ARIZONA DEPARTMENT OF HEALTH SERVICES

BUREAU OF EMERGENCY MEDICAL SERVICES AND TRAUMA SYSTEM

PERFORMANCE IMPROVEMENT TOOLKIT:

MAJOR TRAUMA

AZ-PIERS Q3 & Q4 2013

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Report No. 14-2-EMS-TRAUMA

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Purpose

The report provides agencies with a system wide comparison to their performance in major trauma calls. This report can be used to support Quality Assurance initiatives in their communities.

This report analyzes five related performance measures:

1. Reduce the length of time between unit arrival on scene and unit en route to a hospital,
2. Increase the documentation of triage criteria to determine hospital destination,
3. Improve the documentation related to the mode of transport decision,
4. Improve the documentation on airway protection, and
5. Improve the documentation related to the care of patients with Traumatic Brain Injury (TBI)

Methodology

The Arizona Prehospital Information & EMS Registry System (AZ-PIERS) was analyzed to find records where a traumatic injury occurred. The records in this analysis were pulled on April 30, 2014, AND had:

1. A *Unit Notified Date By Dispatch Date/Time* (E05_04) of July 1, 2013, to December 31, 2013, AND
2. *Possible Injury* (E09_04) equal to "Yes," AND/OR
3. *Protocols Used* (E17_01) that included one or more of the following: Bites and Envenomation, Burns, Drowning / Near Drowning, Electrical Injuries, Extremity Trauma, Head Trauma, Multiple Trauma, Back Pain, Spinal Immobilization Clearance, Pediatric Head Trauma, Spinal Cord Trauma, Thoracic injuries – adult, Thoracic injuries – pediatric, Trauma-Amputation, Trauma-Arrest.
4. *Patient Disposition* (E20_10) equal to "Treated, Transported by EMS," "Treated, Transported by EMS (ALS)," "Treated, Transported by EMS (BLS)," or "Treated, Transferred Care."

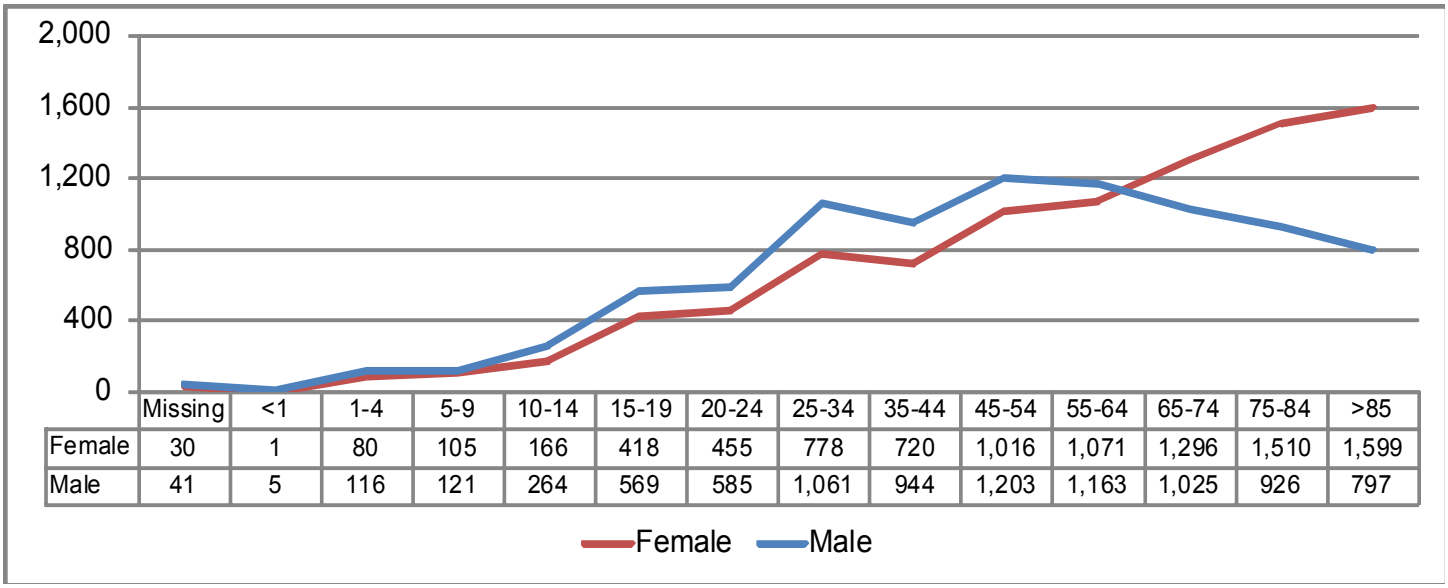
Excellence in Prehospital Injury Care (EPIC) protocol adherence, severity type of Traumatic Brain Injury (TBI), and patient outcomes from the Hospital Discharge Database (HDD) are presented for linked records. TBI cases are defined using the Barell Injury Diagnosis Matrix as developed by the Center of Disease Control and Prevention (CDC).

Limitations

If a patient received care for an injury involving more than one submitting EMS agency, that patient would be counted multiple times (once for each EMS agency encounter).

Additionally, state benchmarks are restricted to only include those agencies participating in the registry. If your agency is not currently participating but would like to sign up please visit us on our AZ-PIERS homepage.

