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Technical Notes

- Utah Trauma Registry (UTR) data¹ and Annual Estimates of the Resident Population Data² (U.S. Census Bureau, Population Division, 2017) were used for this report.
- Per capita rate of traumatic injury incidents and mortality were calculated as per 1,000 based on the population estimates for Utah and its counties by the Census Bureau.
- Trauma designation (level) of Utah hospitals and definitions are shown in Appendix A.
- The UTR follows the strict inclusion criteria of the National Trauma Data Bank (NTDB) created by the American College of Surgeons Committee on Trauma (ASCOT) as well as the state data inclusion criteria (Appendix B). These inclusion criteria are intended to collect data on more “severe” injuries. Thus, the incident and mortality rates of trauma patients in this report are not exactly comparable with those of local or national statistics using other inclusion criteria.
- This report used the definition of “year” as the year injury occurred, not the year the data was submitted to the UTR. Thus the denominators or number of trauma patients may be different than the UTR data shown elsewhere.
- Wherever appropriate, a longer timeline (e.g., from 2001 to 2017) was used for the chart to give a better perspective in trend for the subject.
- Due to missing data, the total count of patients may vary slightly depends on the variables used to group them (e.g., Sex, age group, cause code).
- There was a transition in the medical coding system, ICD9 to ICD10, in 2015. ISS was originally based on ICD9 coding then modified to adjust for ICD10 in 2016 and thereafter. Due to the changes, fluctuations in ISS distribution can be observed during this time period.
- Injury Severity Score (ISS), which range 0 to 75 (Appendix C), are categorized for injury severity descriptions as follows:
 - Minor injury – ISS 0 to 8
 - Moderate injury – ISS 9 to 15
 - Serious injury – ISS 16 to 24
 - Severe injury – ISS 25 to 49
 - Critical injury – ISS 50 to 75

¹ Utah Trauma Registry Data 2001-2017. (2018). [Data file]. Salt Lake City: Intermountain Injury Control and Research Center.

² Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2017. Retrieved from <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>

- The locality of trauma patients was identified by residential county names. Those with county names in Utah were considered Utah residents. Those with “Other” or “NA” in the county code were considered out-of-state residents. Blank and “Unknown” county codes were both considered as unknown.
- For causes of traumatic injuries with higher death rates (often with ISS >15), length of stay (LOS) in the hospital may be shorter since a patient who is deceased in the emergency department will not stay in the hospital.
- Age groups are defined as follows:
 Pediatric – age 0 to 14
 Adult – age 15 to 64
 Geriatric – age 65 and older
- Acronyms and abbreviations used in this report are shown in the following list.

Organizations	ASCOT BEMSP IICRC NEMESIS NTDB PIPS TSAC UDOH UTR	American College of Surgeons Committee on Trauma Bureau of Emergency Medical Services and Preparedness Intermountain Injury Control and Research Center National Emergency Medical Services Information System National Trauma Data Bank Performance Improvement and Patient Safety (workgroup) Trauma System Advisory Committee Utah Department of Health Utah Trauma Registry
Injury scales and scores	AIS GCS ISS RTS TRISS	Abbreviated Injury Scale (Appendix C) Glasgow Coma Score (Appendix H) Injury Severity Score (Appendix C) Revised Trauma Score (Appendix H) Trauma and Injury Severity Score (Appendix H)
Injury causes	ANIMAL ASSAULT BIKE BURN Caught EXP FALL GSW HANG MACHINE MC MV OTHER OV	Animal related Assaulted by another person (excludes gunshot wound or stabbing assault) Bicycle Burns Caught between objects Explosion Fall (from one level to another or ground level) Gunshot wound Hanging Farm or heavy equipment or power tools Motorcycle crash (includes motorcycle vs. motor vehicle) Motor vehicle crash Other Other vehicular crash (includes ATV, 3-wheel, or 4-wheel)

Acronyms and abbreviations (Continued)

Injury causes	PED SPORT STAB STRUCK	Pedestrian Sport injury Stab wound (including cut, sliced, and pierced) Struck against object
Data values	Min Max Avg	Minimum Maximum Average
Hospital related terms	ED LOS	Emergency Department Length of Stay (in hours at the hospital)
Anatomical locations of injury	ABD ARM CHEST CS EXT FACE HEAD LEG LS NECK SPINE TS	Abdomen/pelvic contents Upper extremities Thorax Cervical spine External Face Head Lower extremities Lumbar spine Neck Spine, unspecified Thoracic Spine

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Executive Summary

Traumatic injury is a body wound caused by a force impact from an unintentional or intentional source. Traumatic injury is the leading cause of preventable death and disability in Americans between the ages of one and 44 years old³. Annually, more than 140,000 people die and approximately 80,000 are permanently disabled as a result of injury in the United States⁴. Between 2013 and 2017 in Utah, about 13,000 severe traumatic injury cases were recorded each year, resulting in a 3% mortality rate (approximately 380 deaths per year).

The Utah Department of Health organized a Trauma System Task Force in 1993 to develop a state trauma system plan. The plan was developed and adopted in 1995 and served as a road map and report to assist policymakers, health care providers, and community organizations to establish a coordinated and integrated approach to trauma care and prevention. In 2000, Utah Health Code 26-8a-252 was enacted to mandate the development of an inclusive statewide trauma system which included creating a trauma system advisory committee, developing a trauma system plan, developing a quality assurance program, providing training and public information, and collecting trauma registry data from all hospitals (Appendix F). The purpose of the statute was to create a coordinated system of care to reduce unnecessary mortality and morbidity from traumatic injuries by getting the right patient, to the right facility, at the right time. The current network of designated trauma centers, hospitals, their definitions, and regions are shown in Appendix A.

A successful trauma system must be able to monitor its performance and to assess its impact on trauma mortality and morbidity. In order to collect data from all hospitals, the Utah Department of Health contracted with the Intermountain Injury Control and Research Center (IICRC) to assist in the development and maintenance of the Utah Trauma Registry (UTR). The trauma data collection system provided a foundation for data-driven policymaking, prevention activities, and system quality improvement.

Utilization of the UTR data has been paramount for the improvement of the trauma system. The Trauma System Advisory Committee (TSAC) established the Utah Trauma System Audit Filters. The Utah Trauma Performance Improvement and Patient Safety (PIPS) workgroup with trauma care and EMS specialists utilized the audit filters to assess key issues in trauma patient care using UTR data. Based on the state PIPS reports, the TSAC has issued numerous

³ 10 Leading Causes of Death Reports, 1999-2017, All Races, Both Sexes. Retrieved from <https://webappa.cdc.gov/sasweb/ncipc/leadcause.html>

⁴ National Trauma Data Standard Data Dictionary: Introduction. Retrieved from https://www.facs.org/-/media/files/quality-programs/trauma/ntdb/ntds/data-dictionaries/ntds_data_dictionary_2020.ashx?la=en

recommendations to further enhance the effectiveness of the system. The IICRC also created the Trauma Dashboard and Cube, online data visualization and analytic tools, for Utah hospitals. These data visualization tools enabled hospitals to quantitatively assess their own trauma patient care (Appendix G).

Since 2001, the UTR has accumulated a total of 177,063 traumatic injury cases, which utilized the state's hospital resources. Of those, a total of 65,131 cases were recorded between 2013 and 2017.

This report is submitted in accordance with Utah Health Code 26-8a-201 (Appendix F), Public awareness efforts, to inform the public of traumatic injury trends in Utah.

2013-2017 Statewide Traumatic Injury

- Patient inclusion criteria associated with the Utah Trauma Registry limit registry inclusion to patients suffering more “severe” injuries (Appendix B).
- The Utah Trauma Registry accumulated 177,063 trauma records between 2001 and 2017.
- A total of 65,131 traumatic injuries were recorded in the UTR between 2013 and 2017.
- Along with population growth in Utah (2,899,961 in 2013 to 3,101,833 in 2017), per capita (per 1,000 residents) traumatic injury incidents have slightly increased; 4.1 per 1,000 in 2013 to 4.8 per 1,000 in 2017 (Figure 1).
- Although the number of trauma patients is increasing, the statewide trauma mortality rate has been decreasing steadily. The mortality rate dropped from 4.1% to 3.2% between 2001 and 2013, and from 3.2% to 2.6% between 2013 and 2017 (Figure 2).
- Although only 10% of the Utah population, estimated by the Census Bureau, was aged 65 and older between 2013 and 2017, 40% of UTR data consisted of geriatric patients. On the other hand, trauma patients' proportions were smaller than census estimates for the pediatric (census estimate 26% vs. UTR 11%) and the adult (census estimate 64% vs. UTR 49%) population (Figure 3).
- Eleven percent of all trauma patients in Utah were from out-of-state between 2013 and 2017 (Figure 4).
- For pediatric and adult age groups, males experienced about 30% more traumatic injuries than females between 2013 and 2017. However, the opposite is true for the geriatric age group (Figure 5).
- Between 2013 and 2017, trauma patients who arrived at receiving hospitals by ground ambulance decreased by 5.4% (from 60.7% to 55.3%) and air ambulance by 2.4% (from 9.6% to 7.2%). The use of a privately-operated vehicle as a transport method increased

0.6% (from 28.6% to 29.2%) between 2013 and 2017, 6% between 2001 and 2017 (from 23.2% to 29.2%) (Figure 6).

- Geriatric fall data was added to the UTR in 2008. Falls are the most common cause of traumatic injury, which is steadily increasing. It increased by 1% (from 56% to 57%) between 2013 and 2017. Traumatic injury due to motor vehicle incidents decreased by 1% (from 12% to 11%) between 2013 and 2017 and 11% (from 22% to 11%) between 2001 and 2017 (see Figure 7).
- The top 10 causes of traumatic injury in Utah between 2013 and 2017 were incidents involving a fall, motor vehicle, motorcycle, sport, other vehicles (e.g., ATV), bicycle, being struck by an object, assault, pedestrian, and animal (Table 1).
- The average ages for the top 10 injury causes were younger than age 50, except for falls, which was 64 years old. Pedestrian incidents had the highest mortality rate (8.5%), average ISS (13.7), and the longest average stay (4.7 days) at the hospital (Table 1).
- Between 2013 and 2017, the majority (94%) of all injuries were caused by blunt force trauma. Burn (1%) and penetrating (5%) trauma made up smaller percentages (Figure 8).
- Forty percent of traumatic injuries happened at home. Streets (20%) and recreation areas (12%) (e.g., national and state parks, hiking, biking, boating, swimming, skiing, camping areas) were the second and third most common places for traumatic injuries (Figure 9).
- Seventy-eight percent of all traumatic injuries are minor to moderate in severity (ISS ≤ 15). Although the number of cases is smaller, the death toll increases dramatically for severe to critical injuries (ISS ≥ 16) (Figure 10).
- Hanging and gunshot wounds (including self-inflicted and accidental injuries) were the two most deadly injuries between 2013 and 2017. The mortality rates were 32% and 23% respectively (Table 2).
- Commercial insurance (44%) and Medicare (36%) paid for 80% of all trauma patients between 2013 and 2017 (Figure 11).
- Geographically, in Utah, traumatic injury occurs more often in rural areas. Summit, Garfield, Grand, Millard, and Juab counties had the top five average per capita (per 1,000 residents) trauma incidents between 2013 and 2017 (Figure 12).
- When the severity of traumatic injuries was examined, Piute, Summit, Millard, Rich, and Juab counties had the top five average per capita trauma incidents with ISS greater than 15 (Figure 13).

- In Summit County, motor vehicle incidents had the highest mortality rate (4.7%). Motorcycle incidents had the highest average ISS (13.9) and longest average hospital stay (5.6 days) (Table 3).
- In Summit County, the majority (61%) of injuries occurred in recreation areas (Figure 14).
- Twenty-seven percent of trauma patients in Summit County were from out-of-state (Figure 15).
- In Garfield County, patients from motorcycle incidents had the longest average hospital stay (4.2 days). Although the number was small (3), one out of three patients “caught between objects” died, resulting in a mortality rate of 33%. Patients injured in other vehicle incidents (e.g., ATV) had the second-highest mortality rate (3.8%) (Table 4).
- Almost one-third of the injuries in Garfield County occurred at home. Streets (26%) and recreation areas (20%) are the second and third most common places (Figure 16).
- Thirty-three percent of trauma patients in Garfield County were from out-of-state (Figure 17).
- In Grand County, “other vehicles” (e.g., ATV) incidents had the highest mortality rate (3%). Motor vehicle incidents had the highest average ISS (11.2). Sporting injuries had the longest average hospital stay (3.7 days) (Table 5).
- One-quarter of traumatic injuries occurred in recreation areas in Grand County. The county had higher percentages (about 35%) of “unknown” and “other location.” These may include remote areas not otherwise categorized as a specified location (Figure 18).
- About one-third of trauma patients were from out-of-state in Grand County (Figure 19).
- In Millard County, gunshot wounds resulted in the highest mortality rate (22%), and motorcycle incidents had the highest average ISS (13.9). Motor vehicle incidents had the longest average hospital stay (3.4 days) (Table 6).
- Forty percent of traumatic injuries occurred on streets in Millard County. Home (26%) and recreation areas (9.1%) were the second and third most common places (Figure 20).
- Fifteen percent of trauma patients in Millard County were from out-of-state (Figure 21).
- The average age for the top 10 injury causes was younger (≤ 50 years) in Juab County than in other counties. Other vehicle (e.g., ATV) incidents were the most common (31%) cause of traumatic injuries. Death rates (40%) and average ISS (14.6) were the highest from gunshot wounds (Table 7).
- Thirty-eight percent of traumatic injuries in Juab County occurred in recreation areas. Another 30% occurred on the streets (Figure 22).

- The majority (89%) of trauma patients in Juab County were Utah residents. Nine percent were from out-of-state (Figure 23).
- Between 2013 and 2017, out of 65,131 patients, 2,201 with the most serious injuries (ISS>15) were admitted to a hospital and then transferred to another hospital in Utah. Ninety-one percent of those patients were transferred to Level I or Level II Trauma centers (Table 8).
- Ninety-two percent of the seriously injured patients who were transferred to another Utah hospital needed a higher level of care (Figure 24).
- Between 2013 and 2017, out of 65,131 patients, there were 2,639 who were transferred from out-of-state to Utah hospitals. Level I hospitals in the Central region received about 87% (2,306) of all out-of-state patients. Idaho, Nevada, and Wyoming are the top three states from which Utah received trauma patients (Table 9).
- Between 2013 and 2017, 359 out of 65,131 trauma patients were transferred to out-of-state hospitals. Southeast (239, 66.6%) and Southwest (116, 32.3%) were the two major regions that transferred patients to nearby states. Colorado and Nevada were the top two destination states for the transferred patients (Table 10).
- The majority (98%) of trauma patients who were transferred to out-of-state hospitals needed a higher level of care (Figure 25).

2013-2017 Pediatric Trauma Patients

- The top 10 causes for traumatic injury in pediatric patients were incidents involving a fall, sport, motor vehicle, bicycle, being struck by an object, other vehicles (e.g., ATV), pedestrian, burn, animal, and assault (Figure 26).
- In pediatric patients, a fall (43%) is the most common cause of traumatic injury followed by sporting injury (11%) and motor vehicle incidents (7.4%) (Figure 26).
- Between 2013 and 2017, fall injuries increased by 5% and sports injuries by 1% for pediatric patients. However, between 2001 and 2017, fall and sports injuries increased by 15% and 6% respectively. For the same time period, motor vehicle incidents, burn, and pedestrian injuries decreased by half or more. Other injury types remained constant (Figure 27).
- The head, as an anatomical region, is the most commonly injured body region for pediatric patients for the top five causes (incidents involving a fall, sport, motor vehicle, bicycle, and being struck by objects) of traumatic injury (Table 11).

- Among the top 10 injury causes, pedestrian incidents had the highest average ISS (13.1) and mortality rate (9%). Burn injuries required the longest average stay (5.4 days) in the hospital, followed by assault (5 days) and motor vehicle incidents (3.5 days) (Table 12).
- The pediatric mortality rate went up significantly for the most severe (19.1%) to critical injuries (23.5%) (Figure 28).
- The average per capita incidents between 2013 and 2017 for pediatric patients was 1.9 per 1,000. The pediatric per capita mortality has been relatively stable (0.03 per 1,000). (Figure 29).
- Gunshot wounds have the highest mortality rate (12.5%) for pediatric patients followed by pedestrian incidents (9%) and assaults (7.8%) (Table 13).
- Commercial insurance (64%) and Medicaid (23%) paid for 87% of pediatric trauma patients between 2013 and 2017 (Figure 30).

2013-2017 Adult Trauma Patients

- The top 10 causes for traumatic injury in adult patients were incidents involving a fall, motor vehicle, motorcycle, other vehicles (e.g., ATV), sport, bicycle, assault, stabbing, gunshots, and being struck by an object (Figure 31).
- Fall (35%) and motor vehicle incidents (17%) comprise about half of all injuries for adult trauma patients (Figure 31).
- In contrast with falls, motor vehicle incidents have been decreasing steadily (29% in 2001, 17% in 2013, and 16% in 2017). Bicycle incidents have slightly increased. Other causes remained stable (Figure 31).
- For adult trauma patients, body regions with injury are more diverse by cause than pediatric patients. For the top five causes of injury (incidents involving a fall, motor vehicle, motorcycle, other vehicle such as an ATV, and playing sports), legs are the most commonly injured body region, followed by the head, and chest (Table 14).
- Among the top 10 injury causes, gunshot wounds had the highest mortality rate (22.3%). Motorcycle incidents have the highest average ISS (12.6) and the longest average stay in the hospital (4.1 days), followed by motor vehicle incidents (ISS 12.3, LOS 4 days) (Table 15).
- Compared with pediatric patients, the percentages of the most serious to critical injuries combined increased slightly in adults, so did their mortality rates (Figure 28 and Figure 33).
- The average per capita injury incidents between 2013 and 2017 for adult patients were 3.3 per 1,000. Adult per capita mortality is three times higher than pediatric patients

(Adult 0.10 per 1,000 vs. Pediatric 0.03 per 1,000). However, it was relatively stable between 2013 and 2017 (Figure 34).

