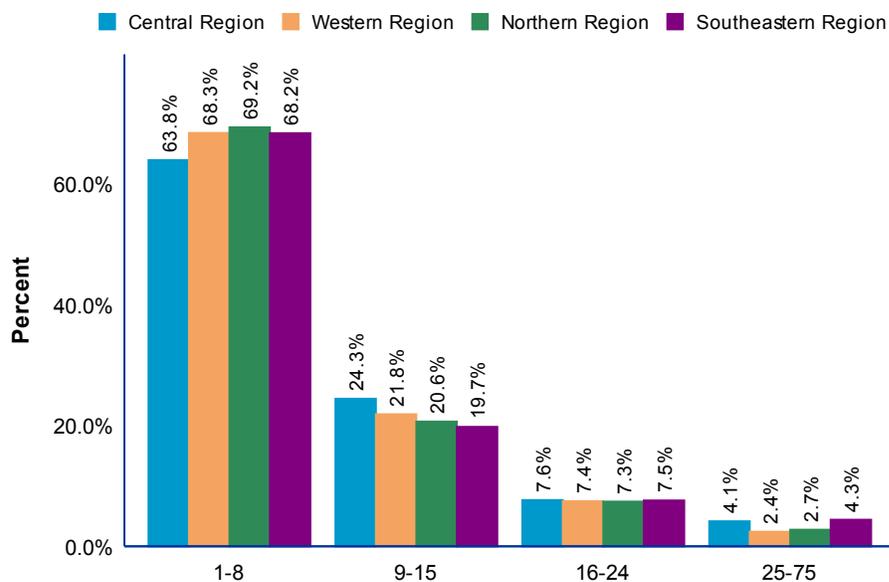
**Table 21: Region-specific trauma mortality rate per 100,000 Arizona residents**

Injury Region	Total Trauma deaths	Rate per 100,000 (95%CI)
Western	32	7 [5, 10]
Northern	93	17 [14, 21]
Southeastern	150	12 [10, 14]
Central	676	15 [14, 16]

Yuma Regional Medical Center only submitted data to the ASTR for the year 2014. CI= Confidence interval

**Figure 28: Region-specific trauma proportion by Injury Severity Score**

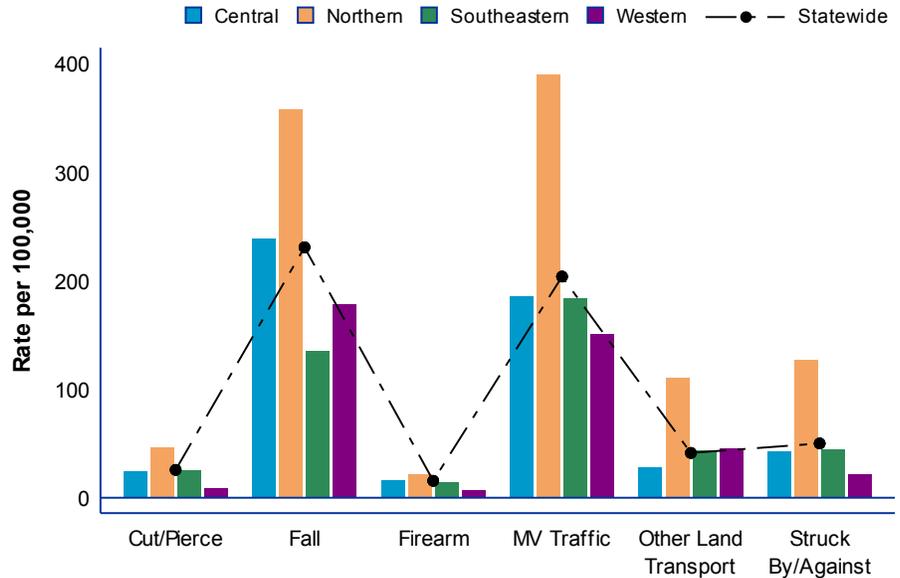
Injury severity was comparable between the four regions. The Central and Southeastern regions had a slightly higher proportion of Severely injured patients.



Data source: Arizona State Trauma Registry 2015

**Figure 29: Region-specific trauma rate per 100,000 Arizona residents, by top 6 mechanisms**

In the Central and Western regions, the highest trauma rates were reported for Falls, while in the Southeastern and Northern regions the highest rates were reported for Motor Vehicle Traffic. The Northern region had the highest rates of trauma across all six mechanisms of injury.