Graph 1: Age distribution of traumatic injury (n=18,219)

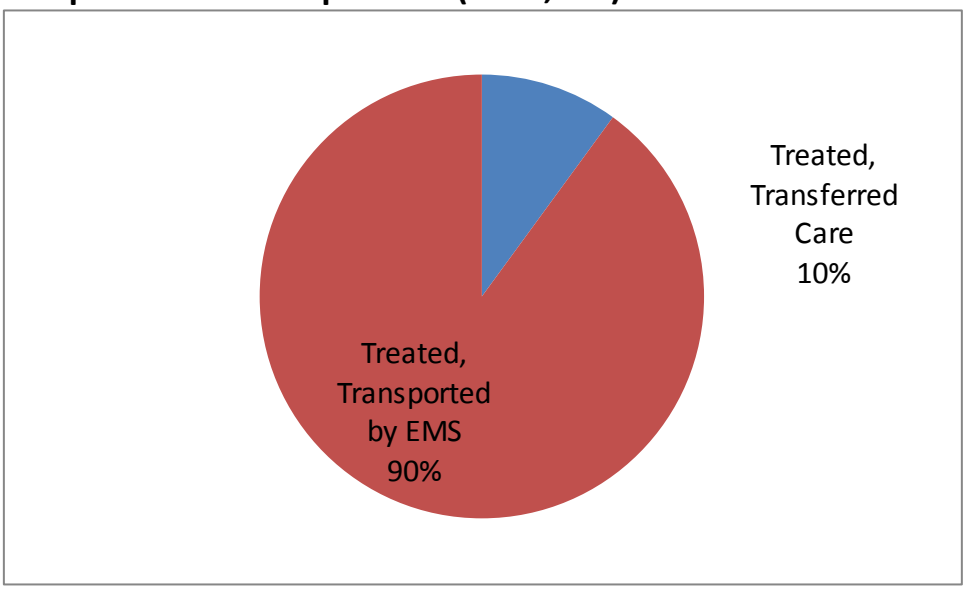


	Missing	<1	1-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65-74	75-84	>85
Female	30	1	80	105	166	418	455	778	720	1,016	1,071	1,296	1,510	1,599
Male	41	5	116	121	264	569	585	1,061	944	1,203	1,163	1,025	926	797

In the last two quarters of 2013, older adults (>65 years of age) were responsible for 49% of all EMS calls; females over 65 were responsible for 30% of the volume. Patients under the age of 19 were responsible for 11% of the volume.

There can be various explanations for the trends presented related to traumatic injuries. This analysis demonstrates that the EMS system in Arizona would benefit in training and resources that target older adults.

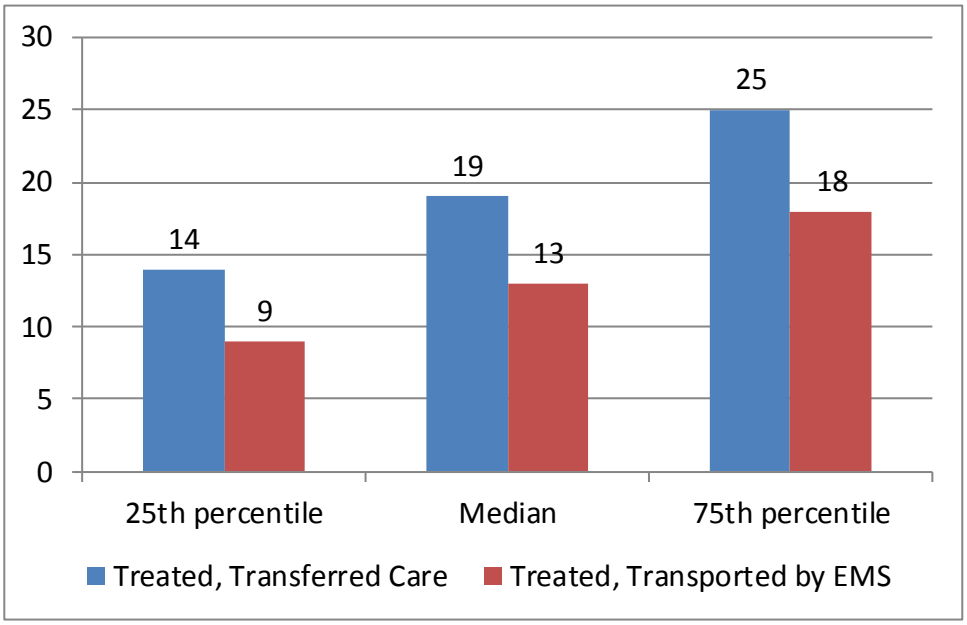
Graph 2: Patient Disposition (n=18,219)



A vast majority of patients (90%) were treated and transported by EMS. Treated and transported means that the responding unit provided care and personally accompanied the patient to a health care facility.

Performance Measure 1: Reduce the length of time between unit arrival on scene and unit goes en route to a hospital

Graph 3: Time interval from arrival on scene to transfer/departure (minutes)



A unit's scene time varied depending on the patient disposition. In the situation where an EMS agency treated and transported a patient, the median scene time was 13 minutes. In the situation where the reporting EMS agency treated and transferred a patient to another EMS agency, the median scene time was 19 minutes.

