

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



# EMS Report: Trauma 2016

## Prepared by:

Robyn Blust, MPH

Vatsal Chikani, MPH

Anne Vossbrink, MS

## Data Sources:

Arizona Prehospital Information & EMS Registry System (AZ-PIERS)-Version 2  
Arizona Hospital Discharge Database (HDD)

## **Purpose:**

The purpose of this report is to provide EMS agencies with the data needed to describe, and improve the prehospital care of trauma patients. This report can be used to evaluate ongoing Quality Assurance initiatives on the following trauma performance measures:

1. Pre-hospital recognition of traumatic injury;
2. EMS on-scene time;
3. Documentation of trauma triage criteria;
4. Documentation of vital signs;
5. Documentation of airway management;
6. Transportation to a designated trauma facility.

## **Methodology:**

The Arizona Prehospital Information & EMS Registry System (AZ-PIERS) and the Hospital Discharge Database (HDD) were linked for events occurring from January 1, 2014, to December 31, 2015. A total of 105,013 trauma patients were identified from the HDD using principal diagnosis codes between 800 and 859 for ICD-9 or S00 to T34 and T79 for ICD-10. These patients made up 143,277 trauma encounters in the AZ-PIERS.

## **Limitations:**

1. If a patient received trauma care from more than one submitting EMS agency, that patient would be counted multiple times (once for each EMS agency encounter). Therefore, EMS data variables describe EMS trauma encounters and not trauma patients.
2. The HDD does not collect data from federal healthcare facilities (Indian Health Services and Veteran Administration hospitals) or from out-of-state hospitals; therefore, patients transported to these facilities are not included.

## **AZ-PIERS data variables associated with report:**

Possible Injury (E09_04)	Date/Time Vital Signs Taken (E14_01)
Providers Primary Impression (E09_15)	Revised Trauma Score (E14_27)
Unit Arrived on Scene Date/Time (E05_06)	Respiratory Rate (E14_11)
Arrived at Patient Date/Time (E05_07)	Systolic Blood Pressure (E14_04)
Transfer of Patient Care Date/Time (E05_08)	Total Glasgow Coma Score (E14_19)
Unit Left Scene Date/Time (E05_09)	Body Temperature (E14_20)
Type of Scene Delay (E02_08)	Procedures (D04_03)
Incident/Patient Disposition (E20_10)	Procedure Successful (E19_06)
Trauma Triage Criteria (IT11_1)	Number of Procedure Attempts (E19_05)

# Population

A total of 143,277 EMS encounters were reported to the AZ-PIERS, for patients with hospital confirmed traumatic injuries, during the years 2014 (66,850) and 2015 (76,427).

Trauma encounters were identified in the Hospital Discharge Database through an ICD-9 diagnosis of 800 to 959 or an ICD-10 diagnosis of S00 to T34 or T79.

## Injury Present:

EMS personnel indicated that the encounter was related to injury or a traumatic event (E09\_04) in 36.7% of cases. The injury present indicator was missing for about 57% of all trauma encounters.

**Improvement Opportunity** →

Injury Present	Count	Percent
<b>Total EMS encounters</b>	143,277	100%
<b>Yes</b>	52,518	36.7%
<b>No</b>	9,073	6.3%
<b>Unknown/Missing</b>	81,686	57.0%

## Provider Primary Impression (Top 10):

EMS providers indicated a primary impression (E09\_15) of traumatic injury in 37.1% of trauma encounters.

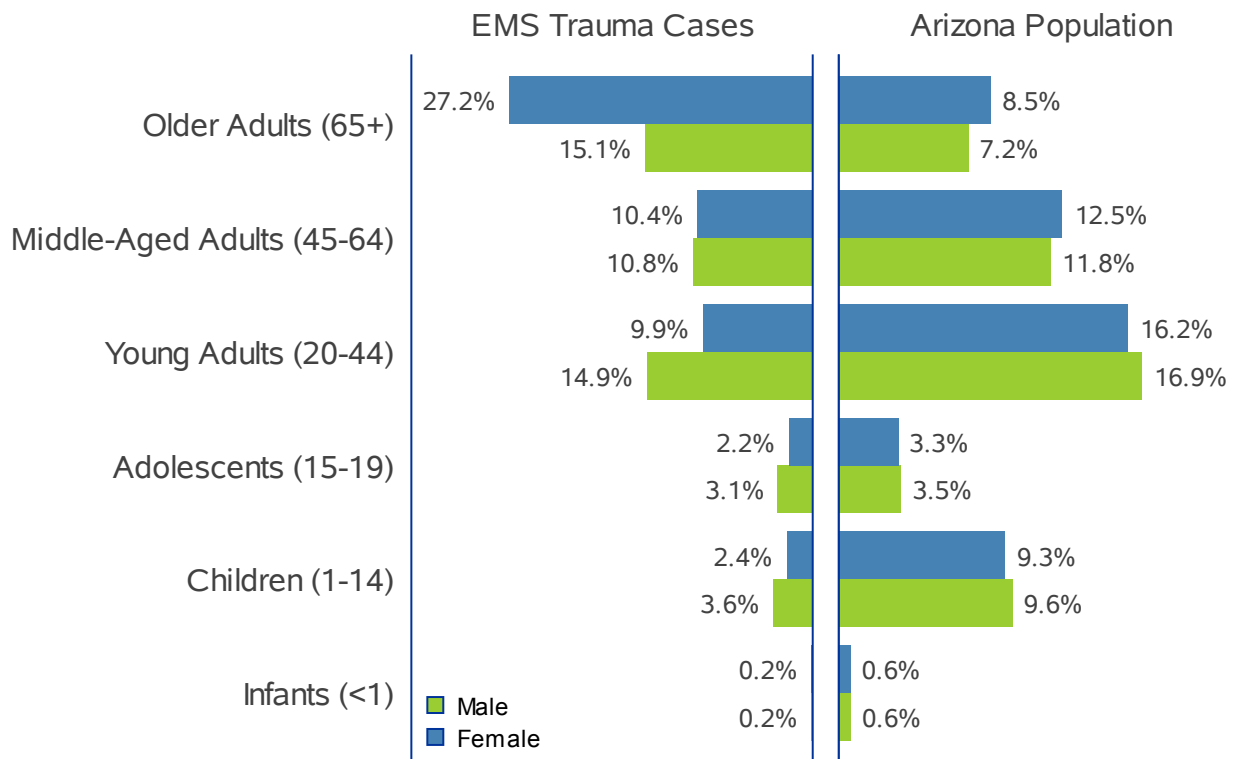
Among encounters with a primary impression of traumatic injury, EMS providers documented that the encounter was related to injury or a traumatic event (E09\_04) in less than half (48%).