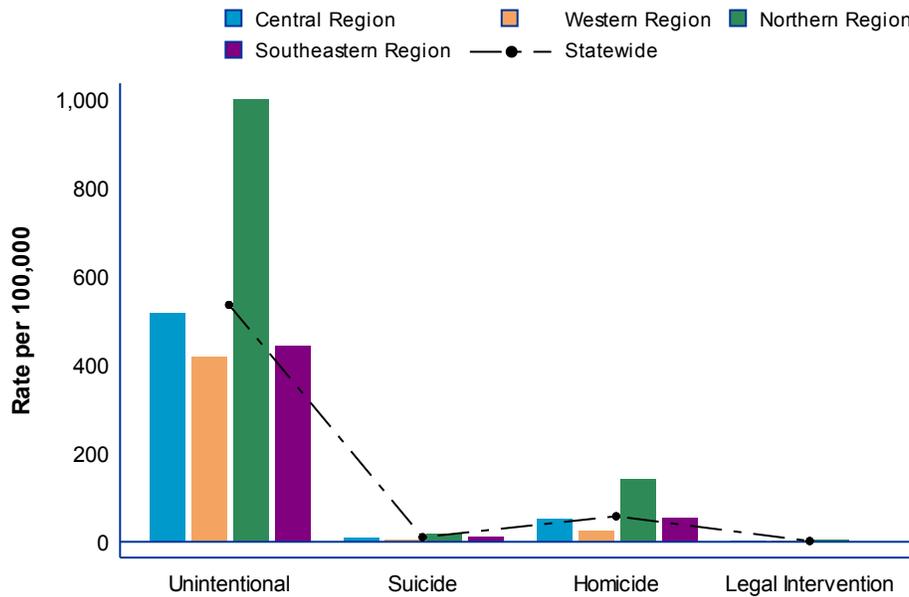
Data source: Arizona State Trauma Registry 2015, MV=Motor vehicle

**Table 22: Region-specific trauma rate per 100,000 Arizona residents, by top 6 mechanisms**

Region	Mechanisms	Total Trauma Cases	Rate per 100,000 (95%CI)
Central	Cut/Pierce	1,114	25 [23, 26]
	Fall	10,803	238 [234, 243]
	Firearm	722	16 [15, 17]
	MV Traffic	8,394	185 [181, 189]
	Other Land Transport	1,280	28 [27, 30]
	Struck By/Against	1,934	43 [41, 45]
Northern	Cut/Pierce	249	46 [40, 52]
	Fall	1,937	358 [342, 374]
	Firearm	115	21 [17, 25]
	MV Traffic	2,107	389 [373, 406]
	Other Land Transport	597	110 [101, 119]
	Struck By/Against	686	127 [117, 136]
Southeastern	Cut/Pierce	310	25 [22, 28]
	Fall	1,670	135 [128, 141]
	Firearm	176	14 [12, 16]
	MV Traffic	2,270	183 [176, 191]
	Other Land Transport	541	44 [40, 47]
	Struck By/Against	554	45 [41, 48]
Western	Cut/Pierce	39	9 [6, 12]
	Fall	785	178 [165, 190]
	Firearm	32	7 [5, 10]
	MV Traffic	667	151 [139, 162]
	Other Land Transport	199	45 [39, 51]
	Struck By/Against	95	21 [17, 26]

Yuma Regional Medical Center did not submitted data to the ASTR for the year 2013 and 2015.  
CI= Confidence interval

**Figure 30: Region-specific trauma rate per 100,000 Arizona residents by intent**



Data source: Arizona State Trauma Registry 2015

The Northern region reported the highest trauma rates across all injury intents, followed by the Central and Southeastern regions. Unintentional trauma had the highest rate in all four regions.

**Table 23: Region-specific trauma rate per 100,000 Arizona residents by intent**

Region	Intent	Total Trauma Cases	Rate per 100,000 (95%CI)
Central	Unintentional	23,437	517 [510, 523]
	Suicide/Self-Inflicted	436	10 [9, 11]
	Homicide/Assault	2,348	52 [50, 54]
	Legal Intervention	73	2 [1, 2]
Northern	Unintentional	5,414	1,000 [974, 1,027]
	Suicide/Self-Inflicted	97	18 [14, 21]
	Homicide/Assault	770	142 [132, 152]
	Legal Intervention	21	4 [2, 6]
Southeastern	Unintentional	5,478	443 [431, 454]
	Suicide/Self-Inflicted	145	12 [10, 14]
	Homicide/Assault	674	54 [50, 59]
	Legal Intervention	15	1 [1, 2]
Western	Unintentional	1,850	419 [400, 438]
	Suicide/Self-Inflicted	22	5 [3, 7]
	Homicide/Assault	105	24 [19, 28]
	Legal Intervention	8	2 [1, 3]

CI= Confidence interval

## Trauma Center Designation

The majority of trauma patients in Arizona went to Level I trauma centers, 20% went to Level IV trauma centers and 14 % went to Level III trauma centers.

**Table 24: Trauma and mortality proportion by trauma center designation, ASTR 2015**

Trauma Center Designation	Count	Percent	Deaths	Mortality Proportion
Level I	27,489	66.14%	854	3.10%
Level III	5,835	14.03%	42	0.71%
Level IV	8,237	19.81%	58	0.70%