- Hanging and gunshot wounds (including self-inflicted and accidental injuries) were the most lethal injuries among adults with a mortality rate of 32.5% and 22.3% respectively (Table 16).
- Commercial insurance (65%) and self-pay (15%) paid for 80% of adult trauma patients (Figure 35).

2013-2017 Geriatric Trauma Patients

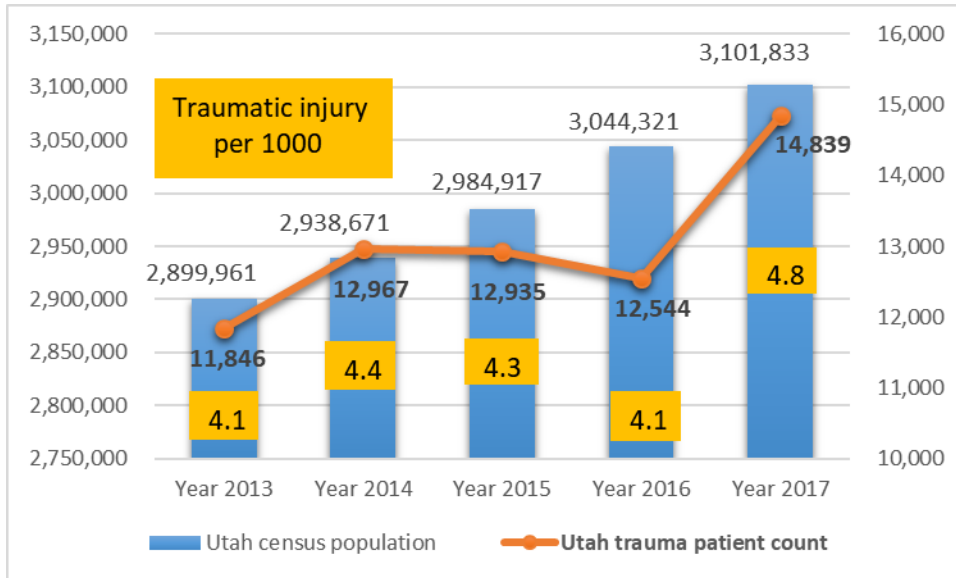
- Eighty-seven percent of all geriatric trauma was caused by a fall (including ground-level falls). Motor vehicle incidents are the second most common cause but to a much lesser degree (5.7%) (Figure 36).
- There were only two causes of injury showing shifting trends. Falls are the one major cause of geriatric trauma since geriatric falls were added to the trauma inclusion criteria in 2008. The rate of falls remained relatively stable. Motor vehicle incidents declined by half since 2001. Other injury causes remained stable between 2013 and 2017 (Figure 37).
- Legs are the most commonly injured body region (51%) in falls, often representing a geriatric hip fracture. Chest (37%), head (17%), and legs (14%) make up 68% of injured body regions in motor vehicle incidents (Table 17).
- Falls are the most common traumatic injury (87%) occurring in the oldest average age (80.5) of geriatric patients. Pedestrian incidents have the highest average ISS (14.1) and longest average hospital stay (5.2 days) (Table 18).
- Compared with pediatric and adult patients, minor injuries in geriatric patients decreased by about 10% and moderately severe injuries increased by about 10%. The mortality rate is higher for geriatric trauma patients for each category of injury severity than their younger counterparts (Figure 28, Figure 33, and Figure 38).
- The average per capita incident of traumatic injury (the 5-year average is 16.8 per 1,000) in geriatric patients is about 5.1 times higher than adults (the 5-year average is 3.3 per 1,000) and 8.8 times higher than for pediatric patients (the 5-year average is 1.9 per 1,000). The per capita death rate for geriatric trauma patients (the 5-year average is 0.59 per 1,000) is about 5.9 times higher than adults (the 5-year average is 0.1 per 1,000) and 19.7 times higher than pediatric patients (the 5-year average is 0.03 per 1,000). At the same time, the number of deaths per capita decreased between 2013 and 2017 (0.65 per 1,000 in 2013 and 0.56 per 1,000 in 2017) (Figure 29, Figure 34, and Figure 39).

- Gunshot wounds are the most lethal injuries (mortality rate of 43.8%) for geriatric trauma patients, followed by pedestrian incidents (mortality rate of 13.8%). The mortality rates in those injuries are higher than those of their younger counterparts (Table 13, Table 16, and Table 19).
- Medicare (83%) and commercial insurance (13%) paid for 96% of geriatric trauma patients between 2013 and 2017 (Figure 40).

I. 2013-2017 Statewide Traumatic Injury

A. 2013-2017 Utah Census Population and Traumatic Injury Incidents

Figure 1 2013-2017 Utah census population and per capita traumatic injury incidents

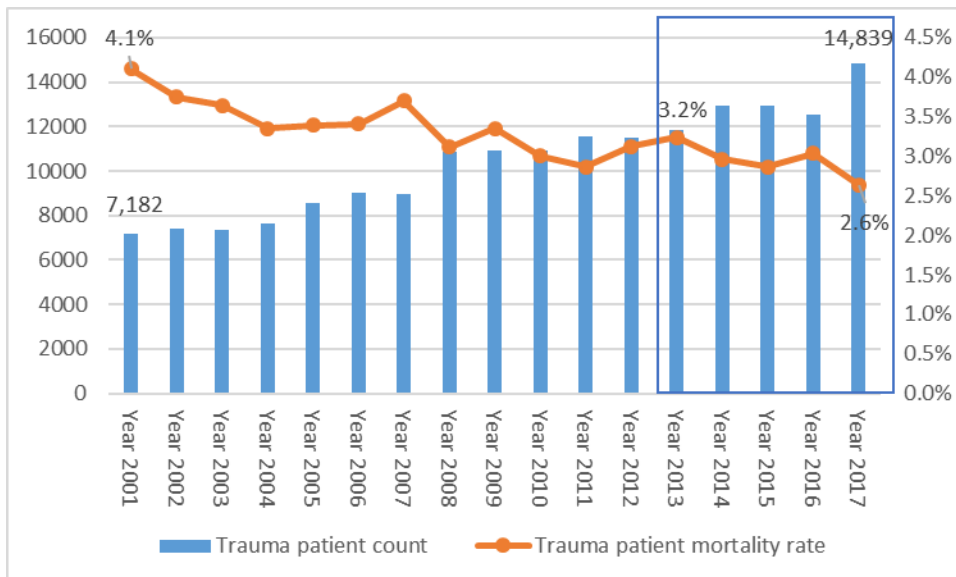


Source: Annual Estimates of the Resident Population as of July 1, 2017. U.S. Census Bureau.

Along with population growth in Utah (2,899,961 in 2013 to 3,101,833 in 2017), per capita (per 1,000 residents) traumatic injury incidents have slightly increased; 4.1 per 1,000 in 2013 to 4.8 per 1,000 in 2017.

B. 2013-2017 All Trauma Patients and Mortality Rate

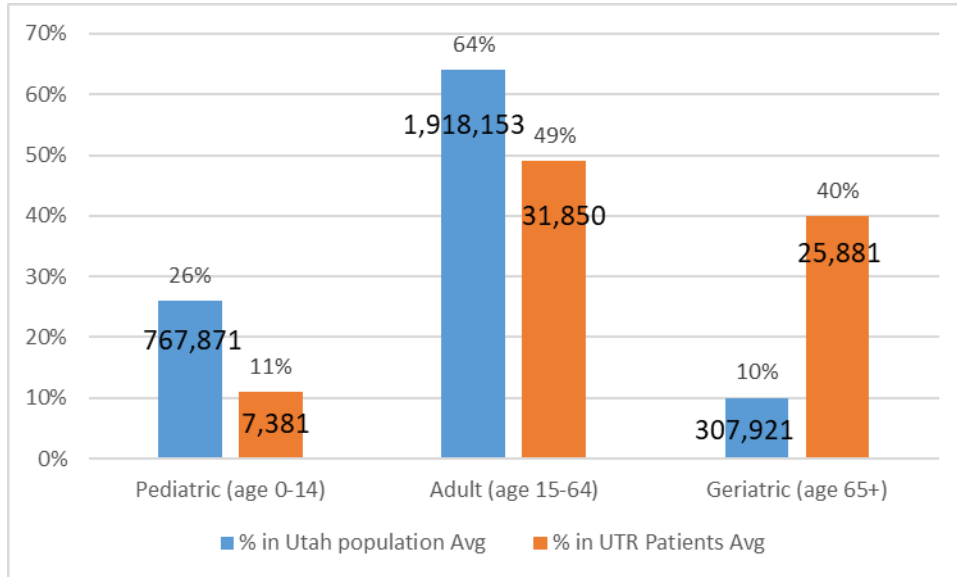
Figure 2 2013-2017 Number of all trauma patients and mortality rate



Although the number of trauma patients is increasing, the statewide trauma mortality rate has been decreasing steadily. The mortality rate dropped from 4.1% to 3.2% between 2001 and 2013, and 3.2% to 2.6% between 2013 and 2017.

C. 2013-2017 Utah Census and UTR Patient Population by Age Group (5-Year Average)

Figure 3 2013-2017 Utah census population and all trauma patients by age group (5-year average)

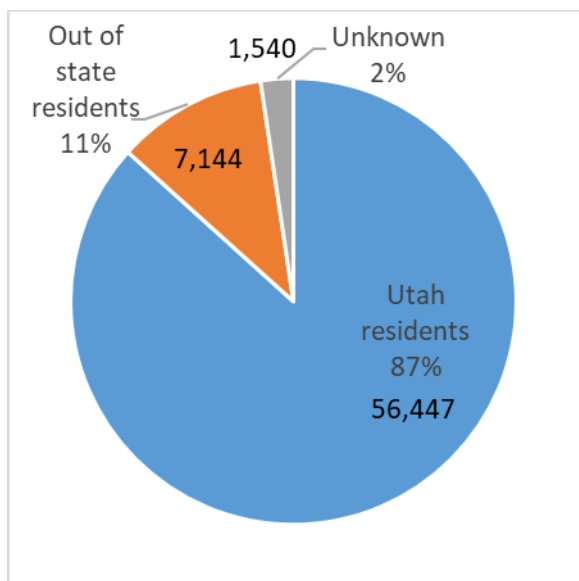


Source: Annual Estimates of the Resident Population as of July 1, 2017. U.S. Census Bureau.

Although only 10% of Utah’s population, estimated by the Census Bureau, was aged 65 and older between 2013 and 2017, 40% of UTR data consisted of geriatric patients. On the other hand, trauma patients’ proportions were smaller than census estimates for the pediatric (Census estimate 26% vs. UTR 11%) and the adult (Census estimate 64% vs. UTR 49%) population.

D. 2013-2017 Locality of All Trauma Patients

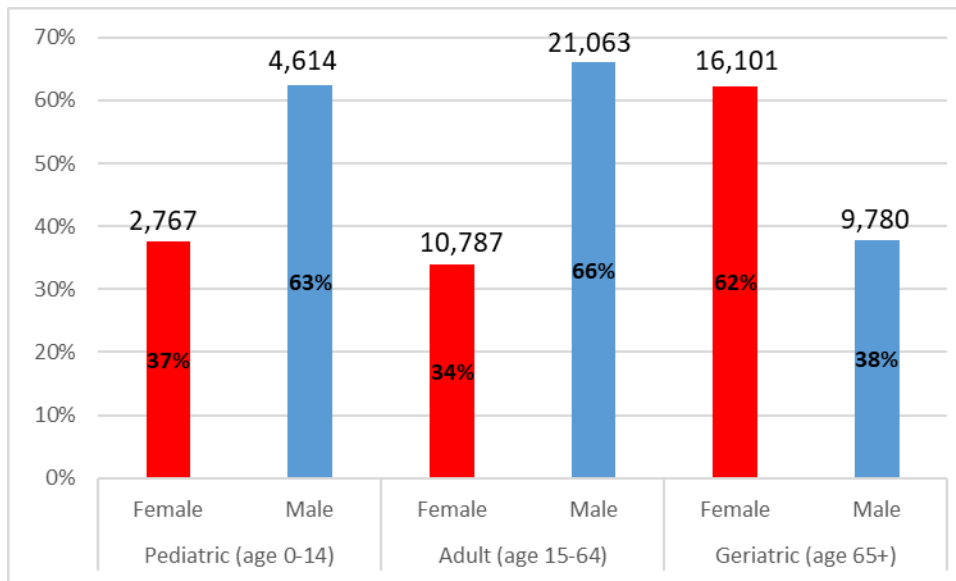
Figure 4 2013-2017 Locality of all trauma patients



Eleven percent of all trauma patients between 2013 and 2017 were from out-of-state.

E. 2013-2017 All Trauma Patients by Sex and Age Group

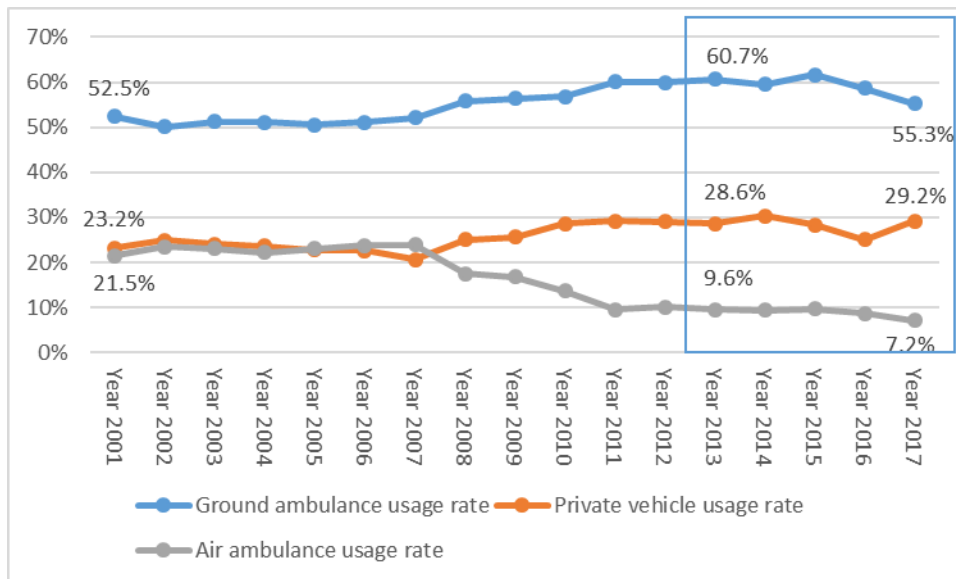
Figure 5 2013-2017 Number of all trauma patients by sex and age group



For pediatric and adult age groups, males experienced about 30% more traumatic injuries than females between 2013 and 2017. However, the opposite is true for the geriatric age group.

F. 2001-2017 Transport Method Trend

Figure 6 2001-2017 Transport method trend for all trauma patients

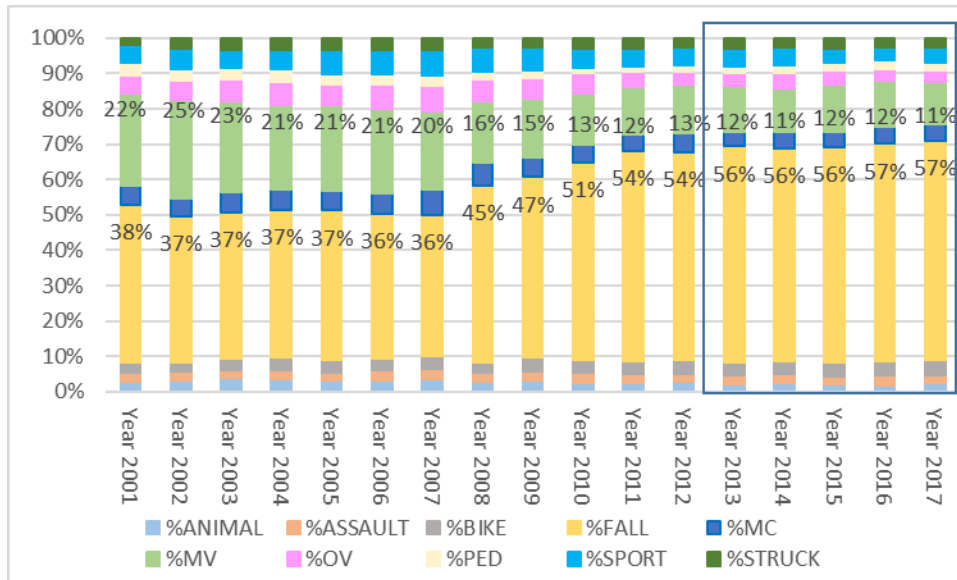


Between 2013 and 2017, trauma patients who arrived at receiving hospitals by ground ambulance decreased by 5.4% (from 60.7% to 55.3%) and air ambulance by 2.4% (from 9.6% to 7.2%). The use of

a privately operated vehicle as a transport method increased 0.6% (from 28.6% to 29.2%) between 2013 and 2017, and 6% between 2001 and 2017 (From 23.2% to 29.2%).

G. 2001-2017 Top 10 Causes of Traumatic Injury Trends

Figure 7 2001-2017 Top 10* causes of traumatic injury trends for all trauma patients



*Top 10 causes included about 88% (n=154,968) of all trauma patients (n=177,063) between 2001 and 2017.

Geriatric fall data was added to UTR in 2008. Falls are the most common cause of traumatic injury, which is steadily increasing. It increased by 1% (from 56% to 57%) between 2013 and 2017.

Traumatic injury due to motor vehicle incidents decreased by 1% (from 12% to 11%) between 2013 and 2017 and 11% (from 22% to 11%) between 2001 and 2017.