Scene time was calculated by subtracting *Unit Arrived on Scene Date/Time* (E05_06) from *Transfer of Patient Care Date/Time* (E05_08) or *Unit Left Scene Date/Time* (E05_09).

Scene time was not calculated in 5.6% of cases because of missing values. Negative scene times and times > 200 minutes were removed from analysis.

Table 1: Time interval from arrival on scene to transfer or departure (minutes)

	Scene Time				
	N	Missing	25th percentile	Median	75th percentile
Treated, Transferred Care	1,180	649	14	19	25
Treated, Transported by EMS	16,011	379	9	13	18

Performance Measure 2: Increase the documentation of triage criteria to determine hospital destination

Graph 4: Trauma triage documentation (n=18,219)

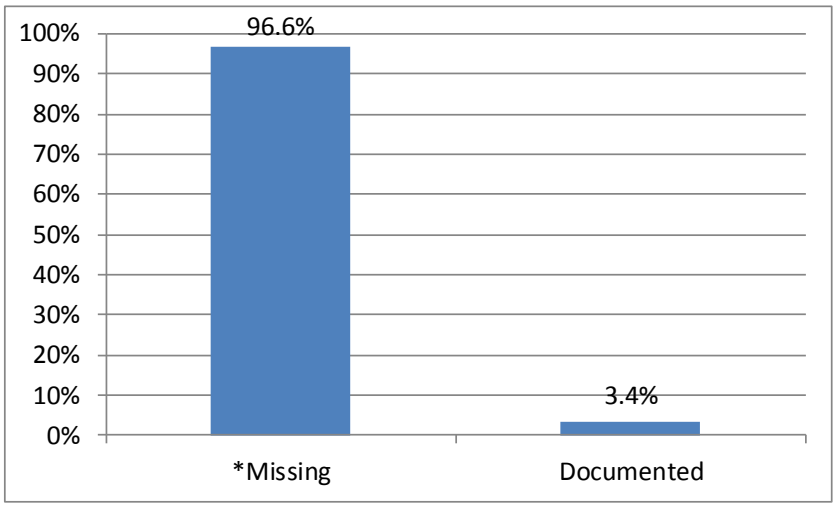


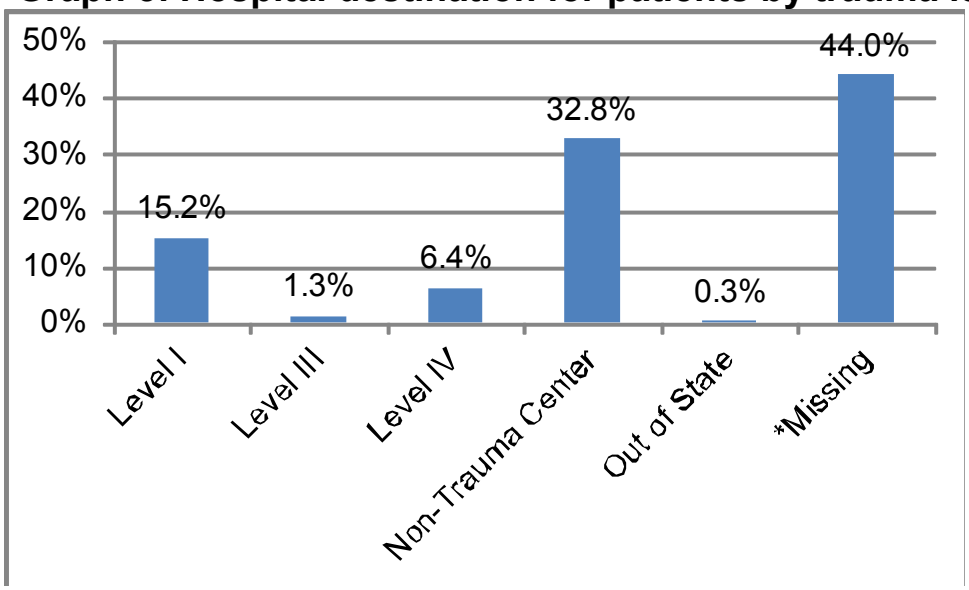
Table 2: Trauma triage documentation (n=18,219)

	N	Percent
Missing	17,595	96.6%
Documented	624	3.4%

Through the proper treatment and triage of trauma patients to the proper level of care, Emergency Medical Care Technicians (EMCTs) directly affect patient outcomes. Trauma centers have requirements of services that they must provide for their patients. The CDC has developed an evidence-based guideline for appropriate field triage for traumas.

A provider's rationale wasn't analyzed in many records (97%) because of missing documentation. This information is gathered from *Trauma Triage Criteria* (IT11_01).

Graph 5: Hospital destination for patients by trauma level (n=18,219)



Destination information was missing in a large percentage of traumas (44%). This field was calculated through *Destination Name* (E20_01).

Patients were transported to a non-trauma center 33% of the time.