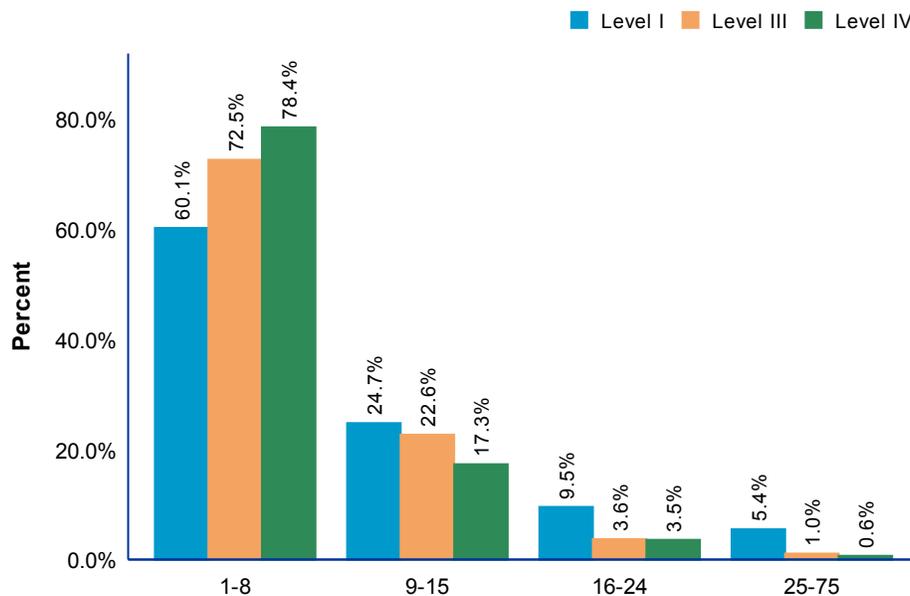
The median charges for trauma patients were \$27,939 at Level I trauma centers, \$17,881 at Level III trauma centers and \$10,258 at Level IV trauma centers.

**Table 25: Trauma charges and reimbursement by trauma center designation, ASTR 2015**

Trauma Center Designation	Total Charges	Median Charges	Total Reimbursement	Reimbursement Percent
Level I	\$1,350,432,541	\$27,939	\$225,587,866	16.7%
Level III	\$180,871,907	\$17,881	\$25,763,856	14.2%
Level IV	\$115,361,818	\$10,258	\$19,656,580	17.0%
	<i>\$1,646,666,266</i>	<i>\$22,196</i>	<i>\$271,008,302</i>	<i>16.4%</i>

Trauma patient's level of care increased with injury severity, with Level I trauma centers treating a larger proportion of patients with Moderate to Severe trauma and a lower proportion of patients with Minor trauma, as compared to Level III and IV trauma centers.

**Figure 31: Injury Severity Score by trauma center designation**



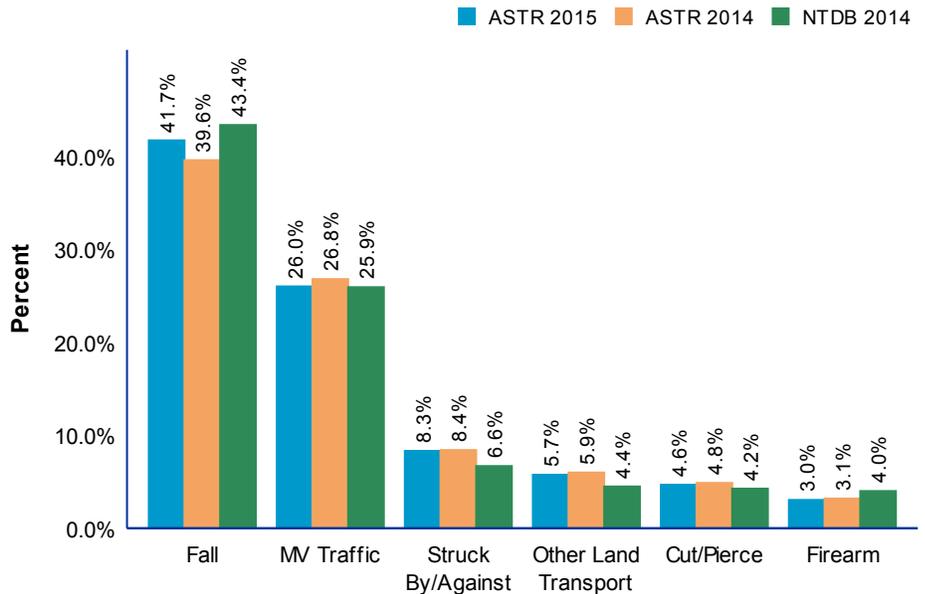
Data source: Arizona State Trauma Registry 2015

## Arizona vs. National

The National Trauma Data Bank (NTDB) is the largest aggregation of trauma registry data in the United States; a total of 746 hospitals submitted data to the NTDB in 2014. For the purpose of this comparison, the ASTR data were modified to match the NTDB inclusion criteria (n = 28,751).