The primary impression was not documented for 26% of EMS trauma encounters.

**Improvement Opportunity** →

Provider Primary Impression	Count	Percent
<b>Traumatic injury</b>	47,613	37.1%
<b>Pain</b>	30,574	23.8%
<b>Altered level of consciousness</b>	3,421	2.7%
<b>Other</b>	3,022	2.4%
<b>Unknown Problem</b>	2,611	2.0%
<b>Behavioral/psychiatric disorder</b>	2,053	1.6%
<b>Other Illness/Injury</b>	1,873	1.5%
<b>Displaced Fracture: Closed</b>	1,622	1.3%
<b>No Apparent Illness/Injury</b>	1,565	1.2%
<b>Weakness</b>	1,259	1.0%
<b>Not Documented</b>	32,869	25.6%

# Demographics



Older adults (65+) make up a disproportionately large number of trauma encounters as compared to the Arizona population, and older females make up 27% of all trauma encounters.

Age Category	Overall		Gender			
			Male		Female	
	Count	Percent	Count	Percent	Count	Percent
<b>Total</b>	143,273	100.0%	68,320	47.7%	74,953	52.3%
<b>Older Adults (65+)</b>	60,583	42.3%	21,580	15.1%	39,003	27.2%
<b>Middle-Aged Adults (45-64)</b>	30,342	21.2%	15,447	10.8%	14,895	10.4%
<b>Young Adults (20-44)</b>	35,567	24.8%	21,385	14.9%	14,182	9.9%
<b>Adolescents (15-19)</b>	7,646	5.3%	4,501	3.1%	3,145	2.2%
<b>Children (1-14)</b>	8,596	6.0%	5,145	3.6%	3,451	2.4%
<b>Infants (&lt;1)</b>	539	0.4%	262	0.2%	277	0.2%

Note: 4 cases with no documented age or date of birth from either the HDD or the AZ-PIERS were excluded.

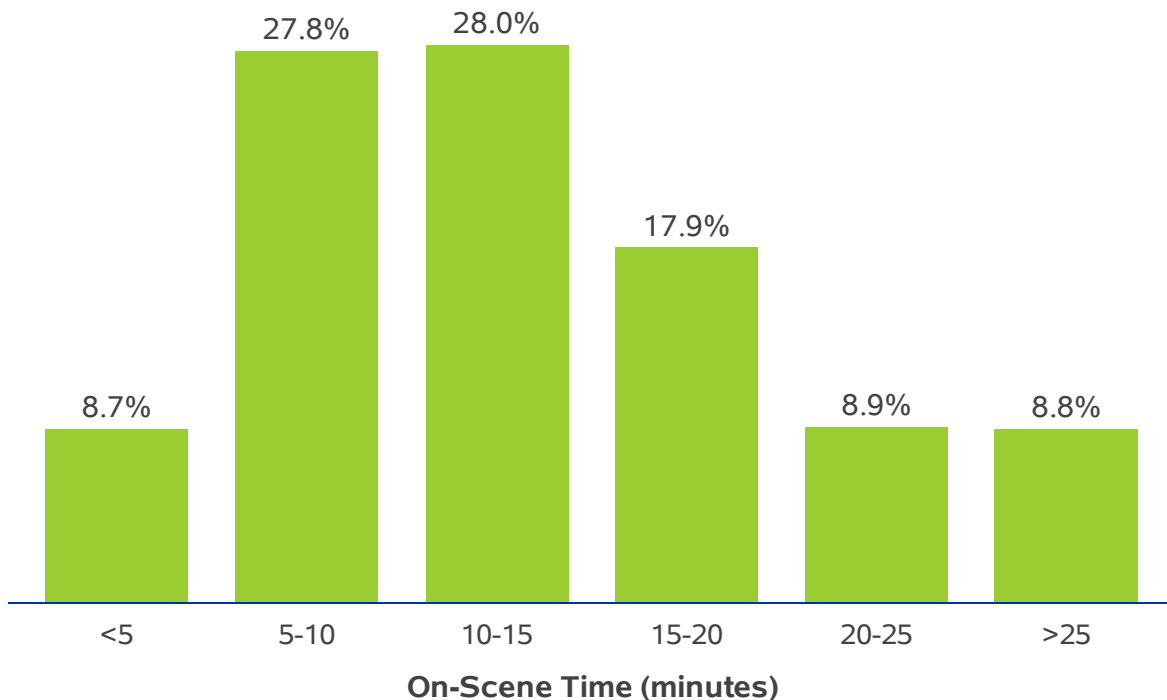
# On-Scene Time

93% of trauma encounters had a valid on-scene time documented.

On-Scene Time	N	Percent
Valid/Documented	133,275	93.0%
Invalid/Not Documented	10,002	7.0%

The median on-scene time for a trauma encounter was 12 minutes, and 82% had an on-scene time of 20 minutes or less.

On-Scene Time (minutes)	Count	Percent	Cumulative Percent
<b>Total</b>	133,275	100.0%	—
<5	11,640	8.7%	8.7%
5-10	37,003	27.8%	36.5%
10-15	37,357	28.0%	64.5%
15-20	23,802	17.9%	82.4%
20-25	11,807	8.9%	91.3%
>25	11,666	8.8%	100.0%



Note: Missing, negative, and scene times greater than 200 minutes were excluded

**Note:** On-Scene time was calculated from the arrived patient data/time (E05\_07) to either the transfer of patient care date/time (E05\_08) or the unit left scene data/time (E05\_09). When arrived patient data was unavailable the unit arrived at scene date/time (E05\_06) was used.

# On-Scene Time Delay

There were 29,004 (20.2%) trauma encounters with either a reason for delay (E02\_08) documented (6,117) or a on-scene time of greater than 20 minutes with no reason for delay documented (22,887).

	Count	Percent
<b>Total On-Scene Time Delays</b>	29,004	100.0%
<b>Reason Documented</b>	6,117	21.1%
< 20min	3,848	13.3%
≥ 20min	2,129	7.3%
<b>No on-scene time documented</b>	140	0.5%
<b>No Reason Documented + on-scene time ≥ 20min</b>	22,887	78.9%

**Improvement Opportunity**

The top 5 most commonly documented reasons for delay were other, staff delay, safety, and extrication > 20 minutes and distance.