H. 2013-2017 Top 10 Causes of Traumatic Injury: Mortality Rate, Average Age, ISS, and LOS

Table 1 2013-2017 Top 10* causes of traumatic injury, mortality, average age, ISS, and LOS for all trauma patients

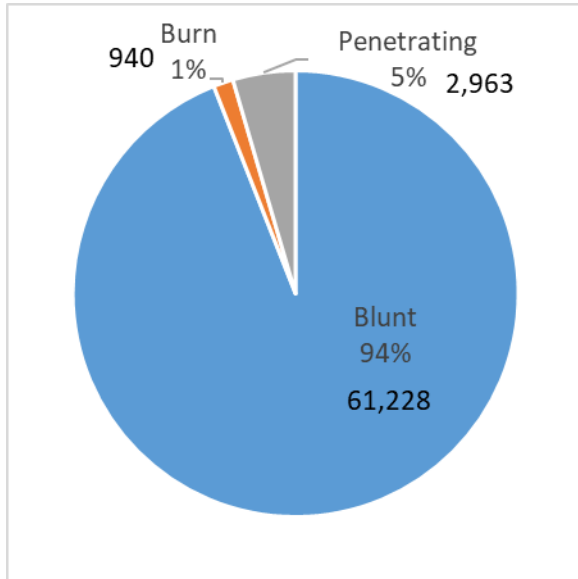
Cause	Count	Percentage	Mortality				Min ISS	Avg ISS	Max ISS	Avg LOS
			Death	Rate	Avg Age					
FALL	36,793	56.5%	856	2.3%	64.0	1	9.4	73	3.1	
MV	7,559	11.6%	333	4.4%	41.8	1	12.2	66	4.1	
MC	2,695	4.1%	102	3.8%	38.7	1	12.5	59	4.0	
SPORT	2,592	4.0%	12	0.5%	27.3	1	8.8	66	2.3	
OV	2,285	3.5%	33	1.4%	35.4	1	11.0	59	3.3	
BIKE	2,276	3.5%	22	1.0%	38.1	1	10.8	59	2.5	
STRUCK	1,679	2.6%	26	1.5%	34.4	1	9.1	59	2.6	
ASSAULT	1,508	2.3%	40	2.7%	33.6	1	9.7	54	3.0	
PED	1,335	2.0%	114	8.5%	35.0	1	13.7	61	4.7	
ANIMAL	1,321	2.0%	8	0.6%	39.7	1	9.3	54	2.7	

*Top 10 causes included about 92% (60,043) of all trauma patients (n=65,131) between 2013 and 2017.

The average ages for the top 10 injury causes were younger than age 50, except for falls, which was age 64. Pedestrian incidents have the highest mortality rate (8.5%), average ISS (13.7), and the longest average stay (4.7 days) in the hospital.

I. 2013-2017 Types of Trauma

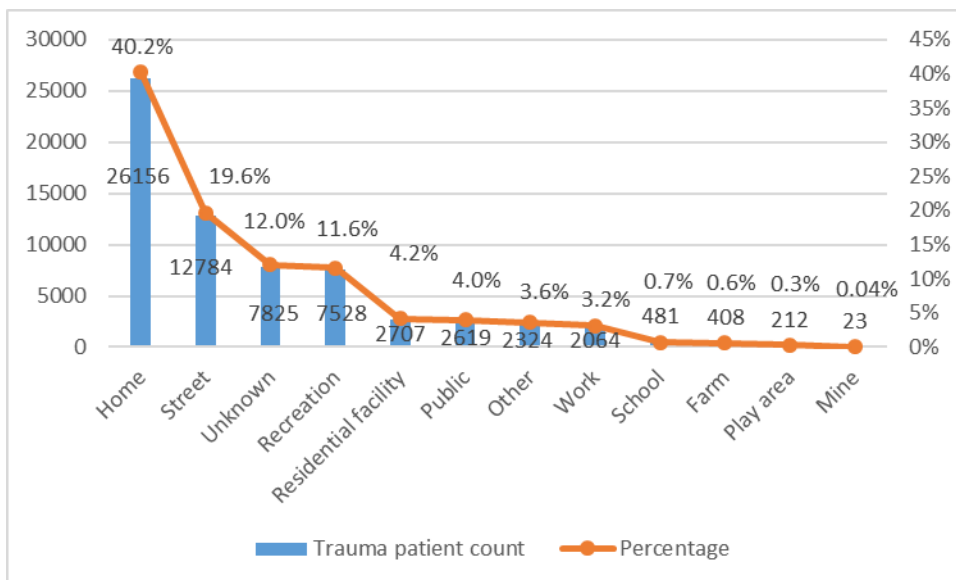
Figure 8 2013-2017 Types of trauma



Between 2013 and 2017, the majority (94%) of all injuries were caused by blunt force trauma. Burn (1%) and penetrating (5%) trauma made up smaller percentages.

J. 2013-2017 Locations Where Traumatic Injury Occurred

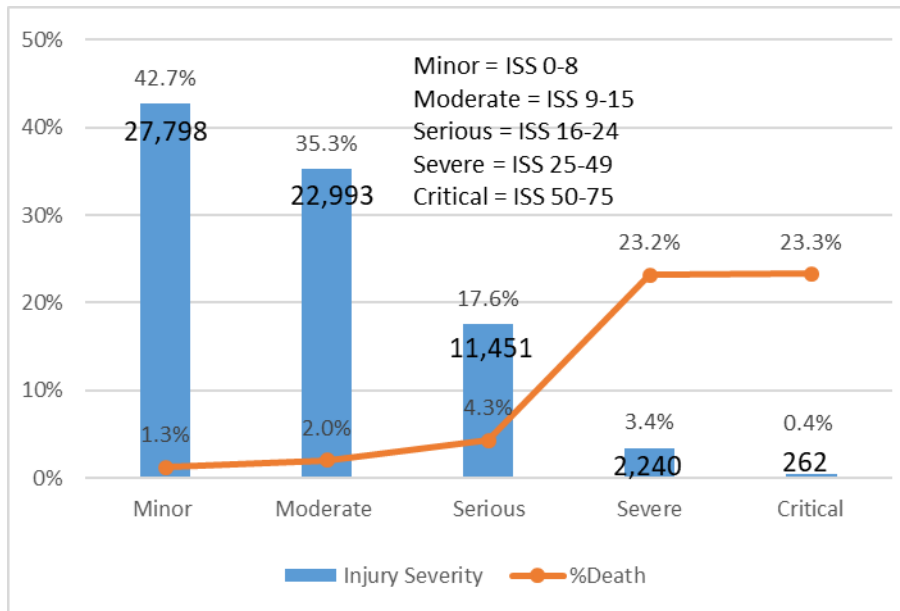
Figure 9 2013-2017 Locations where traumatic injuries occurred



About 40% of traumatic injuries happened at home. Streets (20%) and recreation areas (12%) (e.g., national and state parks, hiking, biking, boating, swimming, skiing, camping areas) were the second and third most common places.

K. 2013-2017 Injury Severity and Mortality Rate

Figure 10 2013-2017 Injury severity and mortality rate for all trauma patients



Seventy-eight percent of all traumatic injuries are minor to moderate in severity (ISS <=15). Although the number of cases is smaller, the death toll increases dramatically for severe to critical injuries (ISS >=16).

L. 2013-2017 Top 10 Lethal Injuries

Table 2 2013-2017 Top 10* lethal injuries

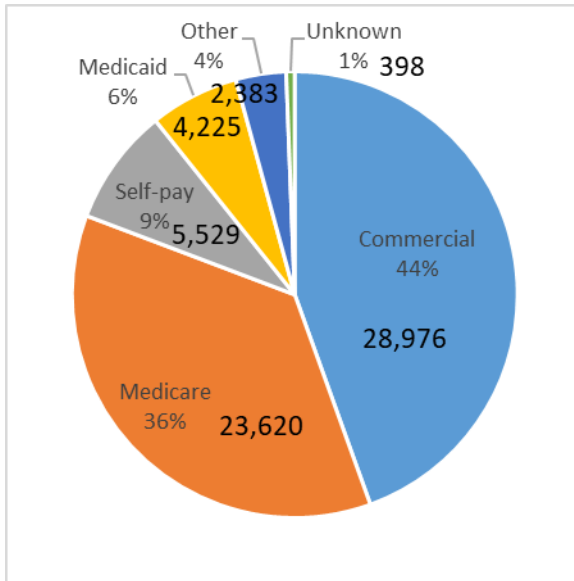
Ranking	Cause	Outcome	Count	%	Total
1	HANG	Alive	30	68.2%	44
		Dead	14	31.8%	
2	GSW	Alive	886	77.5%	1,143
		Dead	257	22.5%	
3	PED	Alive	1221	91.5%	1,335
		Dead	114	8.5%	
4	EXP	Alive	116	92.8%	125
		Dead	9	7.2%	
5	MV	Alive	7224	95.6%	7,557
		Dead	333	4.4%	
6	MC	Alive	2590	96.2%	2,692
		Dead	102	3.8%	
7	BURN	Alive	883	96.4%	916
		Dead	33	3.6%	
8	ASSAULT	Alive	1468	97.3%	1,508
		Dead	40	2.7%	
9	CAUGHT	Alive	372	97.6%	381
		Dead	9	2.4%	
10	FALL	Alive	35909	97.7%	36,765
		Dead	856	2.3%	

*Records with unknown and unspecific causes, unknown outcomes, and cause code with fewer than 30 cases were excluded.

Hanging and gunshot wounds (including self-inflicted and accidental injuries) were the two most deadly injuries between 2013 and 2017. The mortality rates were about 32% and 23% respectively.

M. 2013-2017 Payers for All Trauma Patients

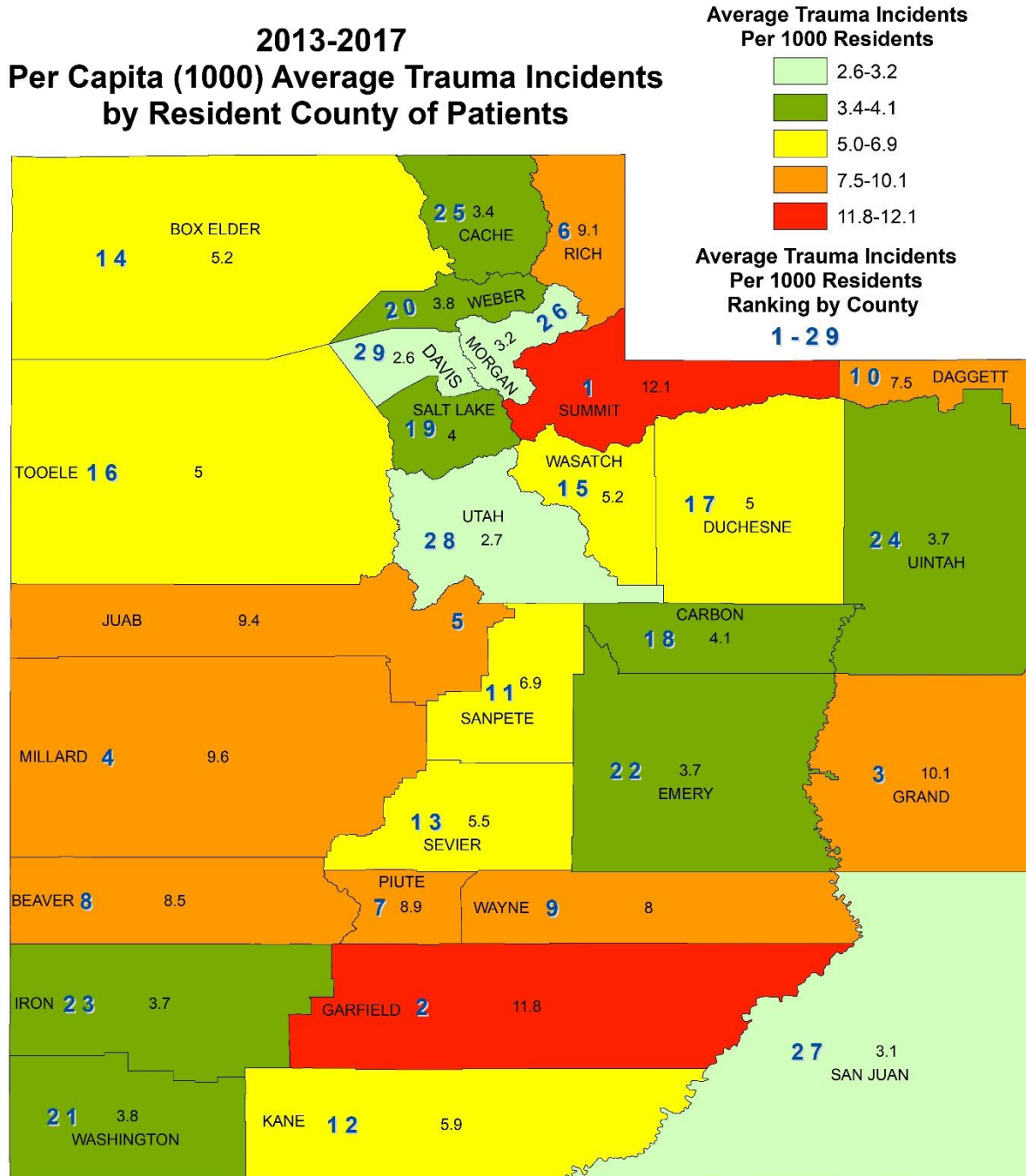
Figure 11 2013-2017 Payers for all trauma patients



Commercial insurance (44%) and Medicare (36%) paid for 80% of all trauma patients between 2013 and 2017.

N. 2013-2017 Per Capita Average Trauma Incidents by County

Figure 12 2013-2017 Per capita average trauma incidents by county

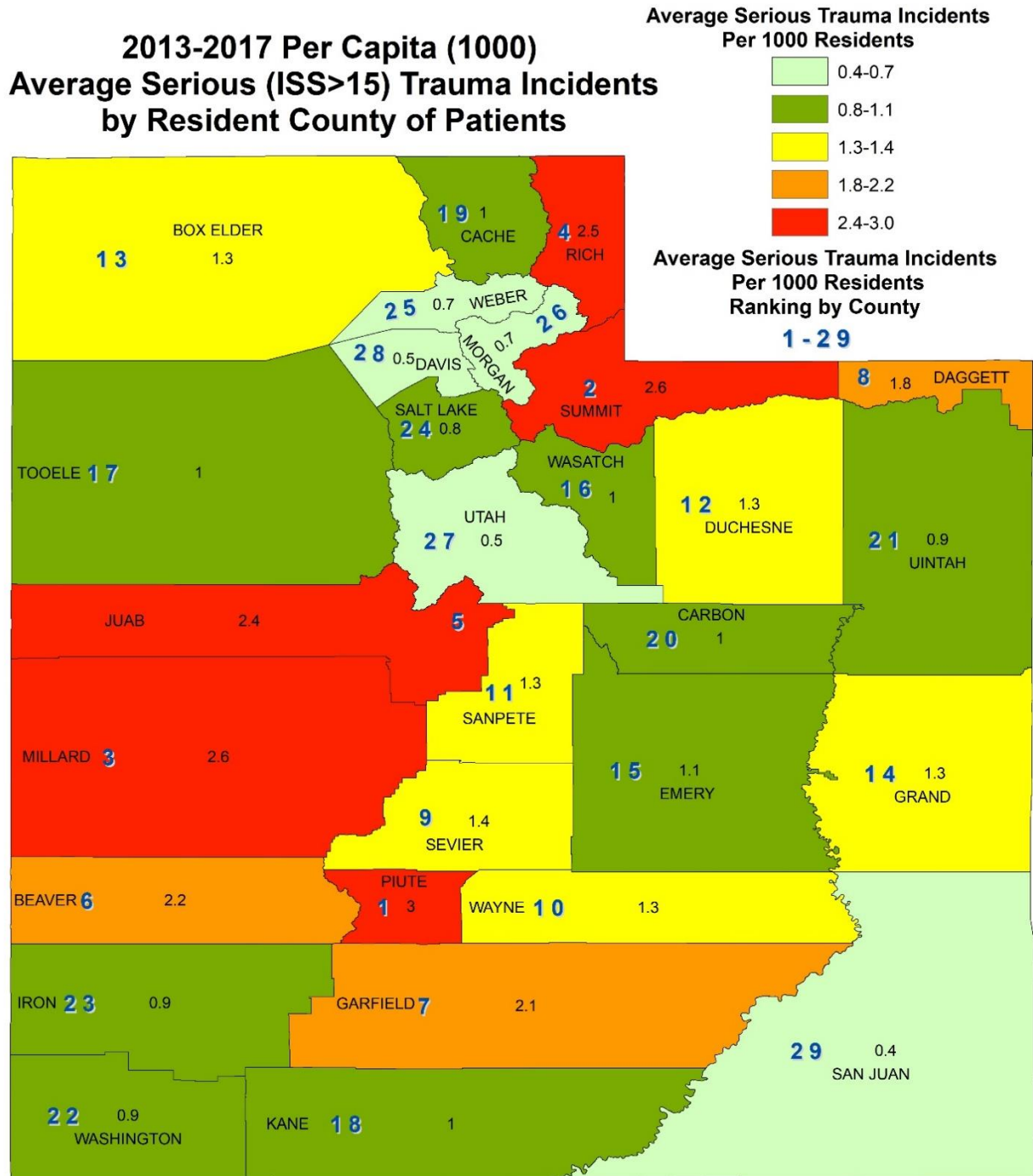


Summit County ranked No. 1 in per 1000 average trauma incidents between 2013 and 2017. The top 5 counties (Summit, Garfield, Grand, Millard, and Juab) are all rural or frontier counties, based on the county classification (see Appendix D). See Appendix E for age group ranking by year.

Source: Annual Estimates of the Resident Population as of July 1, 2017. U.S. Census Bureau

O. 2013-2017 Per Capita Average Serious Trauma (ISS>15) Incidents by County

Figure 13 2013-2017 Per capita average serious trauma (ISS>15) incidents by county



Piute County ranked No. 1 in per 1000 average serious trauma (ISS>15) incidents between 2013 and 2017. The top 5 counties (Piute, Summit, Millard, Rich, and Juab) are all rural or frontier counties, based on the county classification (see Appendix D).