**Figure 32: Trauma proportion by top six mechanisms of injury, Arizona vs. National**

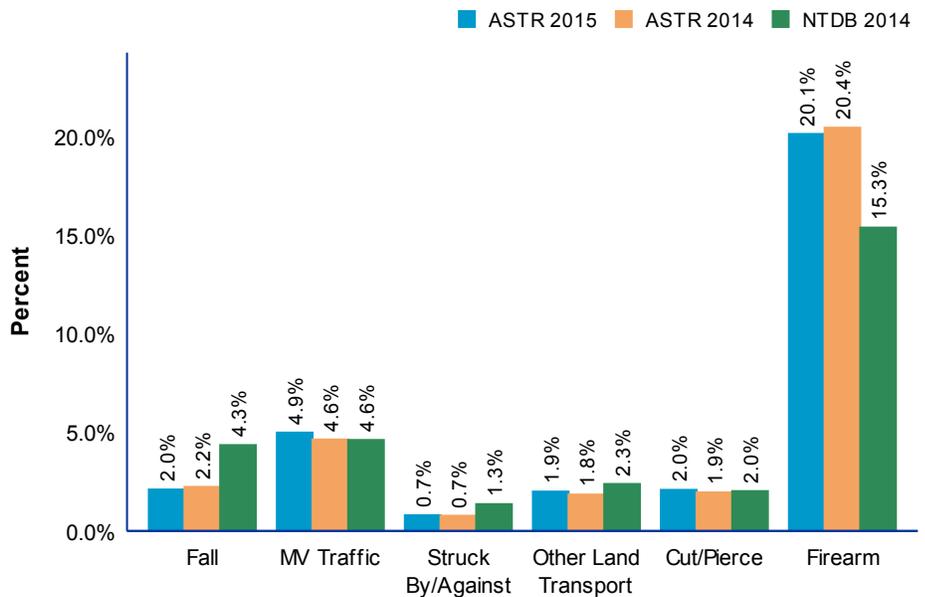
Arizona had a similar distribution of trauma, by injury mechanism, when compared to national data.



Data source: Arizona State Trauma Registry 2014-2015, National Trauma Data Bank 2014

**Figure 33: Trauma mortality proportion by top six mechanisms of injury, Arizona vs. National**

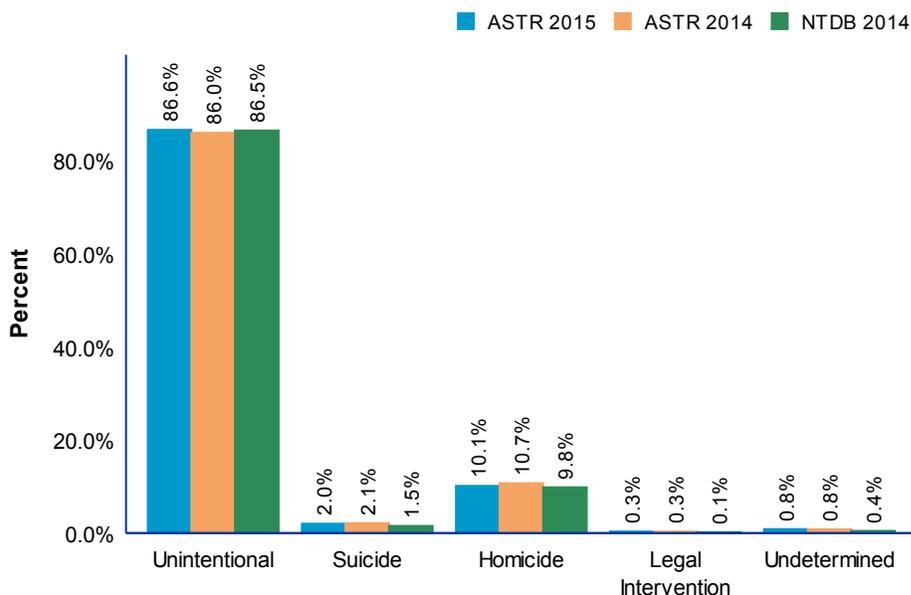
Arizona had a higher proportion of Firearm mortality but a lower proportion of Fall mortality when compared to national data.



Data source: Arizona State Trauma Registry 2014-2015, National Trauma Data Bank 2014

**Figure 34: Trauma proportion by intent of injury, Arizona vs. National**

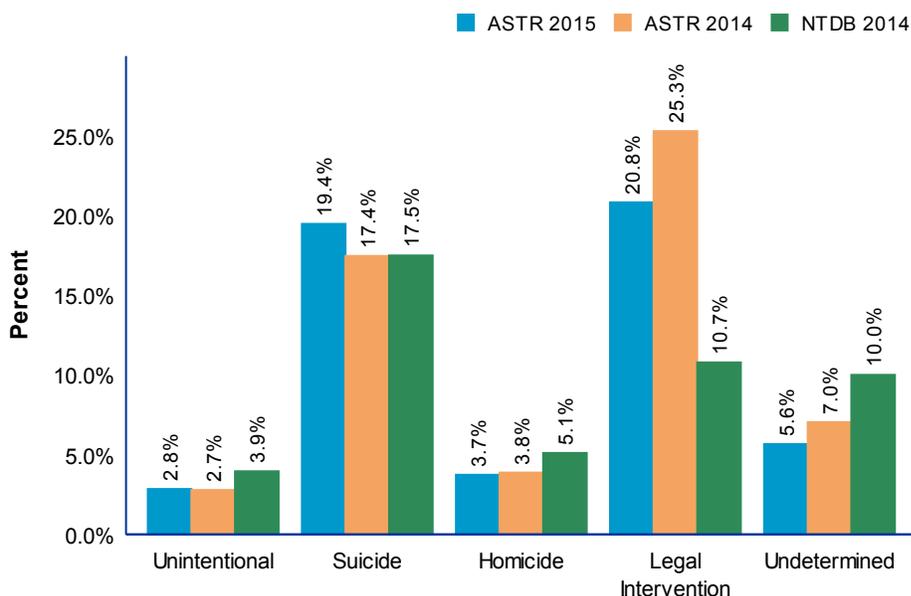
Arizona had a similar distribution of trauma, by intent, when compared to national trauma data.