Reason for On-Scene Time Delay*	Count	Percent
<b>Other</b>	4,126	67.5%
<b>Staff Delay</b>	923	15.1%
<b>Safety</b>	500	8.2%
<b>Extrication &gt;20 min.</b>	330	5.4%
<b>Distance</b>	273	4.5%
<b>Patient Access</b>	180	2.9%
<b>Vehicle Crash</b>	70	1.1%
<b>Traffic</b>	60	1.0%
<b>Directions</b>	54	0.9%
<b>Crowd</b>	50	0.8%
<b>Vehicle Failure</b>	50	0.8%
<b>Weather</b>	39	0.6%
<b>Language Barrier</b>	31	0.5%
<b>Diversion</b>	12	0.2%
<b>Law Enforcement Assistance Required</b>	11	0.2%
<b>HazMat</b>	2	0.0%

\*EMS agencies are able to select multiple reasons for delay; therefore, percentages do not add up to 100%.

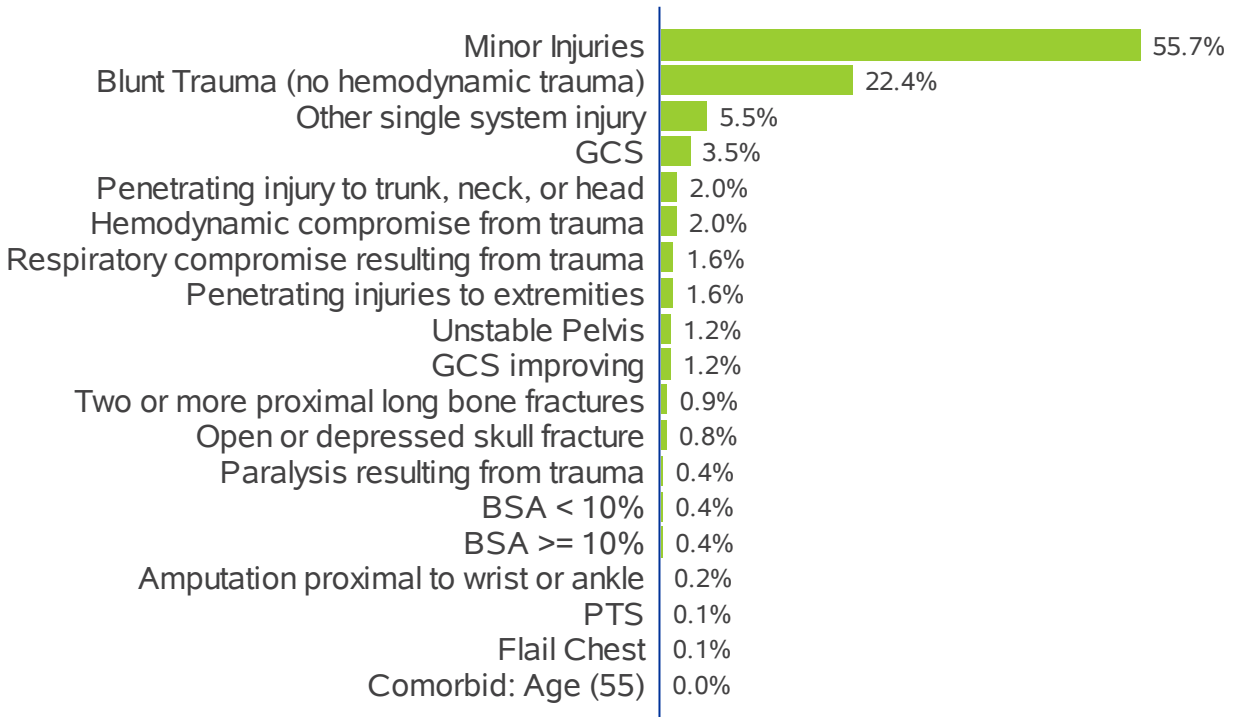
# Trauma Triage Criteria

Trauma triage criteria (IT11\_1) were documented for 2.1% of trauma encounters.

Trauma Triage Criteria	Count	Percent
<b>Total</b>	143,277	100.0%
<b>Documented</b>	3,060	2.1%
<b>Not documented</b>	140,217	97.9%

**Improvement Opportunity** →

The most commonly documented trauma triage criteria were minor injuries and blunt trauma.

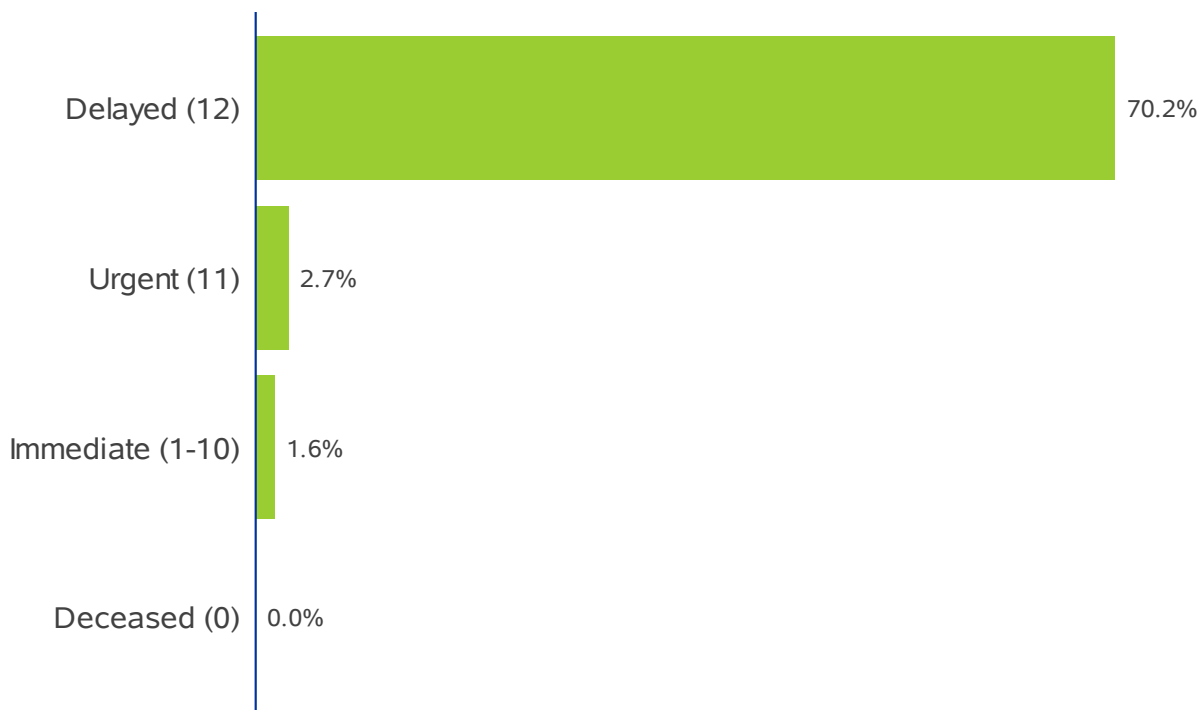


Note: Trauma Triage Criteria is a multiselect variable; therefore, percentages may not add up to 100%

# Revised Trauma Score

The Revised Trauma Score (RTS) (E14\_27) is a physiological scoring system based on the patients initial vital signs. A low RTS is associated with increased injury severity.