Source: Annual Estimates of the Resident Population as of July 1, 2017. U.S. Census Bureau

P. 2013-2017 Trauma Incidents Details for the Top 5 Counties (indicated in L)

1. Summit County

a) 2013-2017 Summit County: Top 10 Causes of Traumatic Injury, Mortality, Average Age, ISS, and LOS

Table 3 2013-2017 Top 10* causes of traumatic injury, mortality, average age, ISS, and LOS in Summit County

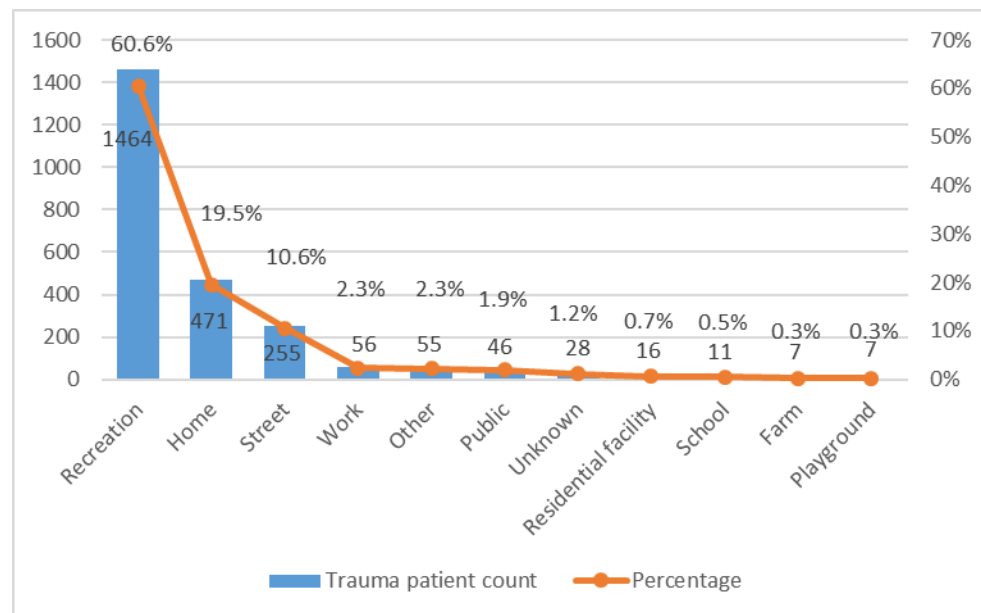
Cause	Count	Percentage	Mortality						
			Death	Rate	Avg Age	Min ISS	Avg ISS	Max ISS	Avg LOS
FALL	1,053	43.6%	1	0.1%	53.5	1	9.5	54	2.3
SPORT	565	23.4%	5	0.9%	38.6	1	9.2	50	2.9
BIKE	267	11.1%	1	0.4%	42.4	1	11.8	59	2.1
STRUCK	128	5.3%	1	0.8%	38.7	1	10.2	50	2.1
MV	128	5.3%	6	4.7%	41.5	1	13.0	51	3.1
OV	76	3.1%	1	1.3%	34.7	1	11.6	54	3.9
MC	49	2.0%	1	2.0%	40.4	1	13.9	50	5.6
ANIMAL	35	1.4%	0	0%	42.8	1	10.9	29	2.5
ASSAULT	22	0.9%	0	0%	29.8	1	8.1	21	0.6
STAB	21	0.9%	0	0%	35.4	1	4.1	32	0.7

*Top 10 causes included 97% (2,344) of all trauma patients (n=2,416) in Summit County between 2013 and 2017.

Motor vehicle incidents had the highest mortality rate (4.7%) in Summit County. Motorcycle incidents had the highest average ISS (13.9) and longest average hospital stay (5.6 days).

b) 2013-2017 Summit County: Injury Locations

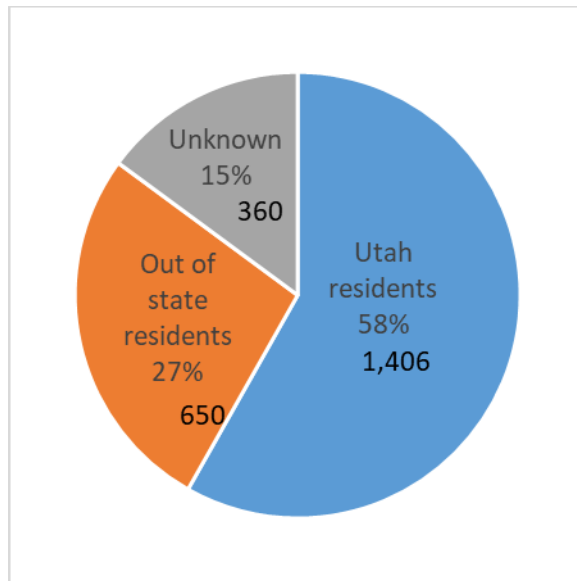
Figure 14 2013-2017 Locations where traumatic injuries occurred in Summit County



In Summit County, the majority (61%) of injuries occurred in recreation areas.

c) 2013-2017 Summit County: Locality of Trauma Patients

Figure 15 2013-2017 Locality of trauma patients in Summit County



Twenty-seven percent of trauma patients in Summit County were from out-of-state.

2. Garfield County

a) 2013-2017 Garfield County: Top 10 Causes of Traumatic Injury, Mortality Average Age, ISS, and LOS

Table 4 2013-2017 Top 10* causes of traumatic injury, mortality, average age, ISS, and LOS in Garfield County

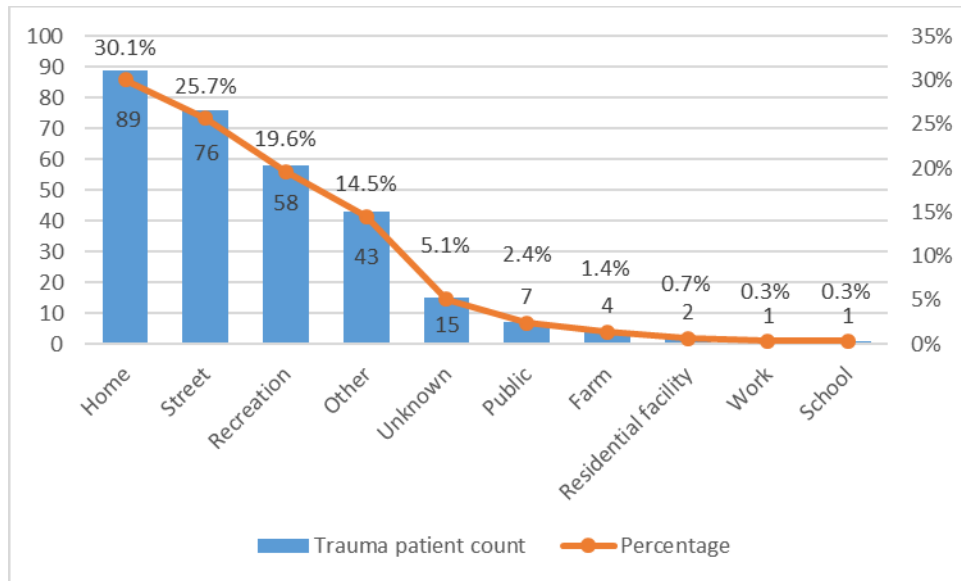
Cause	Count	Percentage	Mortality						
			Death	Rate	Avg Age	Min ISS	Avg ISS	Max ISS	Avg LOS
FALL	145	49.0%	1	0.7%	68.1	1	9.5	35	2.7
MV	40	13.5%	1	2.5%	53.8	1	9.0	22	3.6
MC	34	11.5%	0	0.0%	54.4	4	11.3	24	4.2
OV	26	8.8%	1	3.8%	39.4	2	9.7	29	2.7
ANIMAL	11	3.7%	0	0.0%	43.4	4	10.5	26	2.3
BIKE	8	2.7%	0	0.0%	59.4	6	12.5	19	4.0
STRUCK	8	2.7%	0	0.0%	37.9	4	12.0	26	1.9
STAB	6	2.0%	0	0%	24.0	1	3.8	8	1.2
GSW	5	1.7%	0	0%	20.2	1	10.0	30	4.0
CAUGHT	3	1.0%	1	33%	58.3	4	7.0	12	2.0

*Top 10 causes included about 97% (286) of all trauma patients (n=296) in Garfield County between 2013 and 2017.

In Garfield County, motorcycle incidents had the longest average hospital stay (4.2 days). Although the number was small (3), one out of three patients “caught between objects” died, rendering the mortality rate of 33%. “Other vehicle” incidents (e.g., ATV) had the second-highest mortality rate (3.8%).

b) 2013-2017 Garfield County: Injury Locations

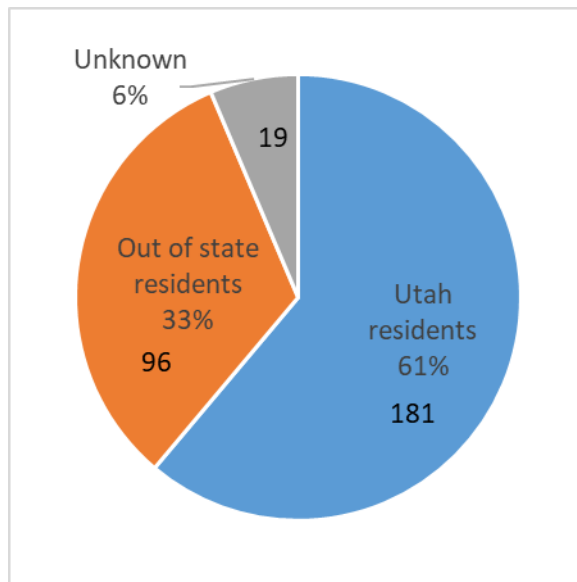
Figure 16 2013-2017 Locations where traumatic injuries occurred in Garfield County



Almost one-third of the injuries in Garfield County happened at home. Streets (26%) and recreation areas (20%) are the second and third most common places.

c) 2013-2017 Garfield County: Locality of Trauma Patients

Figure 17 2013-2017 Locality of trauma patients in Garfield County



Thirty-three percent of trauma patients in Garfield County were from out-of-state.

3. Grand County

a) 2013-2017 Grand County: Top 10 Causes of Traumatic Injury, Mortality Average Age, ISS, and LOS

Table 5 2013-2017 Top 10* causes of traumatic injury, mortality, average age, ISS, and LOS in Grand County

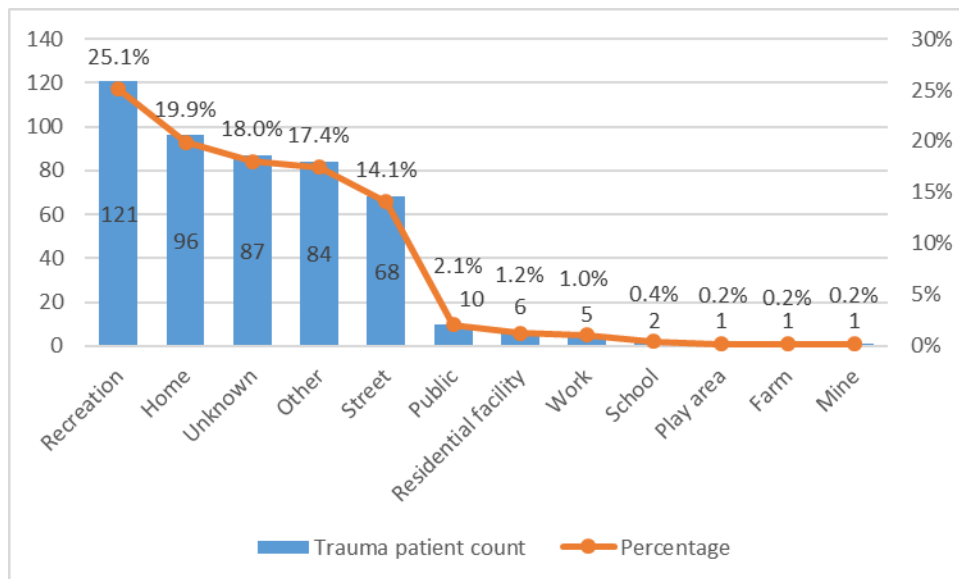
Cause	Count	Percentage	Mortality						
			Death	Rate	Avg Age	Min ISS	Avg ISS	Max ISS	Avg LOS
FALL	202	41.9%	2	1%	61.6	1	7.8	25	2.2
BIKE	87	18.0%	0	0%	46.7	1	8.8	33	2.0
MC	49	10.2%	1	2%	41.1	1	8.9	35	2.1
MV	43	8.9%	0	0%	40.1	1	11.2	36	1.3
OV	33	6.8%	1	3%	49.0	1	9.9	20	2.3
OTHER	16	3.3%	0	0%	43.4	1	6.4	16	0.5
SPORT	11	2.3%	0	0%	32.2	2	9.9	41	3.7
ASSAULT	8	1.7%	0	0%	42.0	1	6.8	19	0.8
ANIMAL	6	1.2%	0	0%	55.2	1	6.8	17	2.7
STRUCK	4	0.8%	0	0%	35.5	1	4.8	9	0.5

*Top 10 causes included about 95% (459) of all trauma patients (n=482) between 2013 and 2017 in Grand County.

In Grand County, “other vehicles” (e.g., ATV) incidents had the highest mortality rate (3%). Motor vehicle incidents had the highest average ISS (11.2). Sporting injuries had the longest average hospital stay (3.7 days).

b) 2013-2017 Grand County: Injury Locations

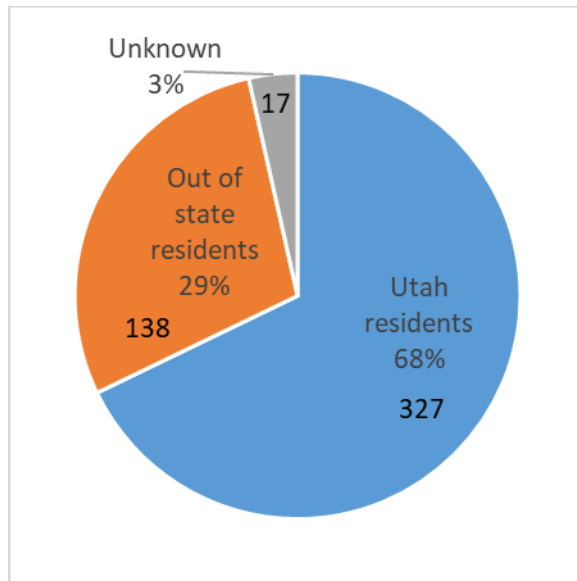
Figure 18 2013-2017 Locations where traumatic injuries occurred in Grand County



One-fourth of traumatic injuries occurred in recreation areas in Grand County. The county had higher percentages (about 35%) of “unknown” and “other location.” These may include remote areas not otherwise categorized as a specified location.

c) 2013-2017 Grand County: Locality of Trauma Patients

Figure 19 2013-2017 Locality of trauma patients in Grand County



About one-third of Grand County trauma patients were from out-of-state.

4. Millard County

a) 2013-2017 Millard County: Top 10 Causes of Traumatic Injury, Mortality, Average Age, ISS, and LOS

Table 6 2013-2017 Top 10* causes of traumatic injury, mortality, average age, ISS, and LOS in Millard County

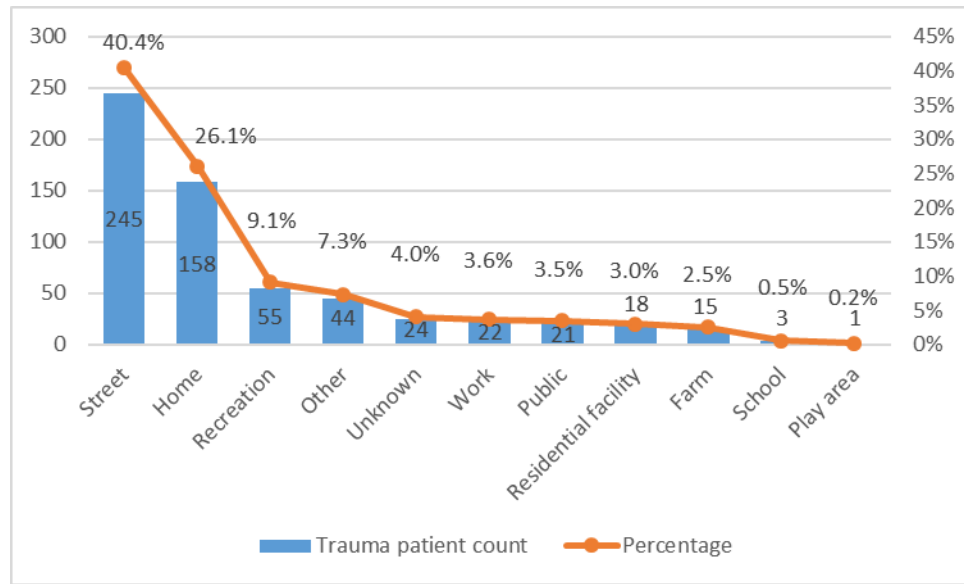
Cause	Count	Percentage	Mortality						
			Death	Rate	Avg Age	Min ISS	Avg ISS	Max ISS	Avg LOS
MV	204	33.7%	7	3.4%	43.1	1	12.6	43	3.4
FALL	204	33.7%	2	1.0%	69.5	1	10.5	29	2.6
MC	49	8.1%	2	4.1%	35.1	1	13.9	51	3.3
OV	41	6.8%	2	4.9%	37.0	1	11.0	33	2.7
ANIMAL	31	5.1%	1	3.2%	39.2	1	10.6	29	1.7
STRUCK	13	2.1%	0	0.0%	31.5	1	8.0	19	1.8
BIKE	10	1.7%	0	0.0%	25.8	4	10.0	22	1.1
GSW	9	1.5%	2	22%	28.2	2	6.8	11	2.6
MACHINE	7	1.2%	0	0%	33.1	1	7.7	24	2.9
ASSAULT	7	1.2%	0	0%	50.4	1	7.1	13	2.3

*Top 10 causes included about 95% (575) of all trauma patients (n=606) between 2013 and 2017 in Millard County.