Data source: Arizona State Trauma Registry 2014-2015, National Trauma Data Bank 2014

**Figure 35: Trauma mortality proportion by intent of injury, Arizona vs. National**

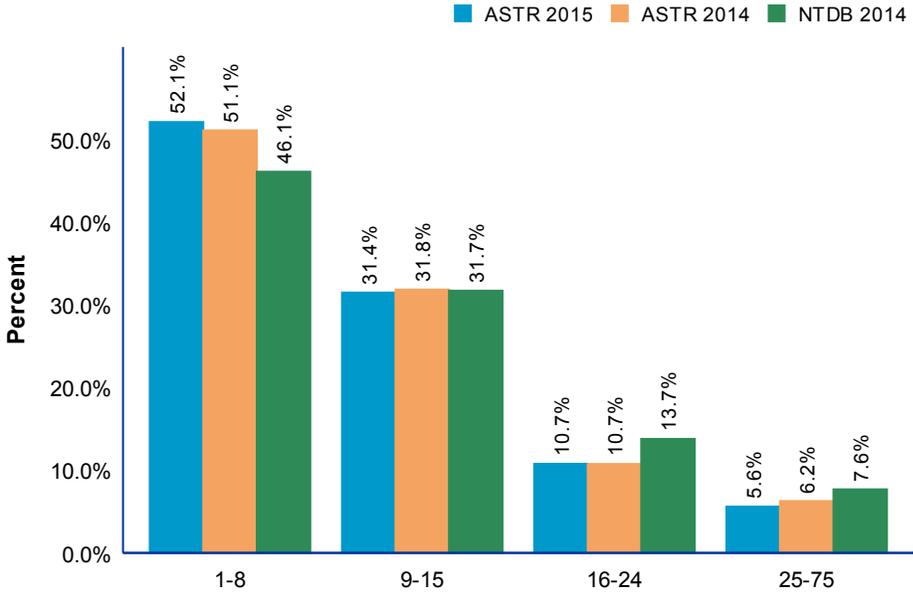
Arizona had a higher mortality proportion for Suicide and Legal Intervention trauma as compared to national trauma data but a lower proportion of Unintentional, and Homicide mortality.



Data source: Arizona State Trauma Registry 2014-2015, National Trauma Data Bank 2014

**Figure 36: Trauma proportion by Injury Severity Score, Arizona vs. National**

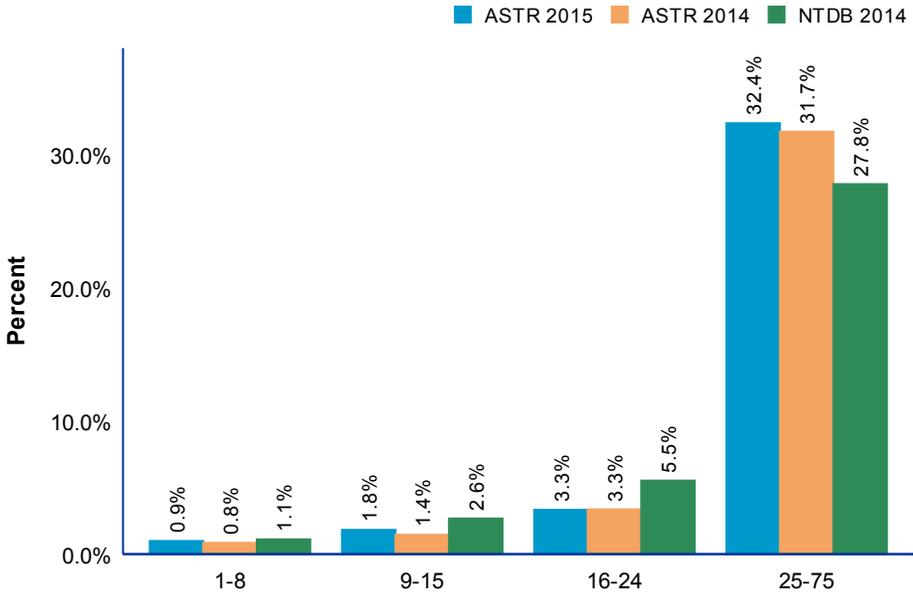
Arizona’s trauma patients had a lower Injury Severity Score as compared to national data.



Data source: Arizona State Trauma Registry 2014-2015, National Trauma Data Bank 2014

**Figure 37: Trauma mortality proportion by Injury Severity Score, Arizona vs. National**

The mortality proportion for Arizona trauma patients with an ISS of 25-75 was higher than national data. However, the mortality proportion was lower for all other ISS categories.



Data source: Arizona State Trauma Registry 2014-2015, National Trauma Data Bank 2014

## Traumatic Brain Injury

Of the 42,351 trauma patients reported to the ASTR, 9,094 (22%) sustained a Traumatic Brain Injury (TBI); 12% had a Major TBI and 10% had a Minor TBI.

Infants (< 1) had the highest proportion of TBIs. More than half of trauma patients < 1 year old sustained a TBI; 31% had a Major TBI and 23% had a Minor TBI. Two infants died as a result of TBI.

Adults 25 to 34 years of age had the highest TBI mortality proportion, with 15% mortality among Major TBI patients.