The majority of trauma encounters had a Revised Trauma Score of “Delayed (12)”, indicating low trauma severity.



	Count	Percent
<b>Total</b>	143,277	100.0%
<b>Delayed (12)</b>	100,619	70.2%
<b>Urgent (11)</b>	3,894	2.7%
<b>Immediate (1-10)</b>	2,288	1.6%
<b>Deceased (0)</b>	45	0.0%
<b>Not Documented</b>	36,431	25.4%



# Documentation of Vital Signs

## Vitals of the RTS:

The three vital measures used to calculate a trauma patients Revised Trauma Score are the initial Respiratory Rate (E14\_11), Systolic Blood Pressure (E14\_04) and Total Glasgow Coma Score (E14\_19).

The Glasgow Coma Score is the least documented assessment for the Revised Trauma Score.

Trauma Patient Vitals	Count	Percent
<b>Respiratory Rate</b>		
0 (0)	326	0.2%
1 (1-5)	107	0.1%
2 (6-9)	142	0.1%
3 (>29)	2,107	1.5%
4 (10-29)	131,791	92.0%
Not Documented	8,804	6.1%
<b>Systolic Blood Pressure</b>		
0 (0)	398	0.3%
1 (1-49)	87	0.1%
2 (50-75)	558	0.4%
3 (76-89)	1,559	1.1%
4 (>89)	132,596	92.5%
Not Documented	8,079	5.6%
<b>Glasgow Coma Score</b>		
0 (3)	862	0.6%
1 (4-5)	204	0.1%
2 (6-8)	563	0.4%
3 (9-12)	1,954	1.4%
4 (13-15)	96,098	67.1%
Not Documented	43,596	30.4%

**Improvement Opportunity** →

## Body temperature:

Body temperature (E14\_20) was documented for only 11.8% of trauma encounters.

Body Temperature	Count	Percent
<b>Total</b>	143,277	100.0%
Documented	16,843	11.8%
Not Documented	126,434	88.2%

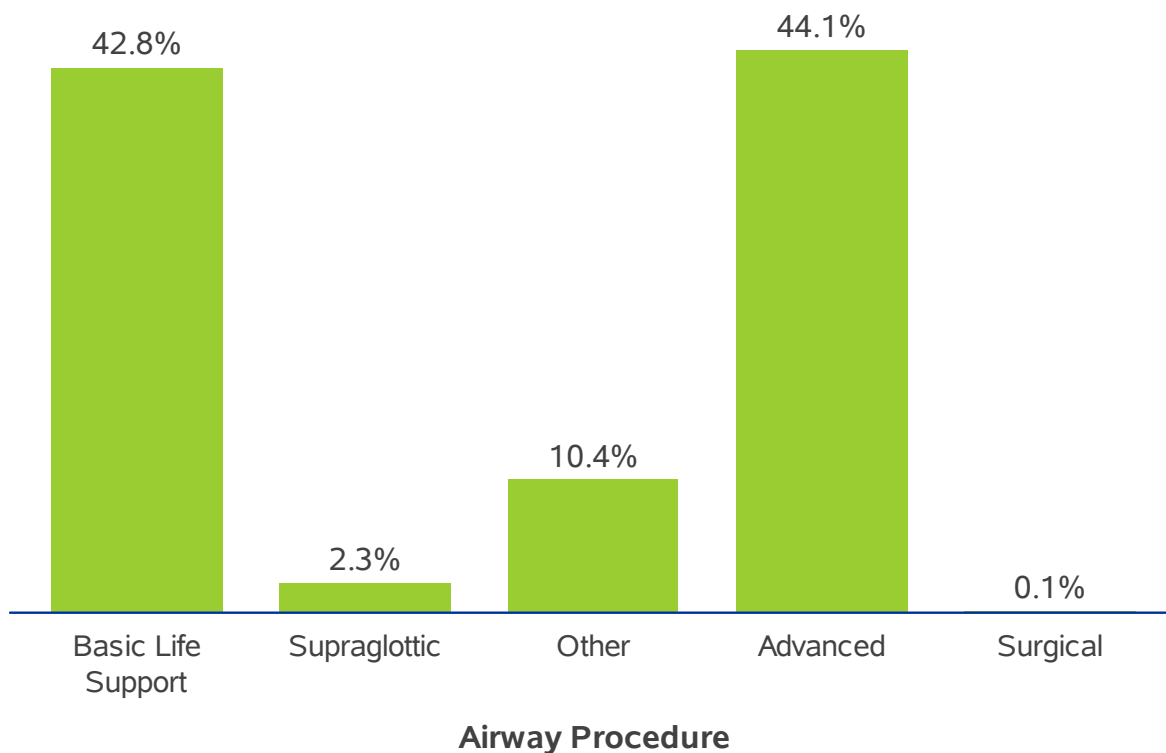
Body Temperature	Count	Percent
Very Low (< 35°C)	485	2.9%
Low (35°C-35.9°C)	1,133	6.7%
Normal (36°C-37.9°C)	14,898	88.5%
High (=> 38°C)	327	1.9%

**Improvement Opportunity** →

# Airway Procedures

1,087 (0.8%) trauma encounters received airway procedures in the prehospital setting. A total 1,765 airway procedures (D04\_03) were performed.