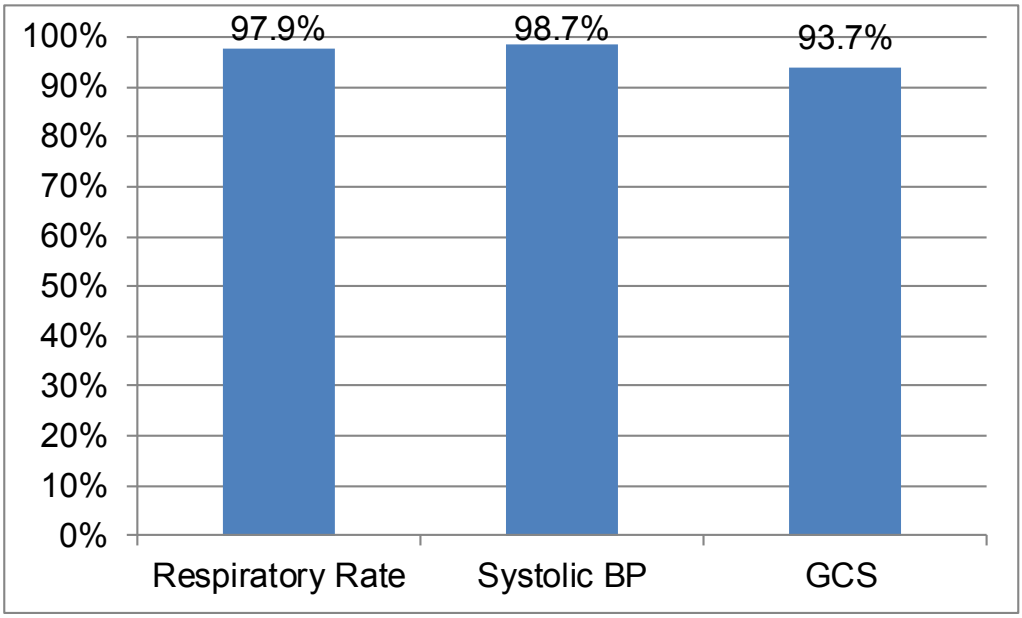
Table 3: Documentation of vitals for Revised Trauma Score

	N	Percent
Total	18,219	100%
Respiratory Rate Documentation		
Missing	384	2.1
Documented	17,835	97.8
Systolic BP Documentation		
Missing	242	1.33
Documented	17,977	98.6
Glascow Coma Score (GCS) Documentation		
Missing	1,141	6.26
Documented	17,078	93.7

A Revised Trauma Score (RTS) is a physiological scoring system based on the patient's initial vital signs. A patient with a low RTS will denote a high severity injury.

An RTS has demonstrated correlation with deaths and survivability of traumatic injuries. These data points can be used to find trends and interventions that will help save the lives of severely injured patients in Arizona.

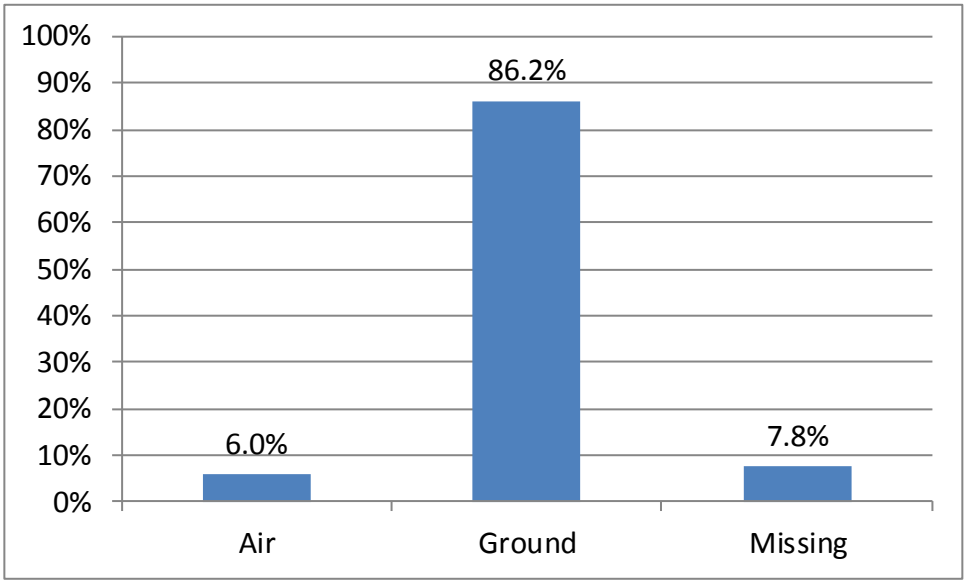
Graph 6: Distribution of Revised Trauma Score among patients



Patient vital signs are increasingly being reported by EMS agencies. The Glascow Coma Score is the least documented assessment.