**Table 26: Age-specific Traumatic Brain Injury and mortality proportion**

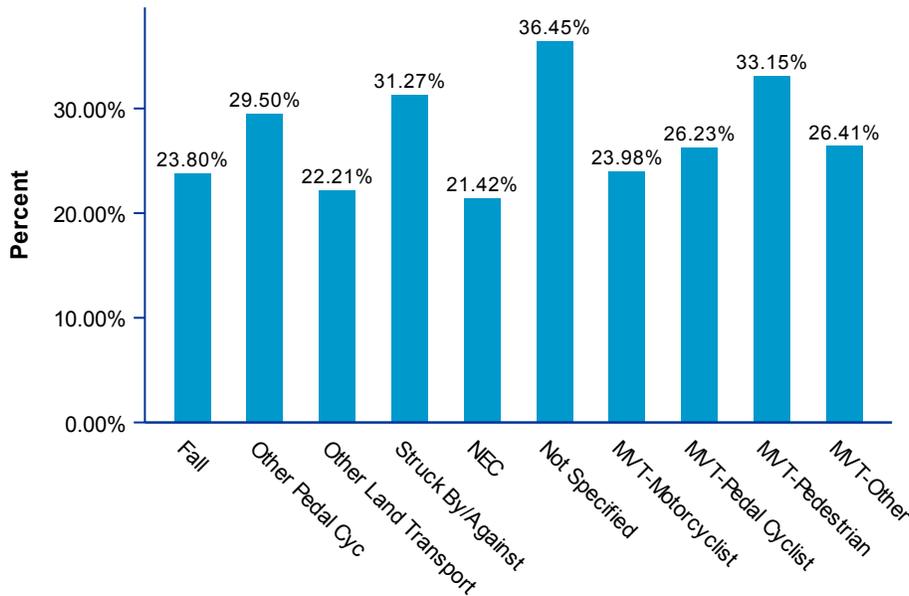
		*Major TBI				**Minor TBI			
Age	Overall	N	Percent	Mortality	Mortality Percent	N	Percent	Mortality	Mortality Percent
Total	42,351	4,959	11.70%	507	10.22%	4,495	10.61%	16	0.35%
<1	440	136	30.90%	2	1.47%	99	22.50%	.	.
1-4	1,326	166	12.51%	10	6.02%	156	11.76%	.	.
5-9	1,350	88	6.51%	4	4.54%	131	9.70%	.	.
10-14	1,631	122	7.48%	1	0.81%	270	16.55%	.	.
15-19	3,123	248	7.94%	22	8.87%	526	16.84%	1	0.19%
20-24	3,824	324	8.47%	45	13.88%	526	13.75%	.	.
25-34	6,081	483	7.94%	71	14.69%	759	12.48%	1	0.13%
35-44	4,367	413	9.45%	53	12.83%	490	11.22%	1	0.20%
45-54	4,478	482	10.76%	69	14.31%	477	10.65%	2	0.41%
55-64	4,310	596	13.82%	63	10.57%	417	9.67%	1	0.23%
65-74	4,080	636	15.58%	63	9.90%	326	7.99%	5	1.53%
75-84	4,052	700	17.27%	74	10.57%	201	4.96%	.	.
85+	3,289	565	17.17%	30	5.30%	117	3.55%	5	4.27%

\*Major TBI is defined as a Type I TBI on the Barell Matrix or an AIS with a head injury severity  $\geq 3$ .

\*\*Minor/Moderate TBI defined as a Type II TBI or a Type III TBI on the Barell Matrix or an AIS with a head injury severity < 3.

More than 20% of trauma patients with Motor Vehicle Traffic, Fall, Struck By/Against and other transport related mechanisms of injury sustained TBIs.

**Figure 38: Proportion of Traumatic Brain Injury by mechanism**



Data source: Arizona State Trauma Registry 2015 NEC: Not Elsewhere Classifiable

TBI patients are classified based on their Glasgow Coma Score (GCS), a neurological assessment of a patients level of consciousness following head injury. Overall, a lower GCS was associated with a higher mortality proportion among TBI patients, and 41% of TBI patients with a GCS < 9 died. Older adults 65+ had the highest mortality proportion regardless of GCS.

**Table 27: Age-specific Traumatic Brain Injury and mortality proportion by Glasgow Coma Score**

Age	Overall	TBI- GCS<9				TBI- GCS 9-12				TBI- GCS 12-15			
		N	Percent	Mortality	Mortality Percent	N	Percent	Mortality	Mortality Percent	N	Percent	Mortality	Mortality Percent
Total	42,351	1,028	2.42%	422	41.05%	392	0.92%	30	7.65%	7,852	18.54%	65	0.82%
<1	440	11	2.50%	2	18.18%	9	2.04%	.	.	204	46.36%	.	.
1-4	1,326	30	2.26%	10	33.33%	19	1.43%	.	.	257	19.38%	.	.
5-9	1,350	14	1.03%	4	28.57%	15	1.11%	.	.	187	13.85%	.	.
10-14	1,631	33	2.02%	1	3.03%	15	0.91%	.	.	335	20.53%	.	.
15-19	3,123	78	2.49%	23	29.48%	26	0.83%	.	.	666	21.32%	.	.
20-24	3,824	120	3.13%	44	36.66%	34	0.88%	.	.	684	17.88%	1	0.14%
25-34	6,081	193	3.17%	68	35.23%	58	0.95%	1	1.72%	984	16.18%	1	0.10%
35-44	4,367	122	2.79%	51	41.80%	37	0.84%	.	.	740	16.94%	3	0.40%
45-54	4,478	138	3.08%	65	47.10%	40	0.89%	1	2.50%	768	17.15%	5	0.65%
55-64	4,310	115	2.66%	49	42.60%	31	0.71%	5	16.12%	850	19.72%	9	1.05%
65-74	4,080	79	1.93%	46	58.22%	34	0.83%	5	14.70%	821	20.12%	16	1.94%
75-84	4,052	62	1.53%	40	64.51%	44	1.08%	9	20.45%	765	18.87%	23	3.00%
85+	3,289	33	1.00%	19	57.57%	30	0.91%	9	30.00%	591	17.96%	7	1.18%