Airway Procedure Given	N	Percent
<b>Total</b>	143,277	100.0%
<b>Yes</b>	1,087	0.8%
<b>None Documented</b>	142,190	99.2%



**Note:** Airway procedure type definitions

Type of Airway Procedure		
<b>Basic Life Support</b>	Bagged (via BVMask); Bagged (via tube); Cleared, Opened, or Heimlich; Nasopharyngeal; Oropharyngeal; Suctioning	
<b>Advanced Life Support</b>	<b>Advanced</b>	Endotracheal Intubation; Intubation Confirm Colorimetric ETCO <sub>2</sub> ; Intubation Confirm Esophageal Detector Device/Bulb (EDD); Intubation of Existing Tracheostomy Stoma; Nasotracheal Intubation; Rapid Sequence Intubation
	<b>Other</b>	CPAP; Direct Laryngoscopy; ECO <sub>2</sub> Monitoring; Foreign Body Removal; Gastric Tube Inserted Nasally; Gastric Tube Inserted Orally; Extubation; Nebulizer Treatment; Ventilator
	<b>Supraglottic</b>	Combitube; King LT Blind Insertion Airway Device; Laryngeal Mask
	<b>Surgical</b>	Surgical Cricothyrotomy; Needle Cricothyrotomy

# Airway Procedures

## Successes:

Of the 1,765 airway procedures given, 39.7% were Basic Life Support and 59.2% of all airway procedures were successful (E19\_06).

Type of Airway Procedure	Total		Successful					
			Yes		No		Unknown/Missing	
	N	Percent	N	Percent	N	Percent	N	Percent
<b>Total</b>	1765	100.0%	1045	59.2%	104	5.9%	616	34.9%
<b>Basic Life Support</b>	700	39.7%	313	44.7%	39	5.6%	348	49.7%
<b>Advanced Life Support</b>	1065	60.3%	732	68.7%	65	6.1%	268	25.2%
<b>Advanced</b>	739	41.9%	485	65.6%	42	5.7%	212	28.7%
<b>Other</b>	264	15.0%	203	76.9%	16	6.1%	45	17.0%
<b>Supraglottic</b>	55	3.1%	42	76.4%	5	9.1%	8	14.5%
<b>Surgical</b>	7	0.4%	2	28.6%	2	28.6%	3	42.9%

## Intubation:

Intubated	N	Percent
<b>Yes</b>	365	0.3%
<b>No/Not Documented</b>	104,673	99.7%

A total of 365 (0.3%) trauma patients received 485 intubation procedures in the pre-hospital setting.

Type of Injury	N	Percent
<b>Total</b>	365	100.0%
<b>Traumatic Brain Injury</b>	158	43.3%
<b>Other head, face and neck</b>	49	13.4%
<b>Other Injury</b>	107	29.3%
<b>Missing</b>	51	14.0%

More than half of intubated patients had a hospital confirmed Traumatic Brain Injury and an additional 14% had either a head, face, or neck injury.

# Hospital Outcomes

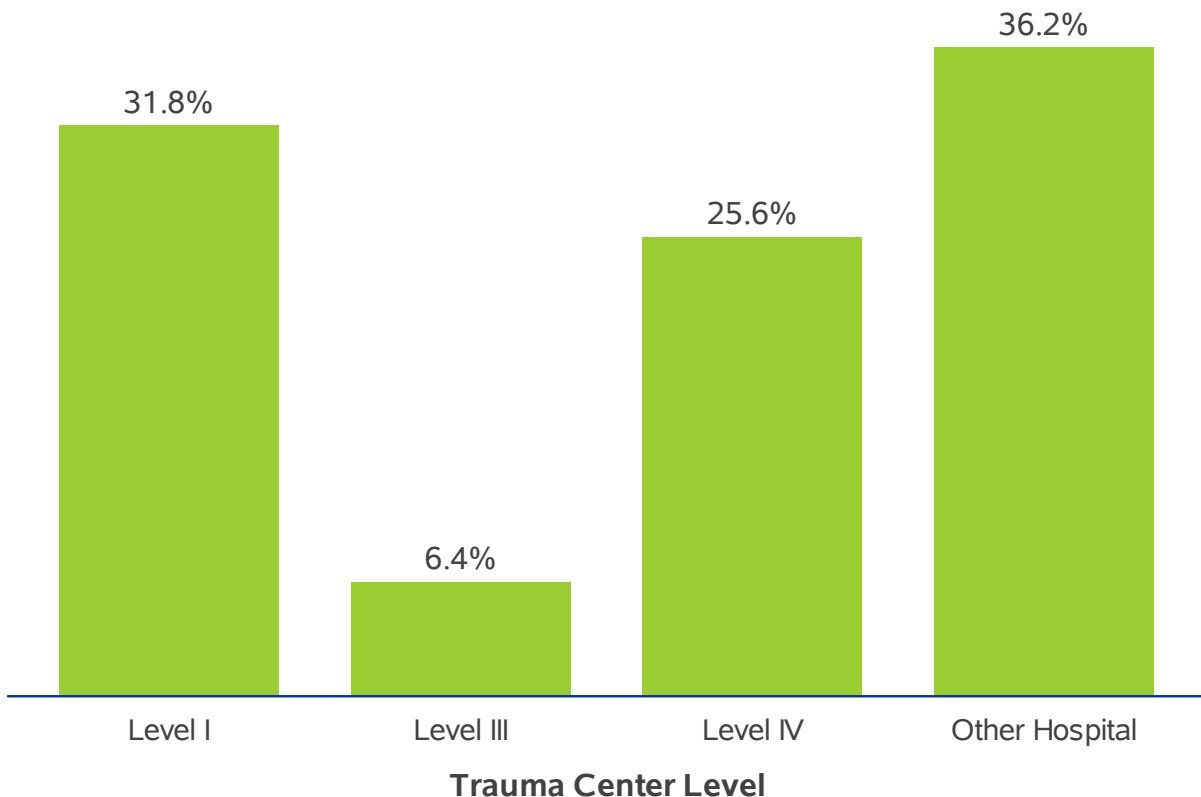
The 143,277 EMS trauma encounters reported to the AZ-PIERS in 2014 and 2015 represent a total of 105,013 patients at the hospital level.

The remainder of the report describes hospital outcome data at the patient level.

## Hospital Destination:

64% of EMS trauma patients were transported to a designated trauma center.