Performance Measure 3: Improve the documentation relating to the mode of transport decision

Graph 7: Patient transport mode to health care facilities



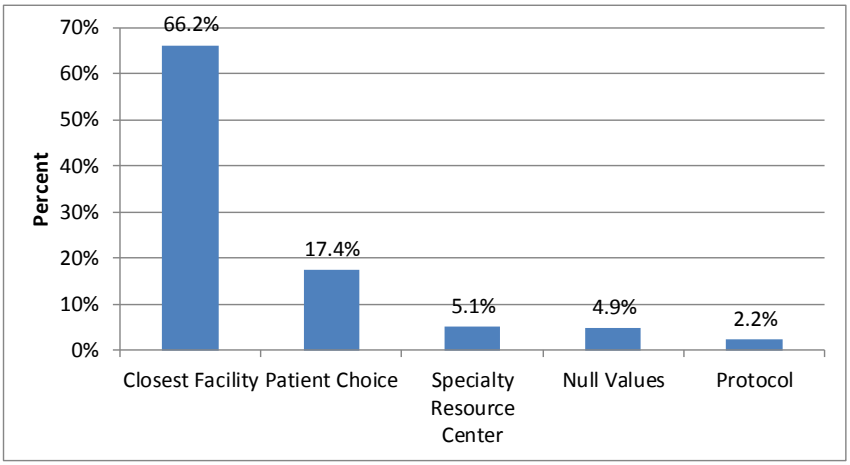
Patients were transported to a health care facility by ground ambulance 86% of the time.

There were 8% of cases with a missing value. The transport mode was calculated by using *EMS Agency ID* (D01_01) and *Transferred to Agency ID* (IT5_04).

Table 4: Reason for choosing destination

	N	Percent
Closest Facility	10,849	66.19%
Patient Choice	2,855	17.42%
Specialty Resource	832	5.08%
Null Values	798	4.87%
Protocol	359	2.19%
Missing	209	1.28%
Family Choice	163	0.99%
On-line Medical	132	0.81%
Patient's Physician's Choice	99	0.6%
Law Enforcement	33	0.2%
Other	32	0.2%
Diversion	25	0.15%
Insurance Status	4	0.02%
Total	16,390	100%

Graph 8: Reason for choosing destination



EMCTs transported a patient to the closest facility 66% of the time. Other factors play a role for choosing a destination such as patient choice (17%), specialty resources (5%), and protocols (2%).

Performance Measure 4: Improve the documentation on airway protection

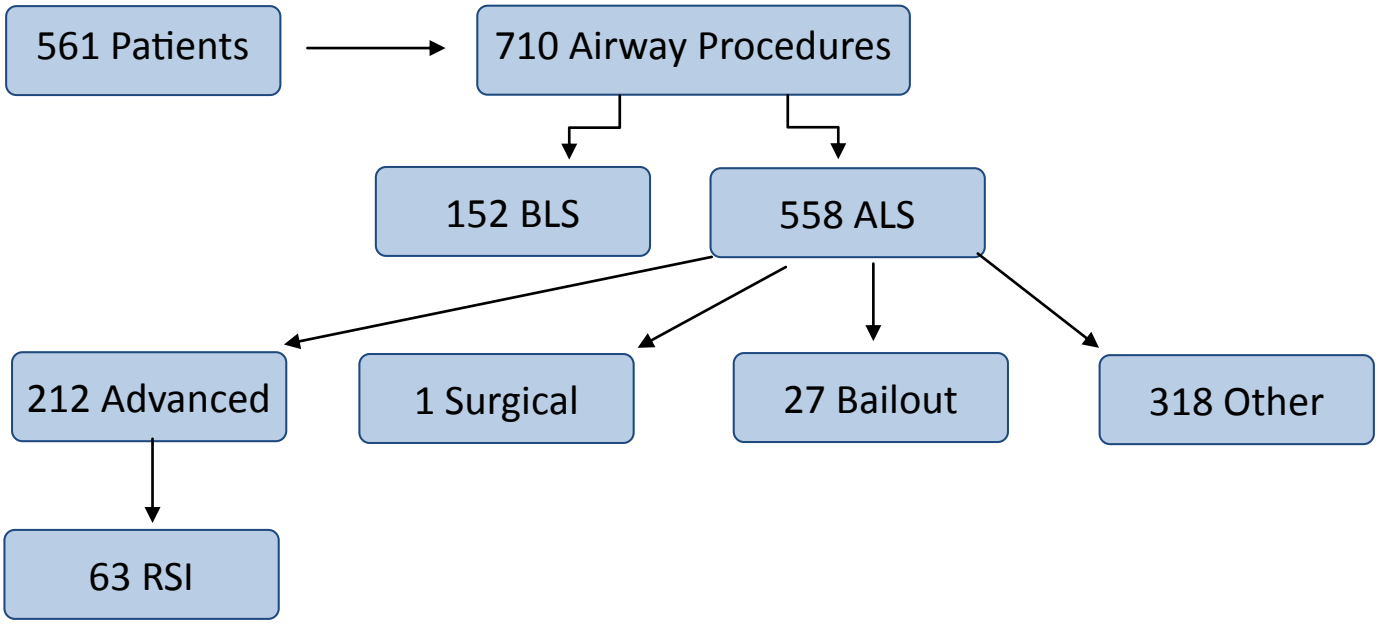
Table 5: Types documented airways (n=710)

		Type of Advanced Airway
Basic Life Support		Bagged (via BVMask); Bagged (via tube); Cleared, Opened, or Heimlich; Nasopharyngeal; Oropharyngeal; Suctioning
Advanced Life Support	Advanced	Endotracheal Intubation; Intubation Confirm Colorimetric ETCO2; Intubation Confirm Esophageal Detector Device/ Bulb (EDD); Intubation of Existing Tracheostomy Stoma; Nasotracheal Intubation; Rapid Sequence Intubation
	Surgical	Surgical Cricothyrotomy; Needle Cricothyrotomy
	Bail Out	Combitube; King LT Blind Insertion Airway Device; Laryngeal Mask
	Other	CPAP; Direct Laryngoscopy; ECO2 Monitoring; Foreign Body Removal; Gastric Tube Inserted Nasally; Gastric Tube Inserted Orally; Extubation; Nebulizer Treatment; Ventilator

Of the 18,219 trauma patients, 561 cases documented an airway through *Procedures* (E19_03). These procedures have been categorized into the groups in Table 5, based on skill level and type.