In Millard County, gunshot wounds had the highest mortality rate (22%), and motorcycle incidents had the highest average ISS (13.9). Motor vehicle incidents had the longest average hospital stay (3.4 days).

b) 2013-2017 Millard County: Injury Locations

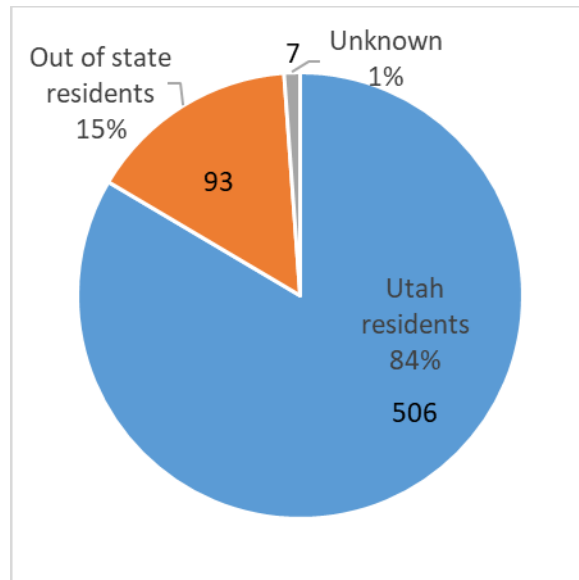
Figure 20 2013-2017 Locations where traumatic injuries occurred in Millard County



In Millard County, 40% of traumatic injuries occurred on streets. Home (26%) and recreation areas (9.1%) were the second and third most common places.

c) 2013-2017 Millard County: Locality of Trauma Patients

Figure 21 2013-2017 Locality of trauma patients in Millard County



Fifteen percent of trauma patients in Millard County were from out-of-state.

5. Juab County

a) 2013-2017 Juab County: Top 10 Causes of Traumatic Injury, Mortality Average Age, ISS, and LOS

Table 7 2013-2017 Top 10* causes of traumatic injury, mortality, average age, ISS, and LOS in Juab County

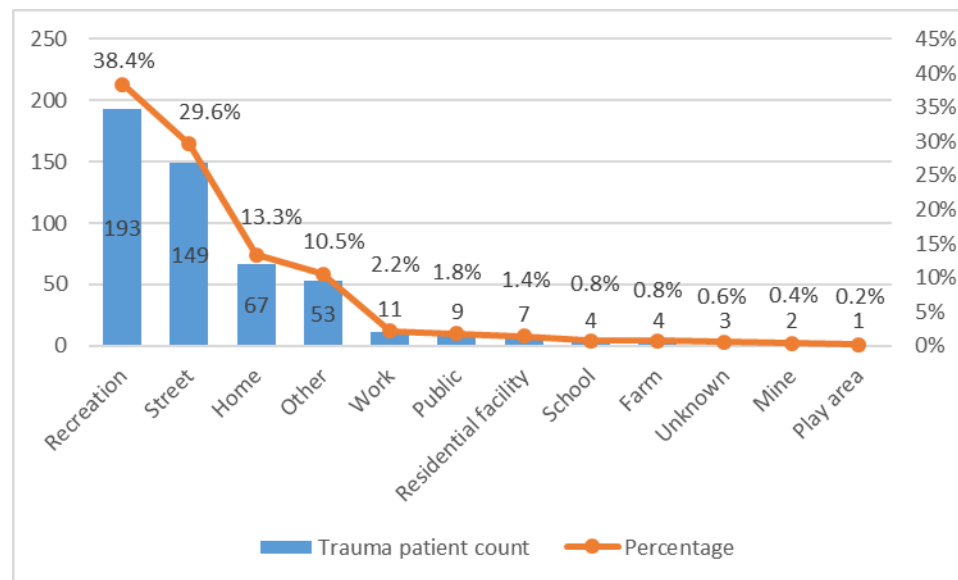
Cause	Count	Percentage	Mortality						
			Death	Rate	Avg Age	Min ISS	Avg ISS	Max ISS	Avg LOS
OV	156	31.0%	2	1.3%	35.3	0	10.9	50	4.3
MV	130	25.8%	2	1.5%	37.8	0	11.6	29	3.5
FALL	94	18.7%	1	1.1%	50.6	0	9.9	25	3.9
MC	67	13.3%	1	1.5%	34.5	4	12.1	26	3.9
ANIMAL	12	2.4%	0	0%	28.8	0	9.7	29	2.8
STRUCK	10	2.0%	0	0%	34.0	0	5.8	17	6.7
GSW	5	1.0%	2	40%	18.0	1	14.6	25	0.6
PED	4	0.8%	1	25%	26.8	4	7.3	10	2.5
BIKE	4	0.8%	0	0%	31.3	4	10.0	22	1.3
SPORT	4	0.8%	0	0%	24.8	4	8.8	18	1.0

*Top 10 causes included about 97% (486) of all trauma patients (n=503) between 2013 and 2017 in Juab County.

In Juab County, the average age for the top 10 causes was younger (<=50 years) than in other counties. “Other vehicle” (e.g., ATV) incidents were the most common (31%) cause of traumatic injuries. Death rates (40%) and average ISS (14.6) were the highest in gunshot wounds.

b) 2013-2017 Juab County: Injury Locations

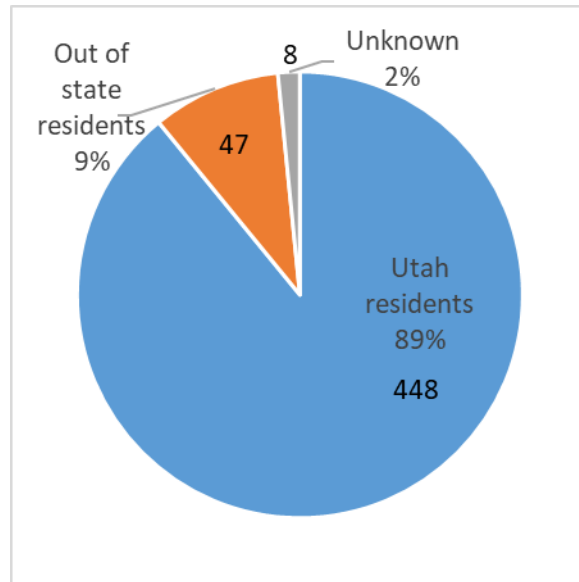
Figure 22 2013-2017 Locations where traumatic injuries occurred in Juab County



Thirty-eight percent of traumatic injuries in Juab County occurred in recreation areas. Another 30% occurred on the streets.

c) 2013-2017 Juab County: Locality of Trauma Patients

Figure 23 2013-2017 Locality of trauma patients in Juab County



The majority (89%) of trauma patients in Juab County were Utah residents. Nine percent were from out-of-state.

Q. 2013-2017 Trauma patient transfer

1. Transfer of Trauma Patients with Most Serious Injuries (ISS>15) in Utah

a) Transfer Destinations

Table 8 2013-2017 Transfer of trauma patients with serious injuries (ISS>15) in Utah

Hospital Level*	Destination Hospital Level†							Total
	Level I	Level II	Level III	Level IV	CAH	Resource	Unknown	
Level I	45	3	1	0	0	0	0	49
Level II	189	3	2	1	0	0	0	195
Level III	304	136	3	2	0	7	98	550
Level IV	480	329	0	6	6	6	37	864
CAH	29	71	0	9	2	2	2	115
Resource	322	76	4	0	0	1	1	404
Unknown	11	8	5	0	0	0	0	24
Total	1,380	626	15	18	8	16	138	2,201
%	62.7%	28.4%	0.7%	0.8%	0.4%	0.7%	6.3%	100%

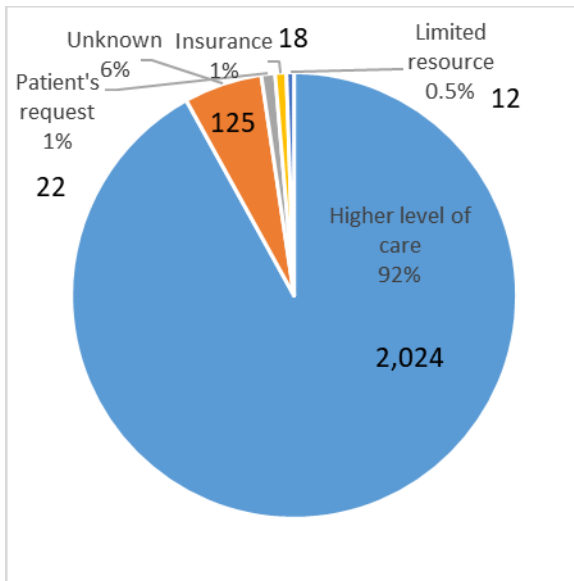
*Hospital level where the patient was originally brought in

†Hospital level where the patient was transferred to

Between 2013 and 2017, out of 65,131 patients, 2,201 with the most serious injuries (ISS>15) were admitted to a hospital then transferred to another hospital in Utah. Ninety-one percent of those patients were transferred to Level I or Level II Trauma centers (see Appendix A for hospital level designation definitions).

b) Transfer Reasons

Figure 24 2013-2017 Transfer reasons for patients with serious injuries (ISS>15)



Ninety-two percent of the seriously injured patients who were transferred to another Utah hospital needed a higher level of care or a more specialized level of care depending on the types of injuries and/or patient’s age (e.g., Burns, neurosurgery, orthopedic surgery, pediatric care).

2. Transfer of Trauma Patients from Out-of-State to Utah Hospitals by Trauma Region

Table 9 Transfer of trauma patients from out-of-state to Utah hospitals by trauma region

Trauma Region	Level of Utah hospital that received transferred trauma patients	Out-of-state hospitals transferred trauma patients to Utah Hospitals	Count	%
Central	Level I	Arizona Hospital	4	0.2%
Central	Level I	Colorado Hospital	25	0.9%
Central	Level I	Idaho Hospital	616	23.3%
Central	Level I	Montana Hospital	171	6.5%
Central	Level I	Nevada Hospital	487	18.5%
Central	Level I	New Mexico Hospital	1	0.0%
Central	Level I	Other out-of-state hospital	27	1.0%
Central	Level I	Wyoming Hospital	975	36.9%
Central	Level II	Idaho Hospital	1	0.0%
Central	Level II	Nevada Hospital	3	0.1%
Central	Level II	Wyoming Hospital	4	0.2%
Central	Level IV	Other out-of-state hospital	1	0.0%
Central	Resource	Idaho Hospital	3	0.1%
Central	Resource	Wyoming Hospital	1	0.0%
Northern	Level II	Idaho Hospital	53	2.0%
Northern	Level II	Nevada Hospital	1	0.0%
Northern	Level II	Other out-of-state hospital	1	0.0%
Northern	Level II	Wyoming Hospital	23	0.9%
Northern	Level III	Idaho Hospital	10	0.4%
Northern	Level III	Other out-of-state hospital	4	0.2%
Northern	Level III	Wyoming Hospital	2	0.1%
Northern	Level IV	Idaho Hospital	4	0.2%
Northern	Level IV	Other out-of-state hospital	1	0.0%
Southcentral	Level II	Nevada Hospital	1	0.0%
Southcentral	Level II	Other out-of-state hospital	5	0.2%
Southcentral	Level II	Wyoming Hospital	2	0.1%
Southwest	Level II	Arizona Hospital	69	2.6%
Southwest	Level II	Nevada Hospital	136	5.2%
Southwest	Level II	Other out-of-state hospital	3	0.1%
Southwest	Level IV	Nevada Hospital	5	0.2%
			2,639	100%

Between 2013 and 2017, 2,639 patients out of 65,131 were transferred from out-of-state to Utah hospitals. Level I hospitals in the Central region received about 87% (2,306) of all out-of-state patients. Idaho, Nevada, and Wyoming are the top three states from which Utah received trauma patients.

3. Transfer of Trauma Patients from Utah to Out-of-State Hospitals by Trauma Regions
 a) Transfer Destinations

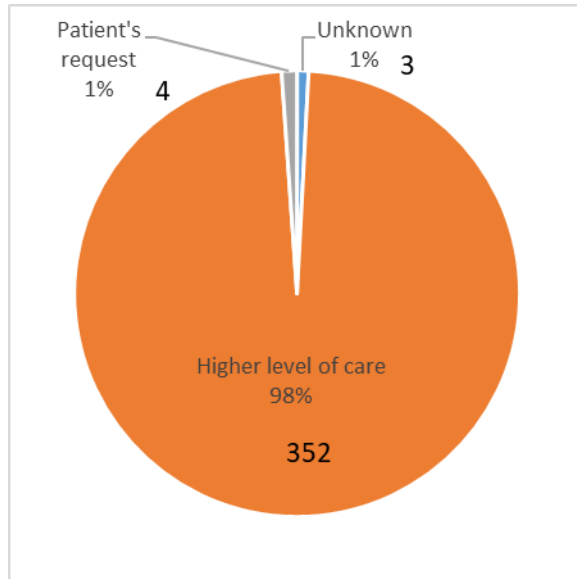
Table 10 Transfer of trauma patients from Utah to out-of-state hospitals by trauma regions

Trauma Region	Level of hospital that transferred trauma patients to out-of-state Hospital	Destination hospital for patient transfer	Count	%
Central	Level IV	Colorado Hospital	3	0.8%
Southcentral	CAH	Colorado Hospital	1	0.3%
Southeast	CAH	Arizona Hospital	5	1.4%
Southeast	CAH	Colorado Hospital	50	13.9%
Southeast	CAH	Idaho Hospital	1	0.3%
Southeast	CAH	New Mexico Hospital	3	0.8%
Southeast	CAH	Other out-of-state Hospital	4	1.1%
Southeast	Level IV	Colorado Hospital	170	47.4%
Southeast	Level IV	Other out-of-state Hospital	6	1.7%
Southwest	CAH	Arizona Hospital	3	0.8%
Southwest	CAH	Colorado Hospital	1	0.3%
Southwest	CAH	Nevada Hospital	5	1.4%
Southwest	Level II	Arizona Hospital	9	2.5%
Southwest	Level II	Colorado Hospital	1	0.3%
Southwest	Level II	Nevada Hospital	82	22.8%
Southwest	Level II	Other out-of-state Hospital	3	0.8%
Southwest	Level IV	Nevada Hospital	12	3.3%
			359	100%

Between 2013 and 2017, 359 out of 65,131 trauma patients were transferred to out-of-state hospitals. Southeast (239, 66.6%) and Southwest (116, 32.3%) were the two major regions that transferred patients to nearby states. Colorado and Nevada were the top two destination states.

b) Transfer Reasons

Figure 25 2013-2017 Transfer reasons for trauma patients who were transferred to out-of-state hospitals

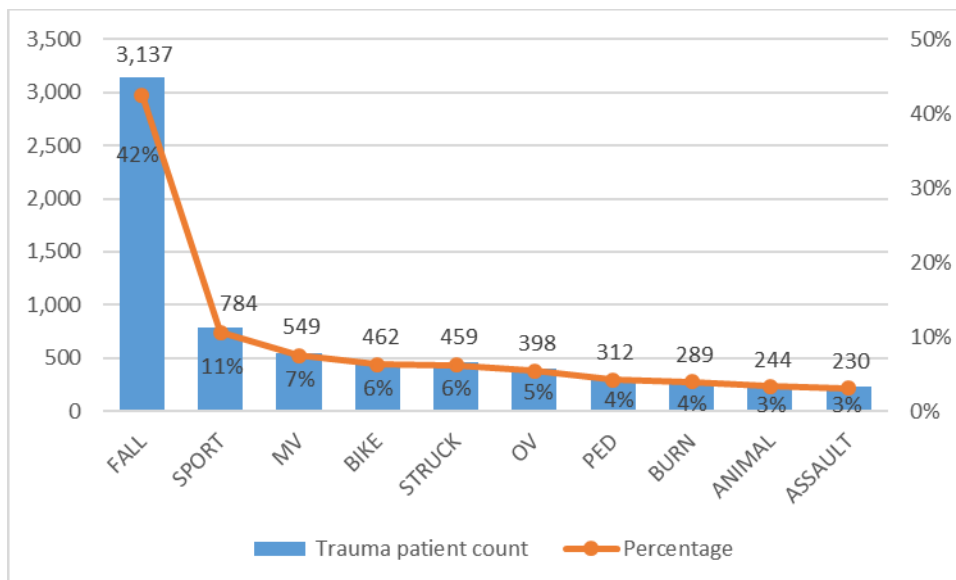


The majority (98%) of trauma patients who were transferred to out-of-state hospitals needed a higher level of care.