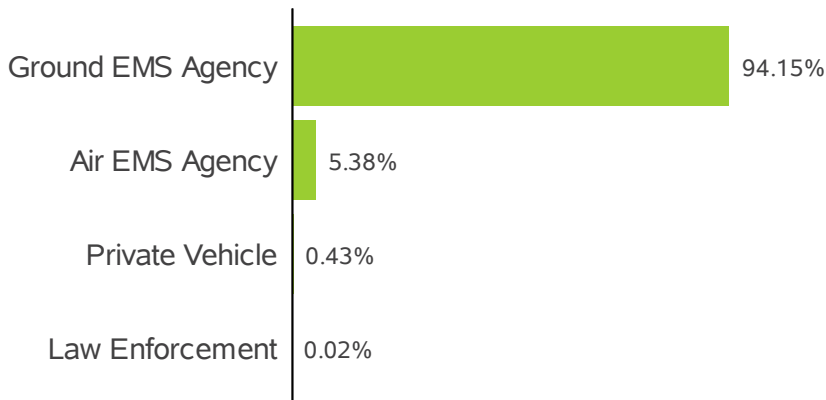
Trauma Center Level	Count	Percent
Level I	33,413	31.8%
Level III	6,729	6.4%
Level IV	26,889	25.6%
Other Hospital	37,982	36.2%



Note: trauma center level represents the final hospital destination for patients with an interfacility transfer

# Mode of Transport

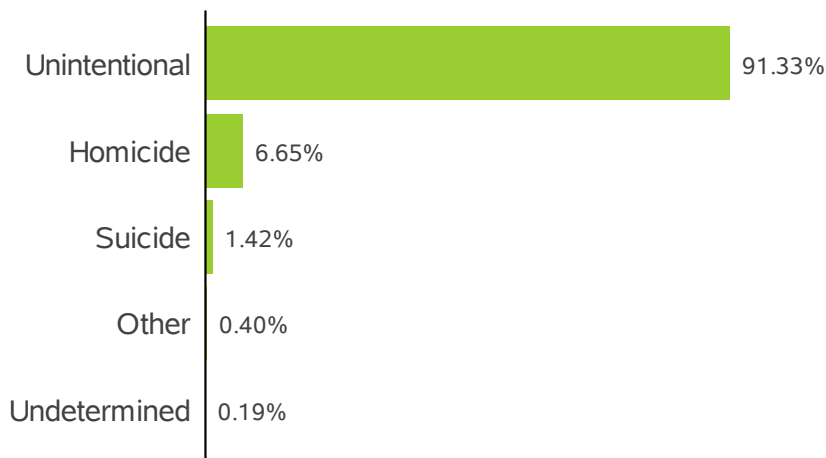
94.7% of EMS trauma patients were transported to the hospital by ground EMS.



Mode of Transport to Hospital	Count	Percent
Ground EMS Agency	35,993	92.6%
Air EMS Agency	1,726	4.4%
Private Vehicle	1,100	2.8%
Law Enforcement	20	0.0%
Unknown	3	0.0%

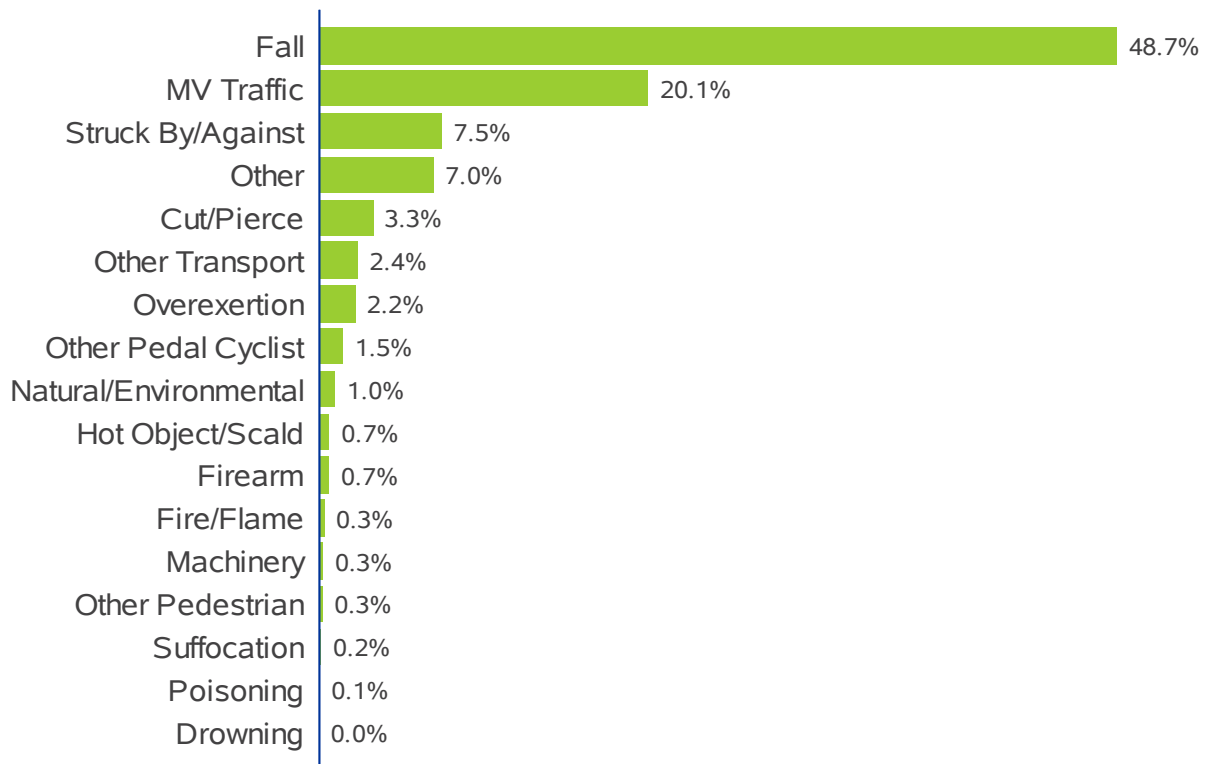
# Intent of Injury

91.3% of EMS trauma patients had an unintentional injury.



Intent of Injury	Count	Percent
Unintentional	94,145	91.3%
Homicide	6,860	6.7%
Suicide	1,465	1.4%
Other	413	0.4%
Undetermined	199	0.2%