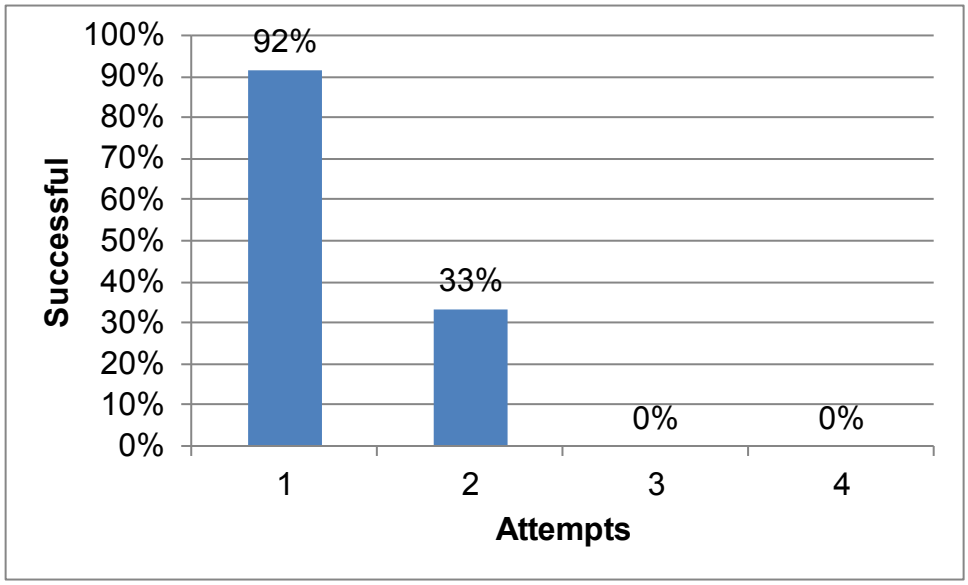
Of the 710 airway procedures documented, 79% of them were ALS level procedures, 318 of which were “other” advanced airway procedures.

Figure 1: Types of Airway Procedures Documented



Performance Measure 4: Improve the documentation on airway protection

Graph 9: Rapid Sequence Intubation (RSI) Attempts and Successes



Rapid Sequence Intubation (RSI) is a critical and often life-saving procedure.

Understanding the number of attempts and successes will allow agencies the opportunity to target their training and education for their providers.

Table 6: RSI Attempts & Success

RSI attempts	RSI success	N	Percent
1	No	5	8.47
	Yes	54	91.53
2	No	2	66.67
	Yes	1	33.33
3	No	0	0
	Yes	0	0
4	No	1	100
	Yes	0	0

It is important for providers to recognize signs of impending respiratory failure, successfully perform an appropriate intervention, and continuously monitor a patient for adverse effects.

Of the 561 trauma patients with documented airway procedures performed, 63 (11%) received a RSI (E19_03).

Of the 63 RSIs attempted, 92% (54) were reported successful in the first attempt. Providers are urged to report all attempts based on the definition provided in *Number of Procedure Attempts* (E19_05).

Performance Measure 5: Improve the documentation related to the care of patients with Traumatic Brain Injury (TBI)

A total of 9,075 TBI cases presented to an Arizona hospital between July 1, 2013, and December 31, 2013. Using the LinkPlus software, records were matched on:

- *Unit Notified by Dispatch Date* (E05_04),
- *Date of Birth* (E6_16),
- *Patient First Name* (E06_02), and
- *Patient Last Name* (E06_01)

A TBI can be classified as severe (Type 1), moderate (Type 2), or minor (Type 3).

Of the linked TBI patients, 23% were transported by air and 70% by ground ambulance.

Surprisingly, 33% of patients did not go to a trauma center to receive their care.

Arizona's trauma centers can be found across the state. All trauma centers have specialized training to provide the best possible care for injured patients. If an EMCT suspects a TBI has occurred, they should transport them to a trauma center.

In the 912 TBI cases, 5.5% of patients died as a result of their injuries while a majority of patients were discharged home (70.5%). Future initiatives will look at the quality of life those patients have through a Functional Independence Measure (FIM) score.