GCS: Glasgow Coma Score

## Discharged to Rehab

Of the 24,996 patients admitted to the hospital, 6.44% were discharged to Rehab. Medicare had the largest proportion of patients discharged to Rehab, followed by Private insurance. A higher proportion of patients with an ISS > 15 were discharged to Rehab, regardless of primary payment source.

**Table 28: Discharge to rehab by Injury Severity Score and primary payment source**

Primary Payer	Total Patient Admitted		Discharged to Rehab		ISS <=15 and Discharged to Rehab		ISS >15 and Discharged to Rehab	
	N	%	N	%	N	%	N	%
AHCCCS	7,965	31.86%	324	4.06%	127	1.95%	195	15.42%
Medicare	6,440	25.76%	664	10.31%	504	9.57%	155	14.35%
Not Documented	254	1.01%	13	5.11%	12	5.12%	1	25.00%
Other	326	1.30%	9	2.76%	6	2.14%	3	6.52%
Private	8,312	33.25%	574	6.90%	308	4.51%	263	19.65%
Self-pay	1,699	6.79%	27	1.58%	13	0.91%	14	5.71%
<b>Total</b>	<b>24,996</b>	<b>100.00%</b>	<b>1,611</b>	<b>6.44%</b>	<b>970</b>	<b>4.73%</b>	<b>631</b>	<b>15.86%</b>

The proportion of trauma patients discharged to Rehab was comparable between the four EMS regions.

**Table 29: Discharge to rehab proportion by region**

Region	Total Patients Admitted		Discharged to Rehab	
	N	%	N	%
<b>Missing Region</b>	701	2.8%	38	5.4%
<b>Central Region</b>	17,734	70.9%	1,126	6.3%
<b>Western Region</b>	849	3.3%	52	6.1%
<b>Northern Region</b>	2,698	10.7%	160	5.9%
<b>Southeastern Region</b>	3,014	12.0%	235	7.7%
<b>Statewide</b>	<b>24,996</b>	<b>100.0%</b>	<b>1,611</b>	<b>6.4%</b>

# Appendix A.

## Hospitals Submitting Data to the ASTR in 2015

<b>Level I Trauma Centers (Full Data Set)</b>
Abrazo West Campus
Banner University Medical Center—Phoenix
Banner University Medical Center—Tucson
Chandler Regional Medical Center
Flagstaff Medical Center
HonorHealth John C. Lincoln Medical Center
HonorHealth Scottsdale Osborn Medical Center
Maricopa Medical Center
Phoenix Children's Hospital
St. Joseph's Hospital and Medical Center

<b>Level III Trauma Centers (Full Data Set)</b>
Banner Baywood Medical Center
Havasu Regional Medical Center
HonorHealth Deer Valley Medical Center
Mountain Vista Medical Center
Tuba City Regional Health Care Corporation
Canyon Vista Medical Center

**Level IV Trauma Centers (Full Data Set)**

Banner Boswell Medical Center

Banner Del E Webb Medical Center

Banner Estrella Medical Center

Banner Gateway Medical Center

Banner Ironwood Medical Center

Banner University Medical Center South

Kingman Regional Medical Center

Verde Valley Medical Center

**Level IV Trauma Centers (Reduced Data Set)**

Banner Page Hospital

Banner Payson Medical Center

Benson Hospital

Chinle Comprehensive Health Care

Cobre Valley Regional Medical Center

Copper Queen Community Hospital

La Paz Regional Hospital

Mt. Graham Regional Medical Center

Northern Cochise Hospital

Oro Valley Hospital

Summit Healthcare Regional Medical Center

White Mountain Regional Medical Center

Wickenburg Community Hospital

Yavapai Reg Med Center - East

Yavapai Regional Medical Center

Little Colorado Medical Center

**Non-designated Trauma Centers**

Banner Desert Medical Center/Cardon Children's (Full Data Set)

Yuma Regional Medical Center (Reduced Data Set)

# Appendix B.

## **TRAUMA PATIENT INCLUSION DEFINITION**

### **ARIZONA STATE TRAUMA REGISTRY (ASTR)**

**Effective for records with ED/Hospital Arrival Dates October 1, 2015 – Current**

#### **❖ 1. EMS TRAUMA TRIAGE PROTOCOL**

A patient with injury or suspected injury who is triaged from a scene to a trauma center or ED based upon the responding EMS provider's trauma triage protocol;