II. 2013-2017 Pediatric Trauma Patients

A. 2013-2017 Top 10 Injury Causes for Pediatric Trauma Patients

Figure 26 2013-2017 Top 10* injury causes for pediatric trauma patients

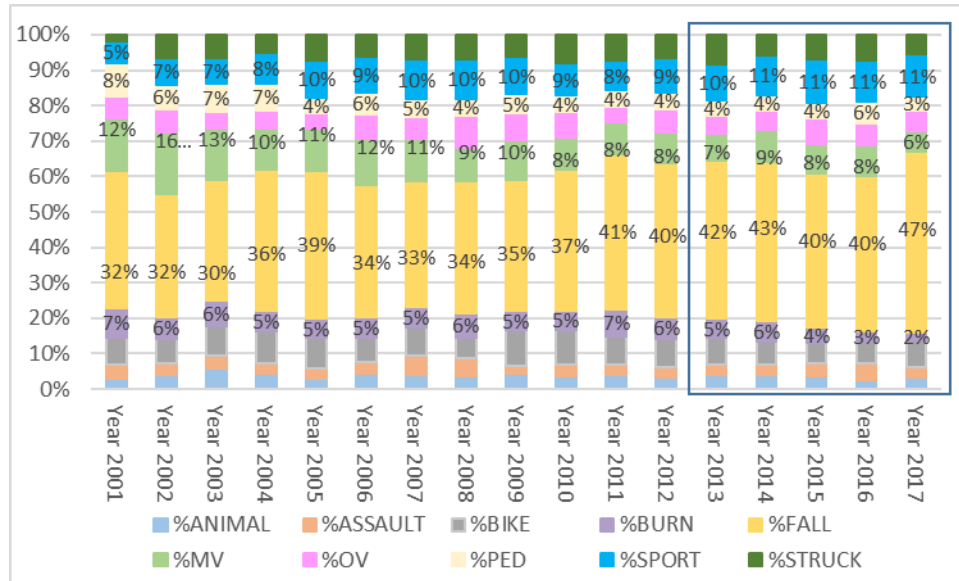


*Top 10 causes included 93% (6,864) of all pediatric trauma patients (n=7,382) between 2013 and 2017.

In pediatric patients, falls (43%) are the most common cause of traumatic injury followed by sporting injury (11%), and motor vehicle incidents (7%).

B. 2001-2017 Trend for Top 10 Injury Causes for Pediatric Trauma patients

Figure 27 2001-2017 Trend for top 10 injury causes for pediatric trauma patients



Between 2013 and 2017, fall injuries increased by 5% and sporting injuries increased by 1% for pediatric patients. However, between 2001 and 2017, fall and sporting injuries increased by 15% and 6% respectively. For the same time period, motor vehicle incidents, burn, and pedestrian injuries decreased by half or more. Other injury types remained constant.

C. 2013-2017 Ten Most Commonly Injured Body Regions by Top 5 Causes for Pediatric Patients

Table 11 2013-2017 Ten most commonly injured body regions by top 10 causes for pediatric patients

Ranking	FALL Total	%	SPORT Total	%	MV Total	%	BIKE Total	%	STRUCK Total	%
1	HEAD 1331	45.2%	LEG 271	35.8%	HEAD 251	47.6%	HEAD 158	37.2%	HEAD 194	43.1%
2	ARM 730	24.8%	HEAD 180	23.8%	LEG 61	11.6%	ABD 85	20.0%	LEG 101	22.4%
3	LEG 501	17.0%	ARM 156	20.6%	ABD 53	10.1%	LEG 65	15.3%	FACE 35	7.8%
4	ABD 110	3.7%	ABD 70	9.3%	ARM 39	7.4%	ARM 61	14.4%	ABD 32	7.1%
5	FACE 97	3.3%	CS 23	3.0%	CHEST 33	6.3%	FACE 24	5.6%	ARM 32	7.1%
6	EXT 55	1.9%	FACE 16	2.1%	EXT 31	5.9%	EXT 16	3.8%	EXT 27	6.0%
7	CHEST 35	1.2%	TS 15	2.0%	FACE 28	5.3%	CHEST 11	2.6%	CHEST 13	2.9%
8	TS 20	0.7%	CHEST 11	1.5%	CS 15	2.8%	CS 2	0.5%	CS 12	2.7%
9	LS 19	0.6%	LS 8	1.1%	LS 7	1.3%	NECK 2	0.5%	NECK 2	0.4%
10	CS 17	0.6%	EXT 4	0.5%	TS 7	1.3%	LS 1	0.2%	TS 2	0.4%

The head, as an anatomical region, is the most commonly injured body region for pediatric patients for the top five causes (incidents involving a fall, sport, motor vehicle, bicycle, and being struck by objects) of traumatic injury.

D. 2013-2017 Pediatric Mortality, Average Age, ISS, and LOS for Top 10 Injury Causes

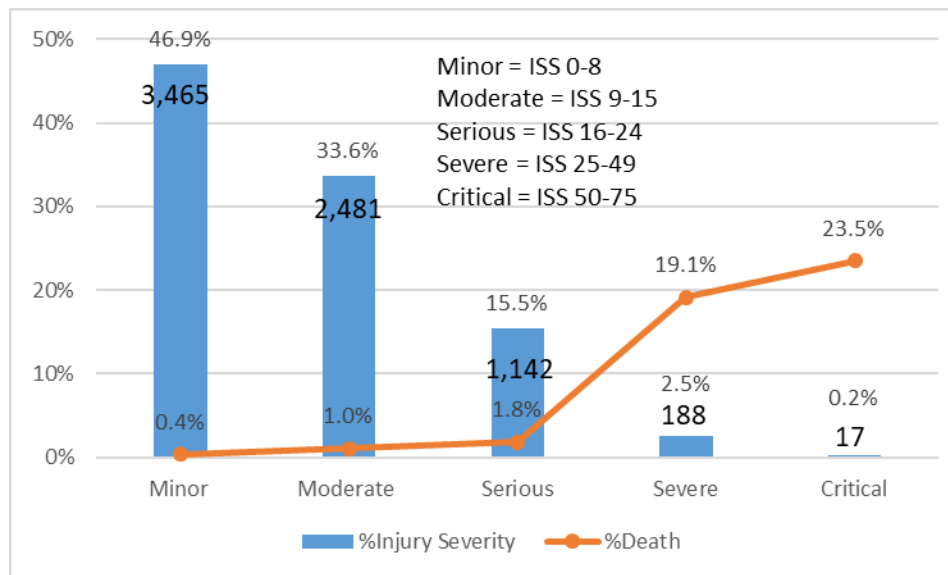
Table 12 2013-2017 Mortality, average age, ISS, and LOS for pediatric top 10 causes of traumatic injury

Cause	Mortality								
	Count	Percentage	Death	Rate	Avg Age	Min ISS	Avg ISS	Max ISS	Avg LOS
FALL	3,137	42.5%	5	0.2%	5.2	1	8.5	72	0.9
SPORT	784	10.6%	0	0.0%	10.2	1	8.5	50	1.4
MV	549	7.4%	22	4.0%	7.9	1	12.3	54	3.5
BIKE	462	6.3%	2	0.4%	8.9	1	9.1	50	1.4
STRUCK	459	6.2%	4	0.9%	6.5	1	8.8	51	1.5
OV	398	5.4%	6	1.5%	10.1	1	10.0	34	2.8
PED	312	4.2%	28	9.0%	7.5	1	13.1	50	2.8
BURN	289	3.9%	0	0.0%	3.8	1	3.5	50	5.4
ANIMAL	244	3.3%	2	0.8%	7.5	1	7.7	27	1.8
ASSAULT	230	3.1%	18	7.8%	1.6	1	12.7	41	5.0

Among the top 10 causes, pedestrian incidents had the highest average ISS (13.1) and mortality rate (9%). Burn injuries required the longest average stay (5.4 days) in the hospital, followed by assault (5 days) and motor vehicle crashes (3.5 days).

E. 2013-2017 Pediatric Injury Severity and Mortality Rate

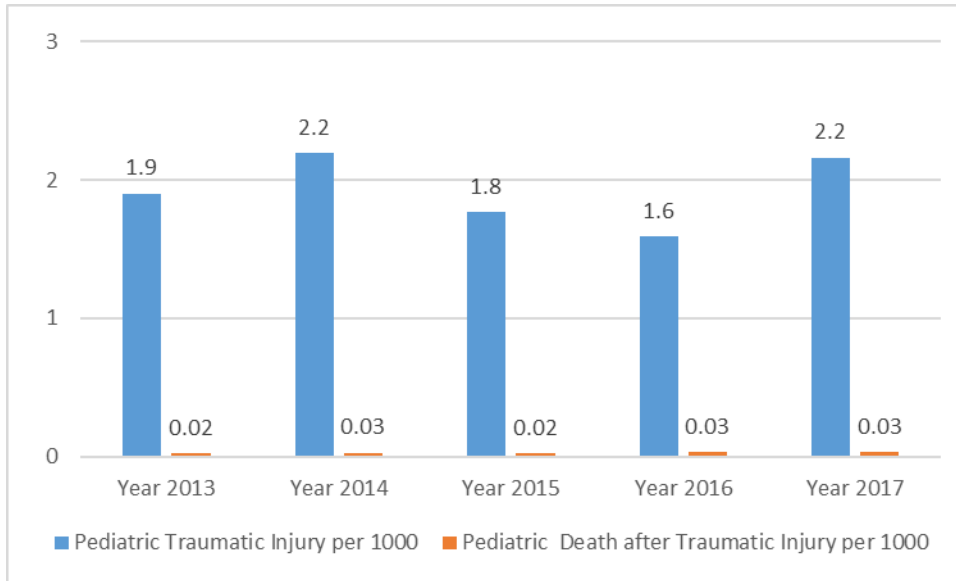
Figure 28 2013-2017 Pediatric injury severity and mortality rate



The pediatric mortality rate went up significantly for the most severe (19.1%) to critical injuries (23.5%).

F. 2013-2017 Pediatric Per Capita Traumatic Injury Incidents and Death

Figure 29 2013-2017 Pediatric per capita traumatic injury incidents and death



The average per capita incidents between 2013 and 2017 for pediatric patients was 1.9 per 1,000. Pediatric per capita mortality has been relatively stable (0.03 per 1,000).

G. 2013-2017 Top 10 Lethal Injuries for Pediatric Patients

Table 13 2013-2017 Top 10* lethal injuries for pediatric patients

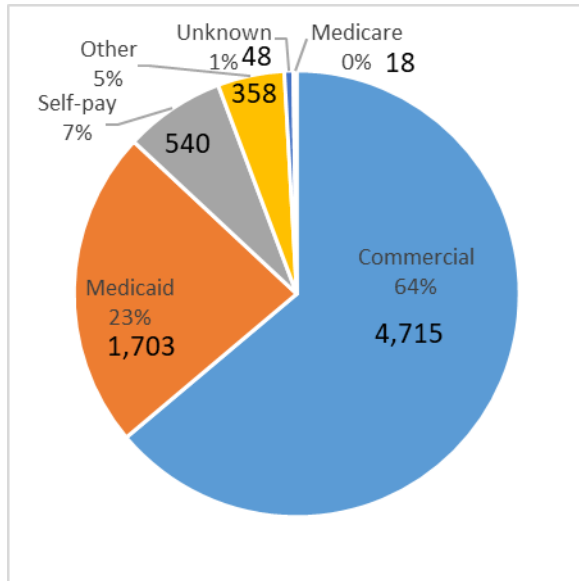
Ranking	Cause	Outcome	Count	%	Total
1	GSW	Alive	70	87.5%	80
		Dead	10	12.5%	
2	PED	Alive	284	91.0%	312
		Dead	28	9.0%	
3	ASSAULT	Alive	212	92.2%	230
		Dead	18	7.8%	
4	MV	Alive	527	96.0%	549
		Dead	22	4.0%	
5	MACHINE	Alive	34	97.1%	35
		Dead	1	2.9%	
6	OV	Alive	392	98.5%	398
		Dead	6	1.5%	
7	MC	Alive	141	98.6%	143
		Dead	2	1.4%	
8	STRUCK	Alive	455	99.1%	459
		Dead	4	0.9%	
9	ANIMAL	Alive	242	99.2%	244
		Dead	2	0.8%	
10	BIKE	Alive	460	99.6%	462
		Dead	2	0.4%	

*Records with unknown and unspecific causes, unknown outcomes, and cause code with fewer than 30 cases were excluded.

Gunshot wounds had the highest mortality rate (12.5%) for pediatric patients followed by pedestrian incidents (9%) and assaults (7.8%).

H. 2013-2017 Payers for Pediatric Trauma Patients

Figure 30 2013-2017 Payers for pediatric trauma patients

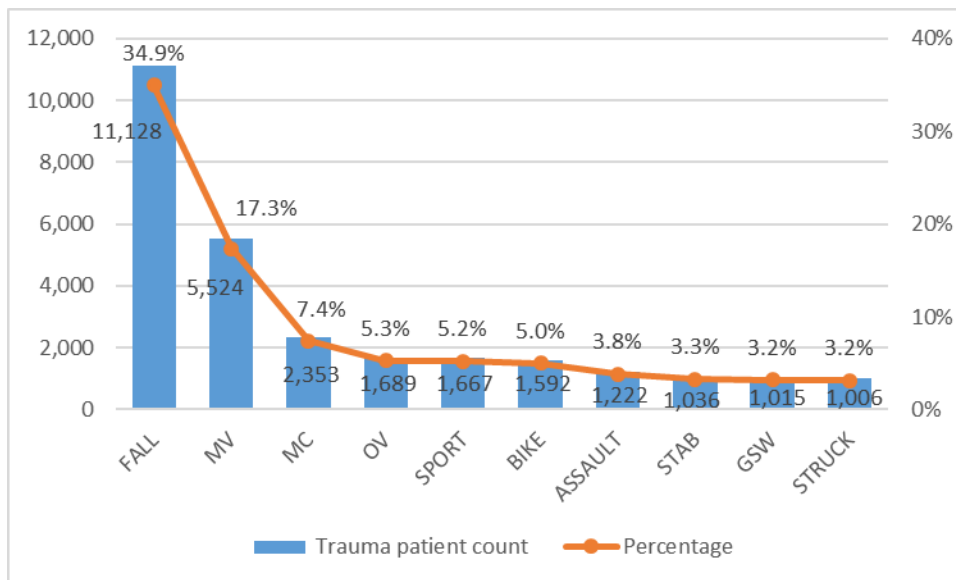


Commercial insurance (64%) and Medicaid (23%) paid for 87% of pediatric trauma patients between 2013 and 2017.

III. 2013-2017 Adult Trauma Patients

A. 2013-2017 Top 10 Injury Causes for Adult Trauma Patients

Figure 31 2013-2017 Top 10* injury causes for adult trauma patients

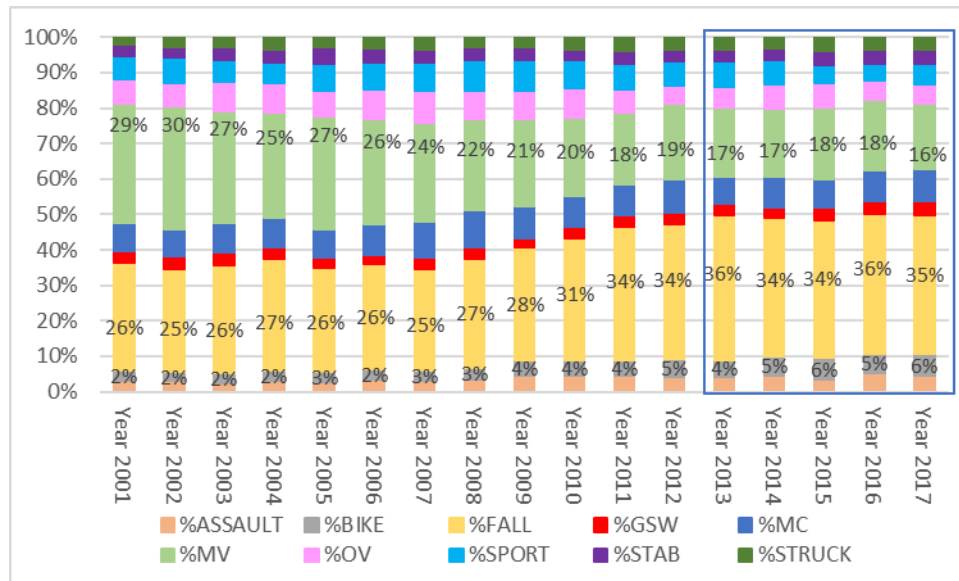


*Top 10 causes included about 89% (28,232) of all adult patients (n=31,859) between 2013 and 2017.

Falls (35%) and motor vehicle incidents (17%) comprise about half of all injuries for adult trauma patients.

B. 2001-2017 Trend for Top 10 Injury Causes for Adult Trauma Patients

Figure 32 2001-2017 Trend for top 10 injury causes for adult trauma patients



In contrast to falls, motor vehicle incidents have been decreasing steadily (29% in 2001, 17% in 2013, and 16% in 2017). Bicycle incidents have been slightly increasing (2% in 2001, 6% in 2017). Other causes remained stable.

C. 2013-2017 Ten Most Commonly Injured Body Regions by Top 5 Causes for Adult Trauma Patients

Table 14 2013-2017 Ten most commonly injured body regions by top 5 causes for adult trauma patients

Ranking	FALL Total	%	MV Total	%	MC Total	%	OV Total	%	SPORT Total	%
1	LEG 4403	43.3%	HEAD 1050	21.6%	LEG 648	30.9%	CHEST 314	22.0%	LEG 745	47.4%
2	HEAD 2140	21.1%	CHEST 1006	20.6%	CHEST 431	20.5%	LEG 295	20.6%	HEAD 288	18.3%
3	ARM 933	9.2%	LEG 969	19.9%	HEAD 371	17.7%	HEAD 264	18.5%	ABD 114	7.3%
4	CHEST 834	8.2%	CS 358	7.3%	ARM 248	11.8%	ARM 156	10.9%	ARM 93	5.9%
5	LS 447	4.4%	ABD 337	6.9%	ABD 105	5.0%	TS 76	5.3%	CHEST 91	5.8%
6	TS 315	3.1%	ARM 330	6.8%	EXT 84	4.0%	ABD 73	5.1%	CS 78	5.0%
7	CS 300	3.0%	EXT 248	5.1%	TS 62	3.0%	EXT 71	5.0%	LS 61	3.9%
8	FACE 296	2.9%	LS 186	3.8%	FACE 56	2.7%	LS 67	4.7%	TS 60	3.8%
9	EXT 226	2.2%	TS 174	3.6%	LS 47	2.2%	FACE 61	4.3%	FACE 27	1.7%
10	ABD 211	2.1%	FACE 171	3.5%	CS 29	1.4%	CS 46	3.2%	EXT 11	0.7%

For adult trauma patients, body regions with injury are more diverse by cause than pediatric patients. For the top five causes of injury (incidents involving a fall, motor vehicle, motorcycle, other vehicle such as an ATV, and playing sports) legs are the most commonly injured body regions, followed by head and chest.