Table 7: TBI Demographics from Hospital Discharge Database (n=912)

	N	Percent
Total TBI Cases	912	100.00
Age		
Pediatric	154	16.89
Adult	758	83.11
TBI Type		
Type 1- Severe	394	43.20
Type 2- Moderate	496	54.39
Type 3- Minor	22	2.41
Transport Method		
Air	212	23.25
Ground	640	70.18
Missing	60	6.58
Destination Type		
Level I	511	56.03
Level III	40	4.39
Level IV	61	6.69
Non-Trauma Center	300	32.89
Discharge Status		
Home	643	70.50
Discharged/Transferred to	125	13.71
Skilled Nursing Facility/	42	4.61
Left Against Medical Advice	11	1.21
Expired	37	4.06
Discharged/Transferred to	18	1.97
Hospice	13	1.43
Other	23	2.52

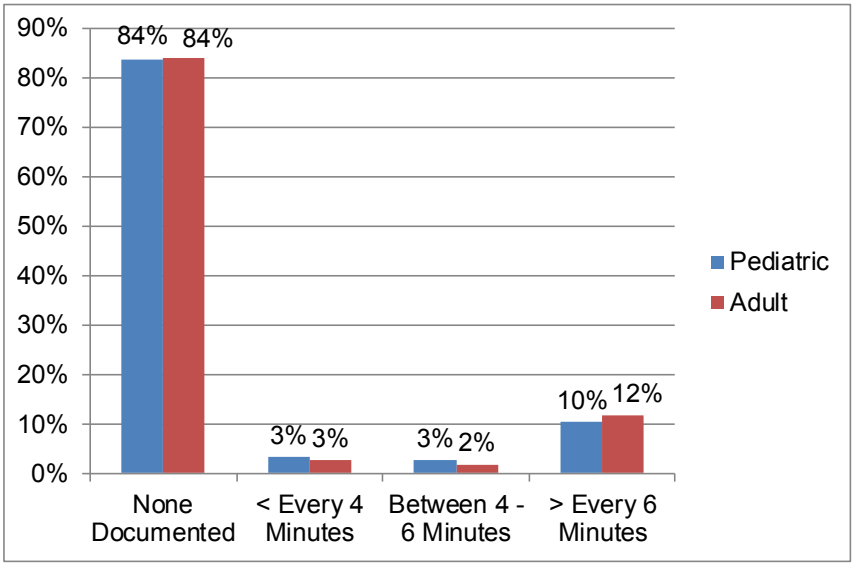
Performance Measure 5: Improve the documentation related to the care of patients with Traumatic Brain Injury (TBI)

Table 8: End Tidal CO_2 in Traumatic Brain Injury Patients

	Pediatric		Adult		Total	
$ETCO_2$ intervals	N	Percent	N	Percent	N	Percent
None Documented	130	83%	638	84%	768	84%
< Every 4 Minutes	5	3%	20	2%	25	2.7%
Between 4-6 Minutes	4	2%	13	1.7%	17	1.8%
> Every 6 Minutes	16	10%	88	11%	104	11.3%
$ETCO_2$ between 35-45%	N	Percent	N	Percent	N	Percent
Missing	130	83%	638	84%	768	84%
Yes	17	10%	55	7%	72	7%
No	8	5%	66	8%	74	8.1%

All systems of health care should be driven by patient outcomes. In TBI cases, positive outcomes have been correlated with maintaining an $ETCO_2$ between 35-45%, SBP at or above 90 (or ≥70+2 x patient's age for pediatric patients), and pulse oximetry above 90%.

Graph 10: End Tidal CO_2 in TBI Patients



In cases of a suspected TBI, vital signs should be recorded every five minutes. $ETCO_2$ was documented as being performed between 4 - 6 minutes only 1.9% of the time. SBP and Pulse Oximetry were recorded as being performed between 4 - 6 minutes 8% and 8.2% respectively. $ETCO_2$ was recorded through *End Tidal or Other CO2 level* (E14_13), SBP through *Systolic Blood Pressure* (E14_04), and pulse oximetry through *Pulse Oximetry* (E14_09).

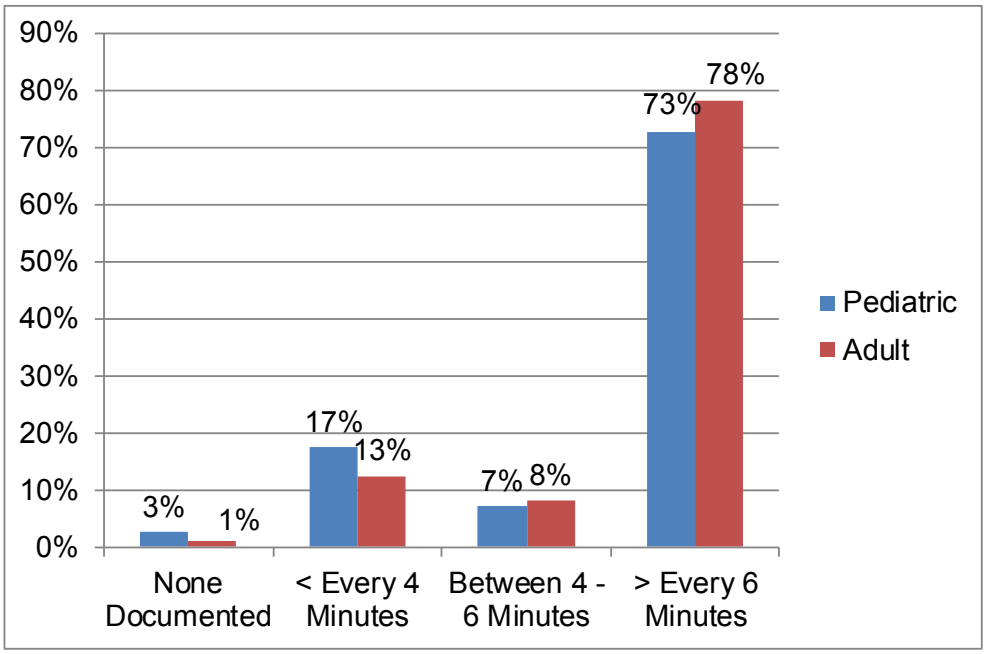
Performance Measure 5: Improve the documentation related to the care of patients with Traumatic Brain Injury (TBI)