# Mechanism of Injury



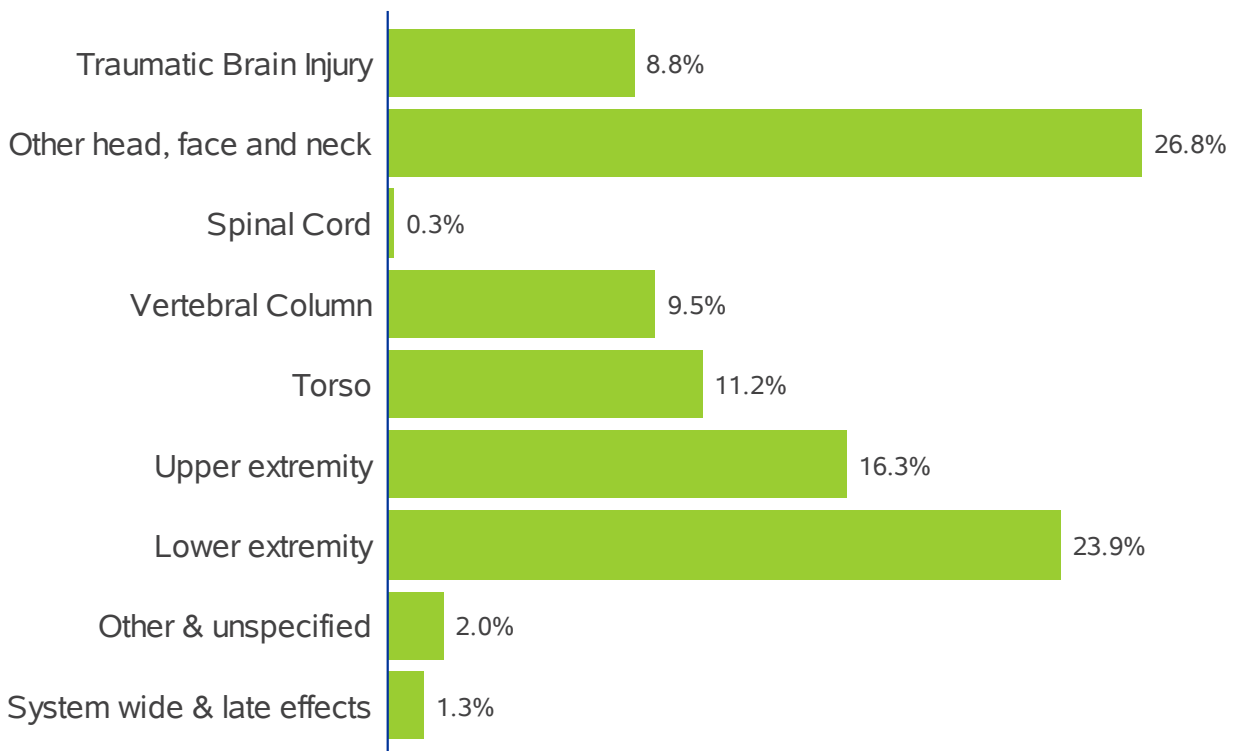
Almost half of all EMS trauma patients were treated for a fall injury.

	Count	Percent
<b>Fall</b>	51,157	48.7%
<b>MV Traffic</b>	21,139	20.1%
<b>Struck By/Against</b>	7,897	7.5%
<b>Other</b>	7,378	7.0%
<b>Cut/Pierce</b>	3,483	3.3%
<b>Other Transport</b>	2,522	2.4%
<b>Overexertion</b>	2,350	2.2%
<b>Other Pedal Cyclist</b>	1,587	1.5%
<b>Natural/Environmental</b>	1,064	1.0%
<b>Hot Object/Scald</b>	714	0.7%
<b>Firearm</b>	684	0.7%
<b>Fire/Flame</b>	361	0.3%
<b>Machinery</b>	306	0.3%
<b>Other Pedestrian</b>	263	0.3%
<b>Suffocation</b>	182	0.2%
<b>Poisoning</b>	62	0.1%
<b>Drowning</b>	14	0.0%
<b>Missing</b>	3,850	3.7%

# Body Region of Injury

The Centers for Disease Control and Prevention, Barell Injury Diagnosis Matrix\* is used to classify traumas by body region and nature of injury using the ICD-9-CM principal diagnosis code.

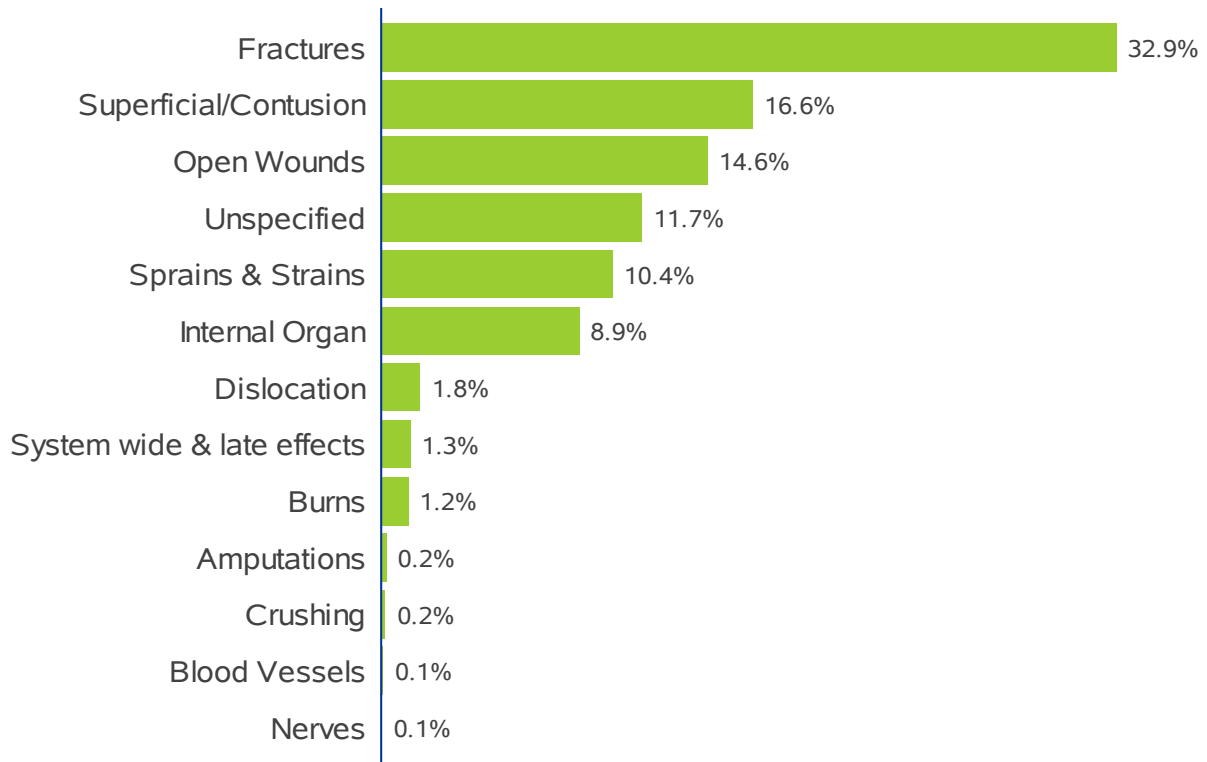
Currently there is no standardized matrix for classifying body region and nature of injury using ICD-10-CM codes; therefore, data for hospital discharges after October, 1st, 2015 could not be included the body region and nature of injury analyses.