D. 2013-2017 Mortality, Average Age, ISS, and LOS for Top 10 Causes for Adult Trauma Patients

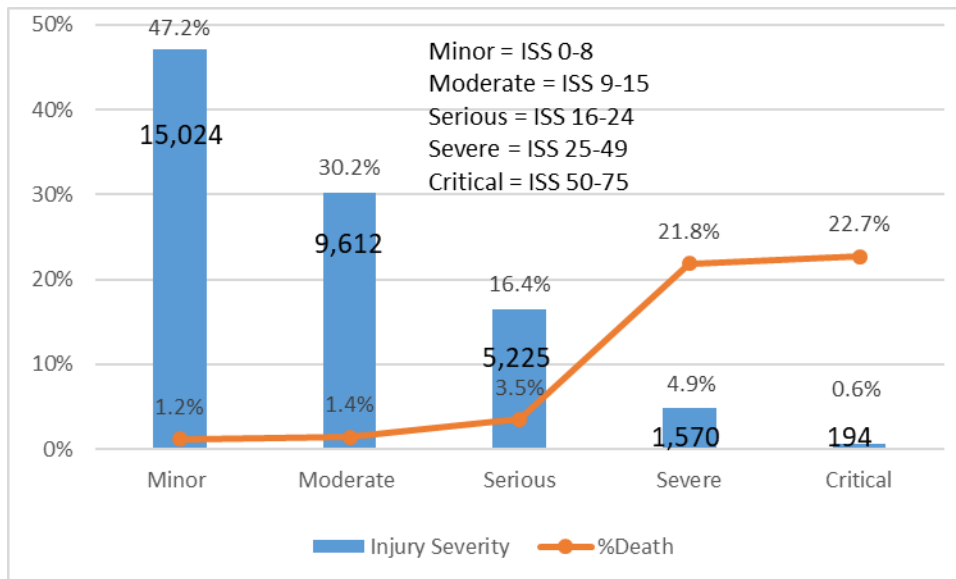
Table 15 2013-2017 Mortality, average age, ISS, and LOS for top 10 causes for adult patients

Cause	Mortality								
	Count	Percentage	Death	Rate	Avg Age	Min ISS	Avg ISS	Max ISS	Avg LOS
FALL	11,128	34.9%	148	1.3%	47.1	1	9.1	61	3.1
MV	5,524	17.3%	219	4.0%	36.0	1	12.3	66	4.0
MC	2,353	7.4%	83	3.5%	37.6	1	12.6	59	4.1
OV	1,689	5.3%	21	1.2%	37.1	1	11.1	59	3.4
SPORT	1,667	5.2%	10	0.6%	31.6	1	8.8	66	2.7
BIKE	1,592	5.0%	15	0.9%	41.8	1	11.1	59	2.7
ASSAULT	1,222	3.8%	21	1.7%	37.7	1	9.1	54	2.6
STAB	1,036	3.3%	14	1.4%	33.2	1	5.3	59	2.5
GSW	1,015	3.2%	226	22.3%	32.4	1	11.3	66	3.6
STRUCK	1,006	3.2%	15	1.5%	38.3	1	9.2	50	2.9

Among the top 10 injury causes, gunshot wounds had the highest mortality rate (22.3%). Motorcycle incidents had the highest average ISS (12.6) and the longest average stay in the hospital (4.1 days) followed by motor vehicle incidents (ISS 12.3, LOS 4 days).

E. 2013-2017 Adult Injury Severity and Mortality Rate

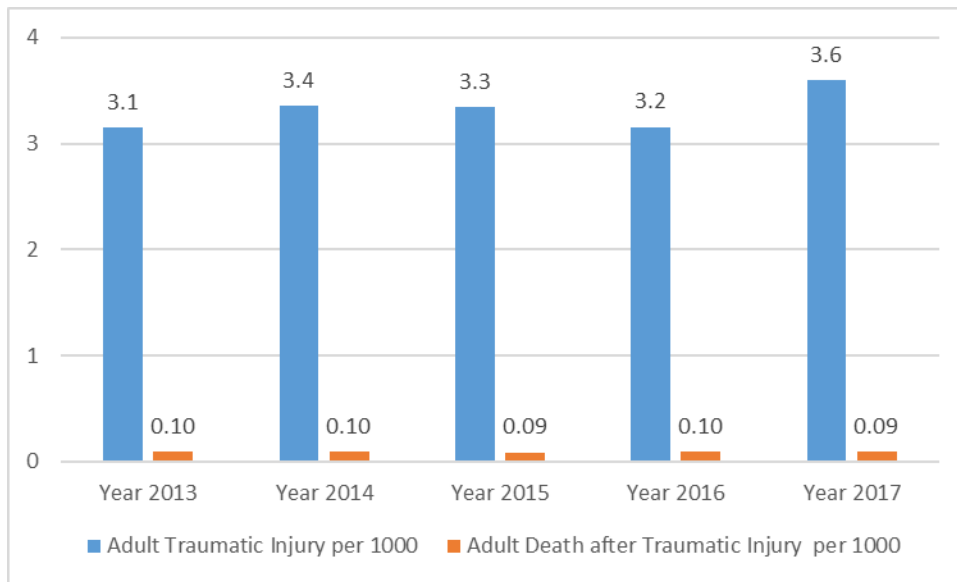
Figure 33 2013-2017 Adult injury severity and mortality rate



Compared with pediatric patients (see Figure 28), the percentages of serious to critical injuries increased slightly in adults, as did the mortality rates.

F. 2013-2017 Adult Per Capita Traumatic Injury Incidents and Death

Figure 34 2013-2017 Adult per capita traumatic injury incidents and death



The average per capita injury incidents between 2013 and 2017 for adult patients were 3.3 per 1,000. Adult per capita mortality is about 3 times higher than pediatric patients (Adult 0.10 per 1,000 vs. Pediatric 0.03 per 1,000). However, it was relatively stable between 2013 and 2017.

G. 2013-2017 Top 10 Lethal Injuries for Adult Patients

Table 16 2013-2017 Top 10* lethal injuries for adult patients

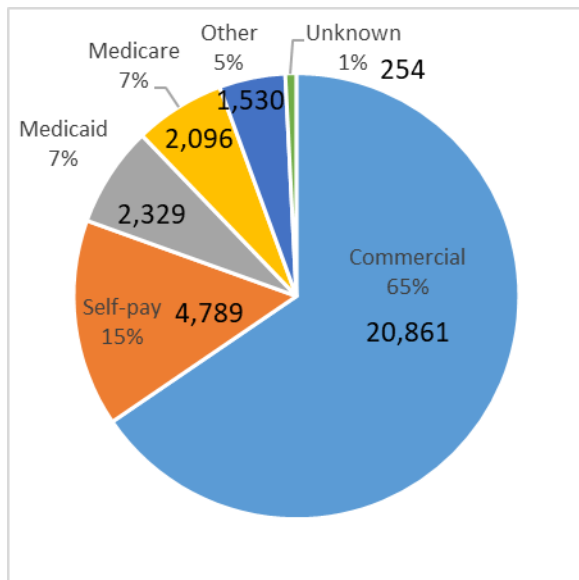
Ranking	Cause	Outcome	Count	%	Total
1	HANG	Alive	27	67.5%	40
		Dead	13	32.5%	
2	GSW	Alive	789	77.7%	1,015
		Dead	226	22.3%	
3	EXP	Alive	95	91.3%	104
		Dead	9	8.7%	
4	PED	Alive	787	92.7%	849
		Dead	62	7.3%	
5	BURN	Alive	515	95.7%	538
		Dead	23	4.3%	
6	MV	Alive	5304	96.0%	5,523
		Dead	219	4.0%	
7	MC	Alive	2267	96.5%	2,350
		Dead	83	3.5%	
8	CAUGHT	Alive	270	97.8%	276
		Dead	6	2.2%	
9	ASSAULT	Alive	1201	98.3%	1,222
		Dead	21	1.7%	
10	STRUCK	Alive	988	98.5%	1,003
		Dead	15	1.5%	

*Records with unknown and unspecific causes, unknown outcomes, and cause code with fewer than 30 cases were excluded.

Hanging and gunshot wounds (including self-inflicted and accidental injuries) were the most lethal injuries among adults with a mortality rate of 32.5% and 22.3% respectively.

H. 2013-2017 Payers for Adult Trauma Patients

Figure 35 2013-2017 Payers for adult trauma patients

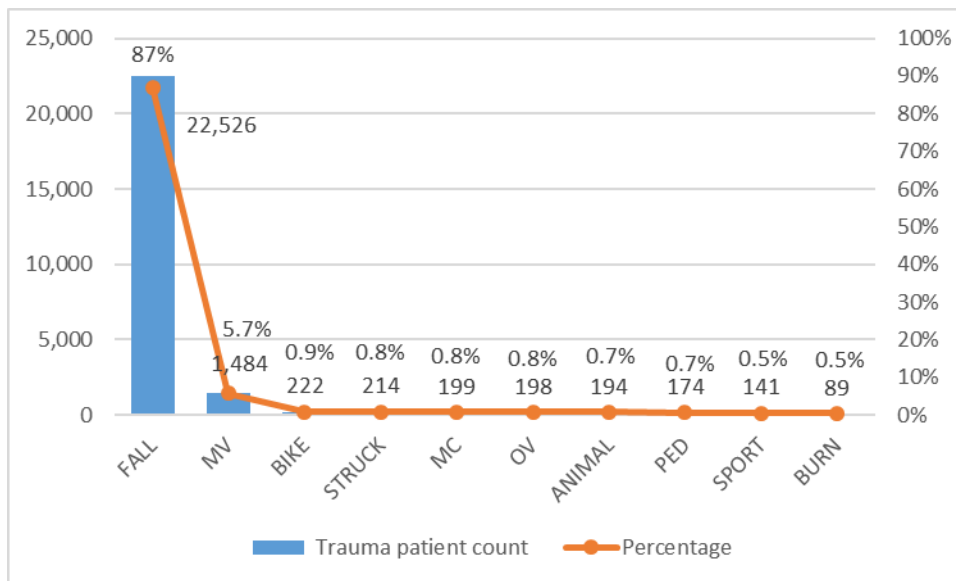


Commercial insurance (65%) and self-pay (15%) paid for 80% of adult trauma patients.

IV. 2013-2017 Geriatric Trauma Patients

A. 2013-2017 Top 10 Causes for Geriatric Trauma Patients

Figure 36 2013-2017 Top 10* causes for geriatric trauma patients



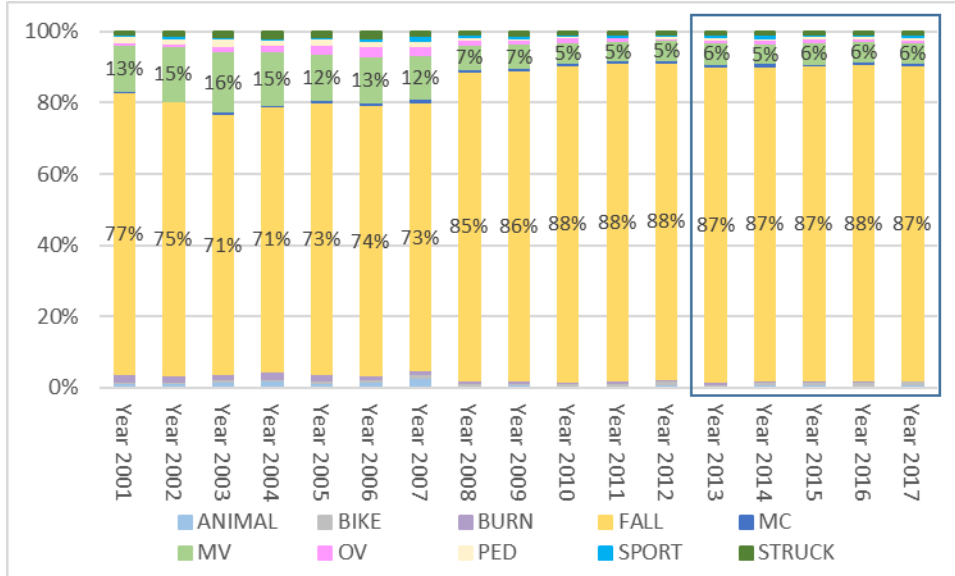
*Top 10 causes included about 98% (25,441) of all geriatric trauma patients (n=25,886).

Eighty-seven percent of all geriatric trauma was caused by a fall (including ground-level fall). Motor vehicle incidents are the second most common cause but to a far lesser degree (5.7%).

B. 2001-2017 Trend for Top 10 Causes for Geriatric Trauma patients

Figure 37 2013-2017 Trend for top 10 causes for geriatric trauma patients

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Only two causes of injury showed shifting trends. Falls are the major cause of geriatric trauma since geriatric fall was added to the trauma inclusion criteria in 2008. The rate of falls remained stable between 2013 and 2017. Motor vehicle incidents declined by more than half since 2001. Other injury causes remained relatively stable.

C. 2013-2017 Ten Most Commonly Injured Body Regions by Top 2 Causes for Geriatric Trauma Patients

Table 17 2013-2017 Ten most commonly injured body regions by top 2 causes for geriatric trauma patients

Ranking	FALL Total	%	MV Total	%
1	LEG 10436	51.1%	CHEST 513	37.1%
2	HEAD 3828	18.7%	HEAD 239	17.3%
3	CHEST 1687	8.3%	LEG 194	14.0%
4	ARM 1559	7.6%	CS 111	8.0%
5	LS 736	3.6%	ARM 61	4.4%
6	CS 644	3%	TS 60	4.3%
7	TS 617	3%	LS 57	4.1%
8	EXT 382	2%	EXT 53	3.8%
9	FACE 368	2%	ABD 48	3.5%
10	ABD 119	1%	FACE 28	2.0%

Legs are the most commonly injured body region (51%) in falls, often representing a geriatric hip fracture. Chest (37%), head (17%), and legs (14%) comprise 68% of injured body regions in motor vehicle incidents.

D. 2013-2017 Geriatric Mortality, Average Age, ISS, and LOS for Top 10 Causes

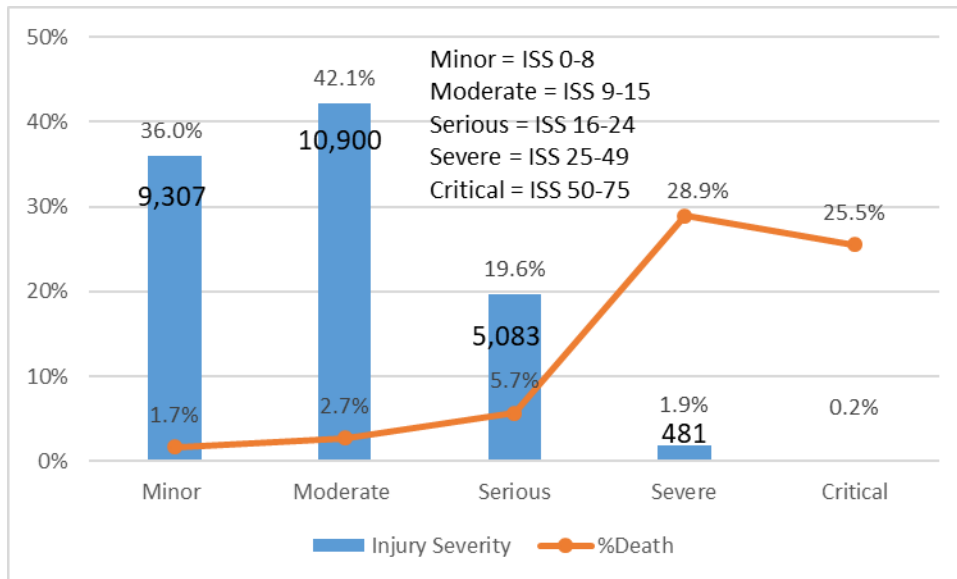
Table 18 2013-2017 Geriatric mortality, average age, ISS, and LOS for top 10 causes

Cause	Mortality								
	Count	Percentage	Death	Rate	Avg Age	Min ISS	Avg ISS	Max ISS	Avg LOS
FALL	22,526	87.0%	702	3.1%	80.5	1	9.7	73	3.5
MV	1,484	5.7%	91	6.1%	75.9	1	11.9	54	4.5
BIKE	222	0.9%	5	2.3%	72.0	1	12.4	54	3.8
STRUCK	214	0.8%	7	3.3%	76.0	1	9.7	59	3.5
MC	199	0.8%	17	8.5%	70.8	1	13.9	52	4.9
OV	198	0.8%	6	3.0%	72.2	1	11.7	36	3.8
ANIMAL	194	0.7%	4	2.1%	73.4	1	12.0	36	3.2
PED	174	0.7%	24	13.8%	75.0	1	14.1	61	5.2
SPORT	141	0.5%	2	1.4%	71.6	1	9.9	50	3.4
OTHER	134	0.5%	4	3.0%	76.9	1	7.2	50	3.5

Falls are the most common traumatic injury (87%) occurring in the oldest average age (80.5) of geriatric patients. Pedestrian incidents have the highest average ISS (14.1) and longest average hospital stay (5.2 days).