**OR**

#### **❖ 1B. INTER-FACILITY INJURY TRANSFERS BY EMS**

A patient with injury who is transported via EMS transport from one acute care hospital to another acute care hospital;

**\*Note: For 2012 trauma data, only Level III and IV Trauma Centers were recommended to report inter-facility injury transfers. For 2008-2011 and 2013 forward, all designation levels are recommended to report inter-facility injury transfers.**

**OR**

#### **❖ 2. HOSPITAL TRAUMA TEAM ACTIVATIONS**

A patient with injury or suspected injury for whom a trauma team activation occurs; **OR**

#### **❖ 3. ADMITTED OR DIED BECAUSE OF INJURY & MEETS ASTR DIAGNOSIS CODES**

A patient with injury who:

Is admitted as a result of the injury **OR** who dies as a result of the injury

**AND**

Has an ICD-9-CM N-code (injury diagnosis code) within categories 800 through 959 or ICD-10-CM (injury diagnosis code) within categories S00 through S99 with 7th character modifiers of A, B, or C ONLY. (Injuries to specific body parts –initial encounter)

T07 (unspecified multiple injuries)

T14 (injury of unspecified body region)

T20 through T28 with 7th character modifier of A ONLY (burns by specific body parts – initial encounter)

T30 through T32 (burn by TBSA percentages)

T79.A1 through T79.A9 with 7th character modifier of A ONLY (Traumatic Compartment Syndrome –initial encounter):

(Except exclusions below):

#### **EXCLUSIONS for admitted or died ICD-9-CM or ICD-10-CM patients:**

##### **❖ Only has late effects of injury or another external cause:**

(ICD-9-CM N-code within categories 905 through 909)

(ICD-10-CM code within categories S00 through S99 (Injuries to specific body parts) with the 7th digit modifier code of D through S;

T20 through T28 (burns by specific body parts) with 7th character modifier of D through S;

T79.A1 through T79.A9 (Traumatic Compartment Syndrome) with 7th character modifier of D through S)

- ❖ **Only has a superficial injury or contusion:**  
(ICD-9-CM N-code within categories 910 through 924)  
(ICD-10-CM code within categories S00, S10, S20, S30, S40, S50, S60, S70, S80 or S90)
- ❖ **Only has effects of a foreign body entering through an orifice:**  
(ICD-9-CM N-code within categories 930 through 939)  
(ICD-10-CM code within T15 through T19)
- ❖ **Only has an isolated femoral neck fracture from a same-level fall:**  
(ICD-9-CM N-code within category 820 **AND** ICD-9-CM E-code within category E885 or E886)  
(ICD-10-CM code within S72.0XXX through S72.2XXX with **any one of** V00.111X, V00.112X, V00.118X, V00.121X, V00.122X, V00.128X, V00.131X, V00.132X, V00.138X, V00.141X, V00.142X, V00.148X, V00.151X, V00.152X, V00.158X, V00.181X, V00.182X, V00.188X, V00.211X, V00.212X, V00.218X, V00.221X, V00.222X, V00.228X, V00.281X, V00.282X, V00.288X, V00.311X, V00.312X, V00.318X, V00.321X, V00.322X, V00.328X, V00.381X, V00.382X V00.388X, W00.0XX, W00.9XX, W01.0XX, W03.XXX, W18.2XX, W18.40X, W18.41X, W18.42X, W18.43X, W18.49XX)
- ❖ **Only has an isolated distal extremity fracture from a same-level fall:**  
(ICD-9-CM N-code within categories 813 through 817 or 823 through 826 **AND** ICD-9-CM E-code within category E885 or E886)  
(ICD-10-CM code within S52.XXXX, S62.XXXX, S82.XXXX or S92.XXXX with **any one of** V00.111X, V00.112X, V00.118X, V00.121X, V00.122X, V00.128X, V00.131X, V00.132X, V00.138X, V00.141X, V00.142X, V00.148X, V00.151X, V00.152X, V00.158X, V00.181X, V00.182X, V00.188X, V00.211X, V00.212X, V00.218X, V00.221X, V00.222X, V00.228X, V00.281X, V00.282X, V00.288X, V00.311X, V00.312X, V00.318X, V00.321X, V00.322X, V00.328X, V00.381X, V00.382X V00.388X, W00.0XX, W00.9XX, W01.0XX, W03.XXX, W18.2XX, W18.40X, W18.41X, W18.42X, W18.43X, W18.49XX)
- ❖ **Only has an isolated burn:**  
(ICD-9-CM N-code within categories 940 through 949)  
(ICD-10-CM code within categories T20 through T32)

\*Inter-facility transfer item 1-B was added to the ASTR Inclusion Criteria, per the Bureau of EMS & Trauma System in November 2008. This item was then revised by the TEPI advisory committee for 2012, requiring only Level III and IV trauma centers to submit inter-facility transfers. For 2013 data forward, the advisory committee reinstated the original 2008-2011 inter-facility transfer criteria.

Note: New ASTR inclusion criteria went into effect for trauma records with ED/Hospital Arrival Dates Jan. 1, 2008 forward. Changes to inclusion criteria affect the numbers and types of records submitted to ASTR. Inclusion changes should be taken into consideration when comparing multiple years of trauma data.