The most commonly injured body regions were the head, face and neck and the upper and lower extremities.

	Count	Percent
<b>Traumatic Brain Injury</b>	8,002	8.8%
<b>Other head, face and neck</b>	24,446	26.8%
<b>Spinal Cord</b>	246	0.3%
<b>Vertebral Column</b>	8,704	9.5%
<b>Torso</b>	10,209	11.2%
<b>Upper extremity</b>	14,876	16.3%
<b>Lower extremity</b>	21,812	23.9%
<b>Other &amp; unspecified</b>	1,843	2.0%
<b>System wide &amp; late effects</b>	1,206	1.3%

# Nature of Injury

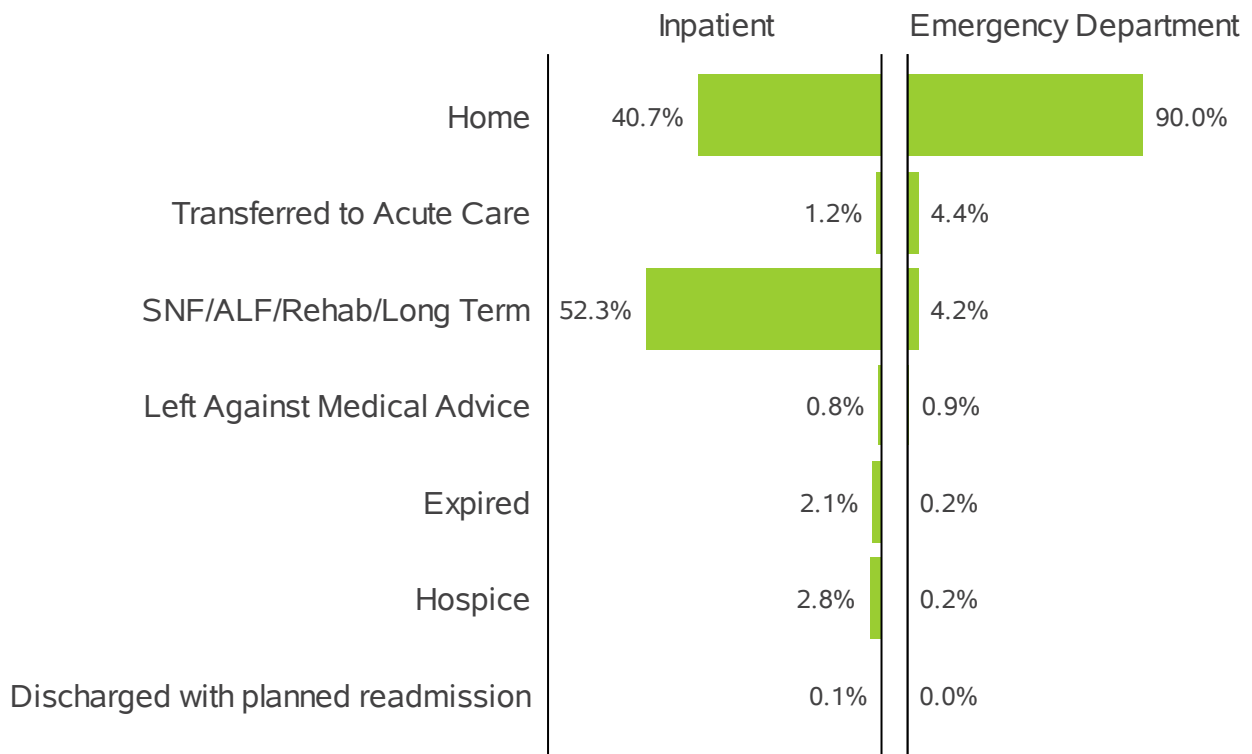


The most common nature of injury for EMS trauma patients was fractures, followed by superficial injuries/contusions and open wounds.

	Count	Percent
<b>Fractures</b>	30,022	32.9%
<b>Superficial/Contusion</b>	15,183	16.6%
<b>Open Wounds</b>	13,335	14.6%
<b>Unspecified</b>	10,665	11.7%
<b>Sprains &amp; Strains</b>	9,465	10.4%
<b>Internal Organ</b>	8,093	8.9%
<b>Dislocation</b>	1,624	1.8%
<b>System wide &amp; late effects</b>	1,206	1.3%
<b>Burns</b>	1,127	1.2%
<b>Crushing</b>	228	0.2%
<b>Amputations</b>	212	0.2%
<b>Blood Vessels</b>	123	0.1%
<b>Nerves</b>	61	0.1%



# Discharge Disposition



73% of EMS trauma patients were discharged from the Emergency Department (ED), and 27% were admitted to the hospital.

The majority (90%) of ED patients were discharged home. The majority of inpatients (52.3%) were discharged to either a skilled nursing, rehab or long term care facility.

The median length of stay for hospital inpatients was 4 days.

Discharge Disposition	Overall		Inpatient		Emergency Department	
	Count	Percent	Count	Percent	Count	Percent
<b>Home</b>	80,704	76.9%	11,431	40.7%	69,273	90.0%
<b>SNF/ALF/Rehab/Long Term</b>	17,909	17.1%	14,671	52.3%	3,238	4.2%
<b>Transferred to Acute Care</b>	3,721	3.5%	335	1.2%	3,386	4.4%
<b>Hospice</b>	973	0.9%	791	2.8%	182	0.2%
<b>Left Against Medical Advice</b>	910	0.9%	211	0.8%	699	0.9%
<b>Expired</b>	743	0.7%	587	2.1%	156	0.2%
<b>Discharged with Planned Readmission</b>	53	0.1%	39	0.1%	14	0.0%

# Hospital Charges

The median hospital charge for an EMS trauma patient was \$9,267 and the total hospital charges for 2014 and 2015 combined were \$2.8 billion.

Total Hospital Charges						
N	Total Charges	Median	Minimum	Maximum	25th Percentile	75th Percentile
105,012	\$2,834,802,449	\$9,267	\$0	\$4,403,596	\$3,880	\$27,854

## Payer Source:

The majority of hospital charges were billed to Medicare.

Payer Type	Count	Percent
<b>Medicare</b>	45,344	43.2%
<b>AHCCCS/Medicaid</b>	23,397	22.3%
<b>Private Insurance</b>	22,021	21.0%
<b>Self-Pay</b>	7,935	7.6%
<b>Other</b>	4,014	3.8%
<b>Workers Compensation</b>	2,301	2.2%