Table 9: Systolic Blood Pressure in TBIs

Systolic Blood Pressure Intervals	Pediatric		Adult		Total	
	N	Percent	N	Percent	N	Percent
None Documented	4	2.5	8	1.05	12	1.31
< Every 4 Minutes	27	17.4	95	12.5	122	13.3
Between 4 - 6 Minutes	11	7.1	62	8.1	73	7.9
> Every 6 Minutes	113	72.9	594	78.2	707	77.3
Systolic Blood Pressure Within Range	**N**	**Percent**	**N**	**Percent**	**N**	**Percent**
Missing	4	2.5	8	1.05	12	1.31
Yes	146	94.1	737	97.1	883	96.6
No	5	3.2	14	1.84	19	2.08

Intervals for all the vital signs were calculated by dividing the frequency of a vital sign ($ETCO_2$, SBP, or pulse oximetry) over the duration of the call. The call duration spans from the *Arrived at Patient Date/Time* (E05_07) until the *Patient Arrived at Destination Time* (E05_10). If the *Arrived at Patient Date/Time*, was unavailable then the *Unit Arrived on Scene Date/Time* (E05_06) was used.

Graph 11: Systolic Blood Pressure in TBIs

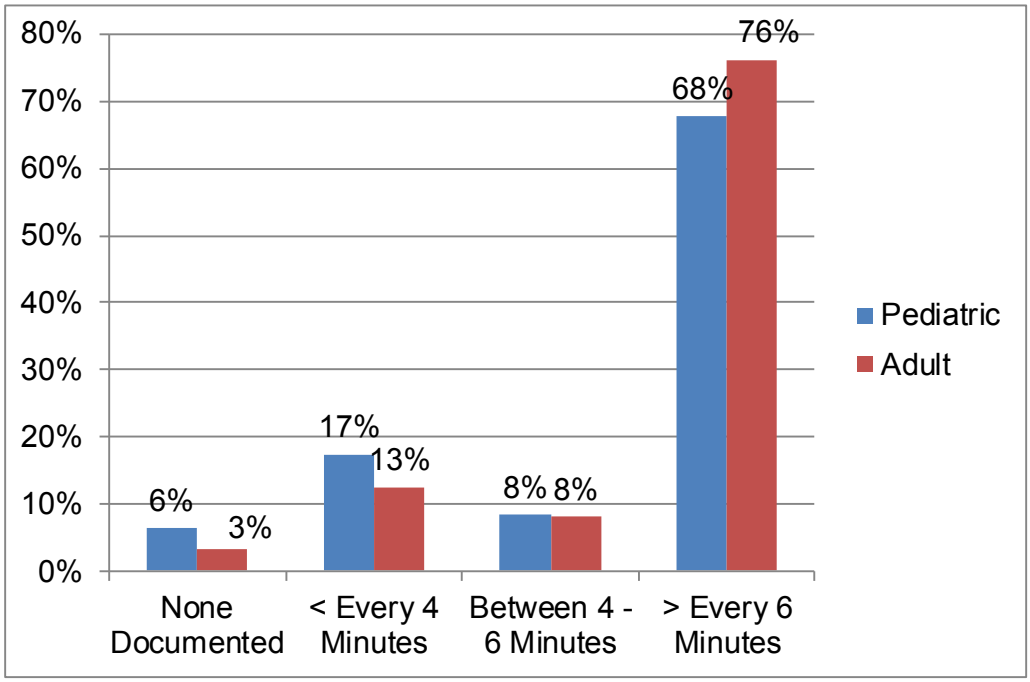


Performance Measure 5: Improve the documentation related to the care of patients with Traumatic Brain Injury (TBI)

Table 10: Pulse Oximetry in TBIs

Pulse Oximetry Intervals	Pediatric		Adult		Total	
	N	Percent	N	Percent	N	Percent
None Documented	10	6.4	24	3.16	34	3.72
< Every 4 Minutes	27	17.4	95	12.5	122	13.3
Between 4 - 6 Minutes	13	8.39	62	8.17	75	8.2
> Every 6 Minutes	105	67.7	578	76.1	683	74.7
Pulse Oximetry ≥ 90%	**N**	**Percent**	**N**	**Percent**	**N**	**Percent**
Missing	10	6.4	24	3.16	34	3.7
Yes	143	92.2	723	95.2	866	94.7
No	2	1.29	12	1.58	14	1.5

Graph 12: Pulse Oximetry in TBIs



More information on EPIC training programs can be found at http://www.epic.arizona.edu/training. Additionally, the latest information on treatment protocols for adults and children can be accessed through the EPIC TBI App. The EPIC TBI App can be found at no cost by visiting: http://www.epic.arizona.edu/pocket-tbi-now-available-google-play-iphone-app-store