E. 2013-2017 Geriatric Injury Severity and Mortality Rate

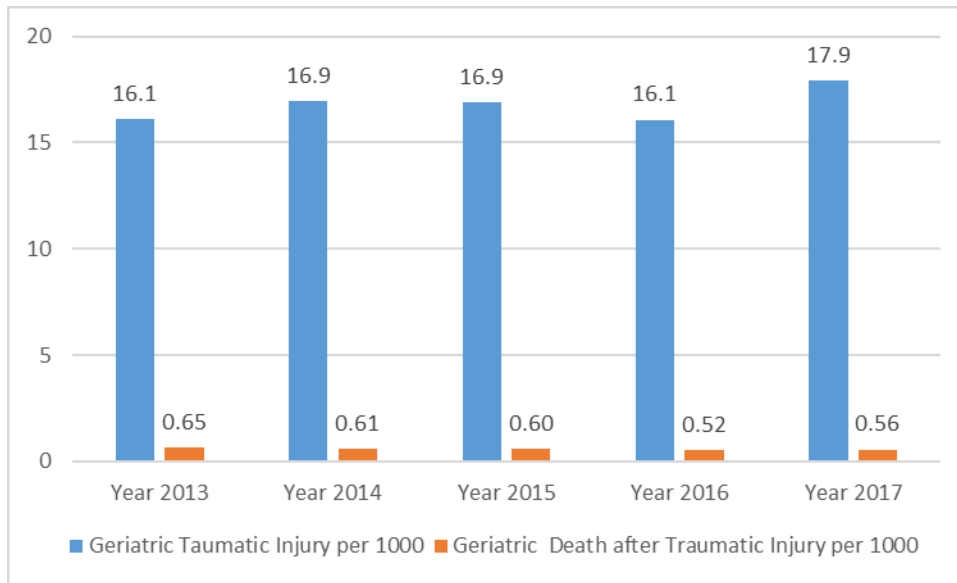
Figure 38 2013-2017 Geriatric injury severity and mortality rate



Compared with pediatric (Figure 28) and adult patients (Figure 33), minor injuries decreased by approximately 10% and moderate injuries increased by approximately 10% in geriatric patients. The mortality rate is higher in geriatric trauma patients for each category of injury severity than their younger counterparts.

F. 2013-2017 Geriatric Per Capita Injury Incidents and Death

Figure 39 2013-2017 Geriatric per capita injury incidents and death



The per capita incident of traumatic injury (5-year average of 16.8 per 1,000) in geriatric patients is about 5.1 times higher than adults (5-year average of 3.3 per 1,000) (Figure 34) and 8.8 times higher than pediatric patients (5-year average of 1.9 per 1,000) (Figure 29). The per capita death for geriatric trauma patients (5-year average of 0.59 per 1,000) is about 5.9 times higher than adults (5-year average of 0.1 per 1,000) and 19.7 times higher than pediatric patients (5-year average of 0.03 per 1,000). At the same time, the number of deaths per capita decreased between 2013 and 2017 (0.65 per 1,000 in 2013 and 0.56 per 1,000 in 2017).

G. 2013-2017 Top 10 Lethal Injuries for Geriatric Trauma Patients

Table 19 2013-2017 Top 10* lethal injuries for geriatric trauma patients

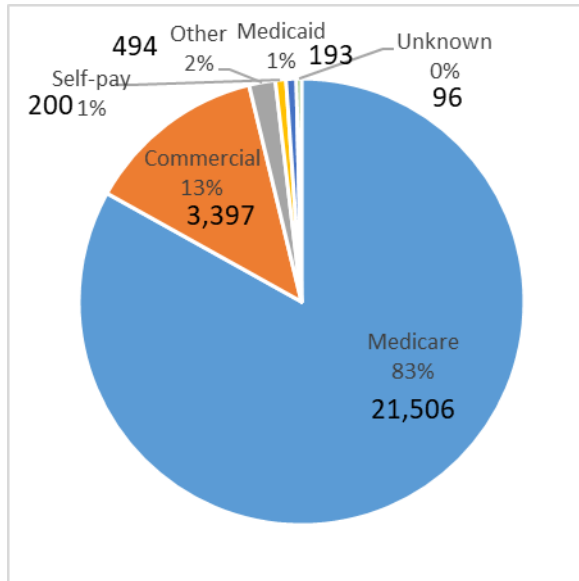
Ranking	Cause	Outcome	Count	%	Total
1	GSW	Alive	27	56.3%	48
		Dead	21	43.8%	
2	PED	Alive	150	86.2%	174
		Dead	24	13.8%	
3	STAB	Alive	39	88.6%	44
		Dead	5	11.4%	
4	BURN	Alive	79	88.8%	89
		Dead	10	11.2%	
5	MC	Alive	182	91.5%	199
		Dead	17	8.5%	
6	CAUGHT	Alive	39	92.9%	42
		Dead	3	7.1%	
7	MV	Alive	1392	93.9%	1,483
		Dead	91	6.1%	
8	STRUCK	Alive	206	96.7%	213
		Dead	7	3.3%	
9	FALL	Alive	21807	96.9%	22,509
		Dead	702	3.1%	
10	OV	Alive	192	97.0%	198
		Dead	6	3.0%	

*Records with unknown and unspecific causes, unknown outcomes, and cause code with less than 30 cases were excluded.

Gunshot wounds are the most lethal injuries (mortality rate of 43.8%), followed by pedestrian incidents (mortality rate of 13.8%). The mortality rates in those injuries are higher than those of their younger counterparts (Table 13 and Table 16).

H. 2013-2017 Payers for Geriatric Trauma Patients

Figure 40 2013-2017 Payers for geriatric trauma patients



Medicare (83%) and commercial insurance (13%) paid for 96% of geriatric trauma patients between 2013 and 2017.

V. Trauma Audit Filters 1 to 8: From Quarterly PIPS Workgroup Discussion 2017-2018

In 2016, the Trauma System Advisory Committee (TSAC) created the Trauma System Audit Filters to improve the trauma system performance in Utah. The State Trauma Performance Improvement and Patient Safety (PIPS) workgroup utilized the UTR data to assess critical issues in patient care addressed in the audit filters. Quarterly meetings were held to discuss the findings.

A. Audit filter 1

Trauma patients with more than one inter-hospital transfer prior to definitive care. (Definitive care is defined as the final discharge hospital.)

1. Summary of findings for audit filter 1

The analysis used 2001-2015 UTR data (n=149,680). There were only 15 double-transfer patients “identifiable.” Since trauma registrars at the definitive care hospitals are seldom able to obtain the name of the original hospital for twice-transferred patients, the State Trauma PIPS workgroup decided to delegate this performance measure to regional PIPS groups where patient transfer information is more readily available.

B. Audit filter 2

Trauma patients with an ISS* (Injury Severity Score) greater than 15 (and all penetrating trauma) or scene RTS* (Revised Trauma Score) less than 5.5 with EMS scene times (EMS scene arrival to EMS scene departure) greater than 10 minutes. *See Appendix C and Appendix H

1. Summary of findings for audit filter 2

The original analysis used 2012-2016 UTR data (n=61,818). The State Trauma PIPS workgroup decided to do away with scene RTS since the completion of the data field was insufficient for the analysis in trauma data. The accuracy of scene time data was also questionable. In order to bypass the problem, 2007 to 2016 UTR data and prehospital data were linked to provide more accurate scene time from the prehospital data. Since air ambulance patient transfers often involve relaying of a patient between two ambulances (e.g., a patient handed from a ground ambulances to an air ambulance), determining the exact scene time for the air transfer was difficult. Therefore, only linked ground ambulance data were used. The extreme scene times (below the 1 percentile and above the 99 percentile) were then excluded, yielding the range with the minimum scene time of 1 minute and the maximum scene time of 66 minutes. The final linked data contained a total of 58,649 matched records. The analysis results showed that the more severe the injury, the faster the patients were transported (Figure 41). Thus, the mortality rate was higher for the trauma patients who were transported in a shorter period of time (Figure 42). This result was contrary to the traditional belief of the “golden 10-minute scene time,” suggesting the shorter the scene time, the lower the mortality rate of trauma patients.

Figure 41 Audit filter 2 - Scene time and injury severity for the trauma patients

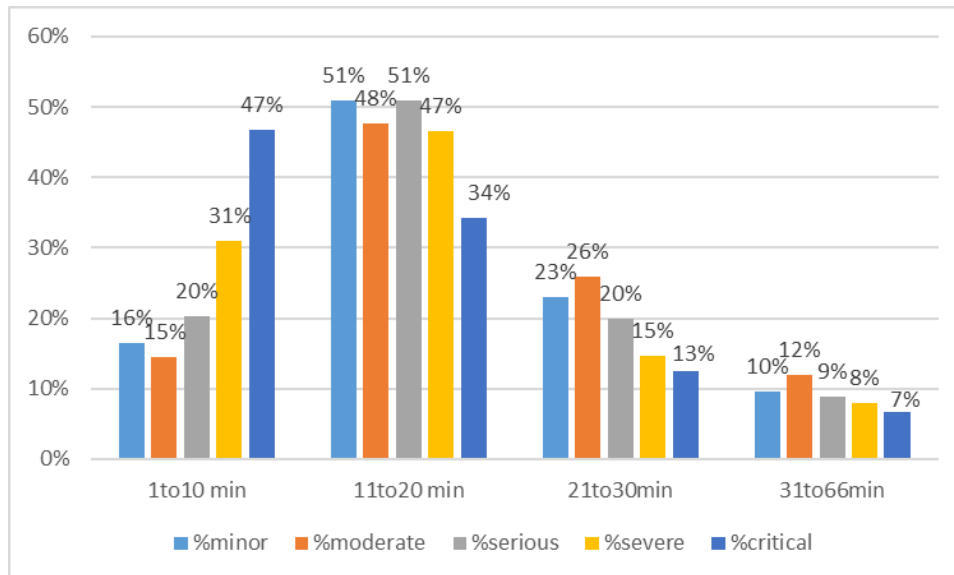
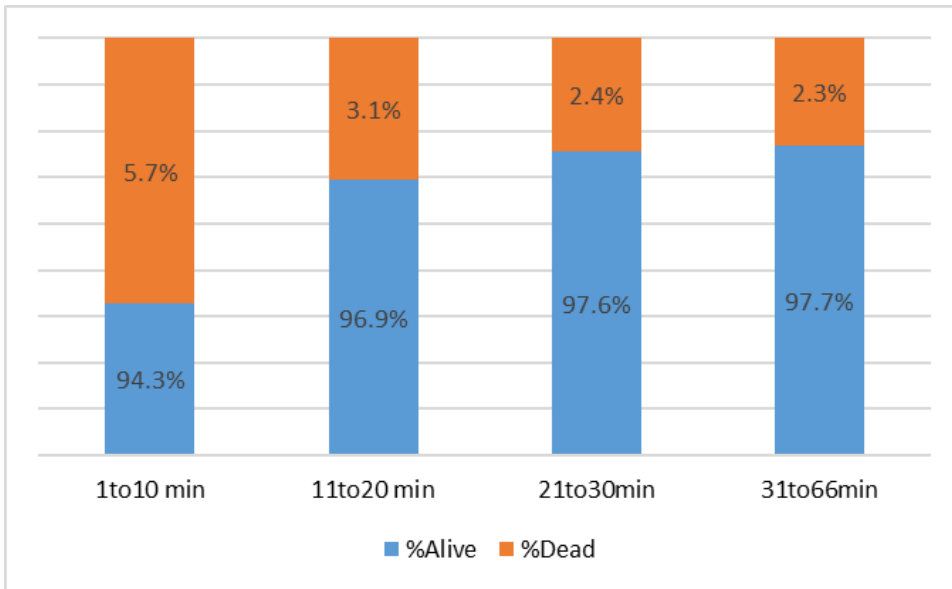


Figure 42 Audit filter 2 - Scene time and mortality rate of trauma patients



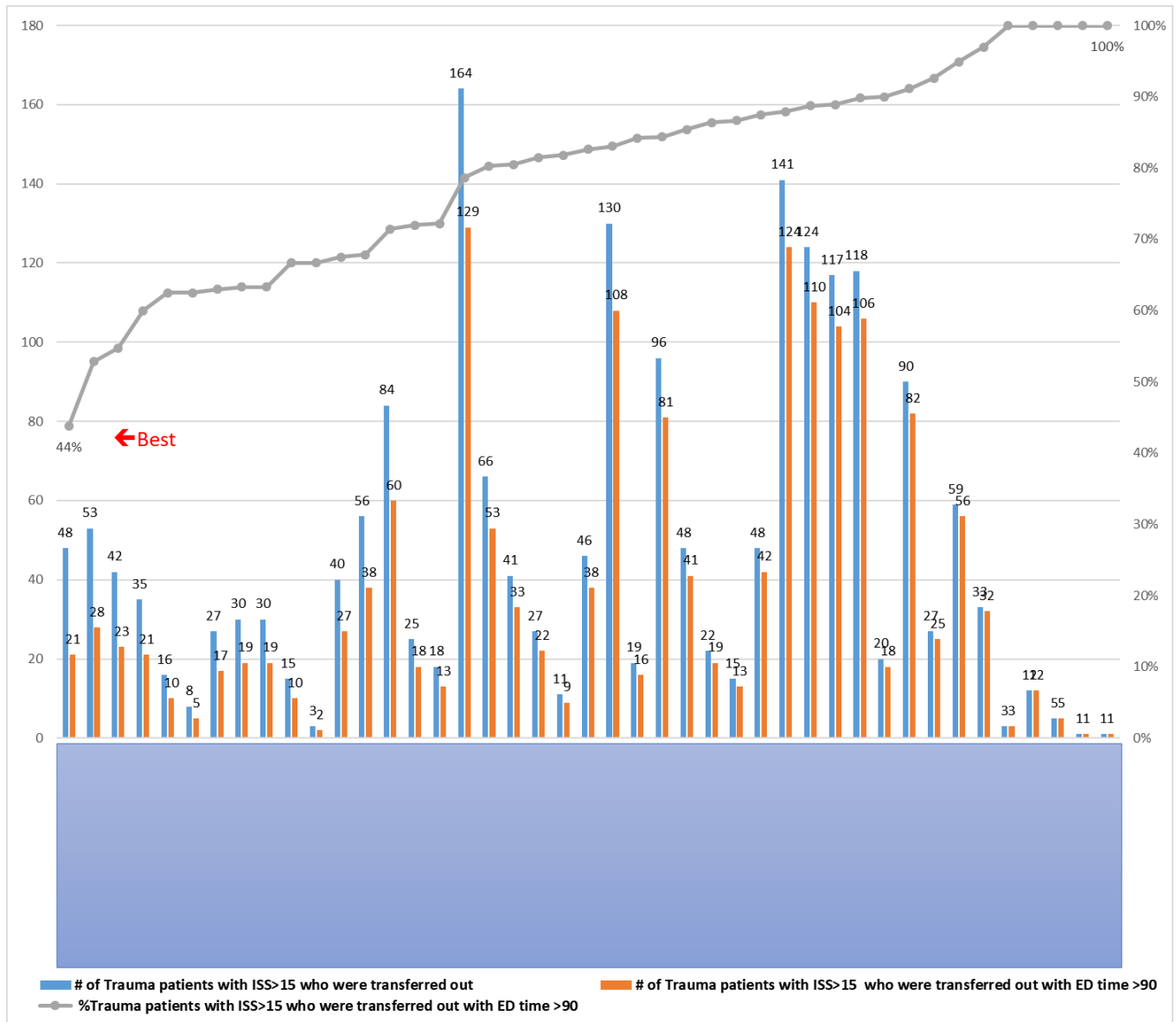
C. Audit filter 3

Transferred trauma patients with an ISS greater than 15 and transfer time (ED admit to ED discharge) greater than 90 minutes.

1. Summary of findings for audit filter 3

The analysis used 2011-2015 UTR (n=60,822). Utah hospitals were assessed for the 90-minute patient transfer time. The best hospital with the highest percentage of patients with serious injury (ISS >15) who were transferred within 90 minutes was identified (Figure 43 – Hospital names are unrevealed). The best hospital’s transfer protocol was distributed among other hospitals as a best practice guide for patient transfer.

Figure 43 Audit filter 3 - Patient transfer time for Utah hospitals



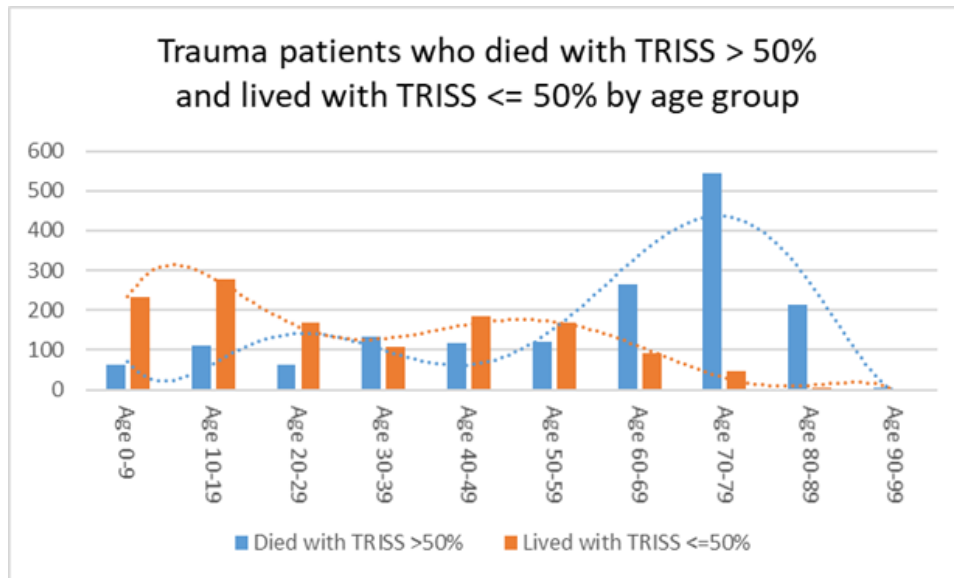
D. Audit filter 4

Trauma patients who die with a probability of survival* (TRISS) > 50% or who live with a probability of survival (TRISS) < 50%. *See Appendix H

1. Summary of findings for audit filter 4

The analysis used 2012-2016 UTR data (n=61,818). The trauma patients who survived serious injuries and a lower probability of survival were predominantly younger (age <=59). On the other hand, the patients who died despite the higher probability of survival score were older (age >= 60) (Figure 44).

Figure 44 Audit filter 4 - Trauma patients who died with TRISS >50% and lived with TRISS <=50%



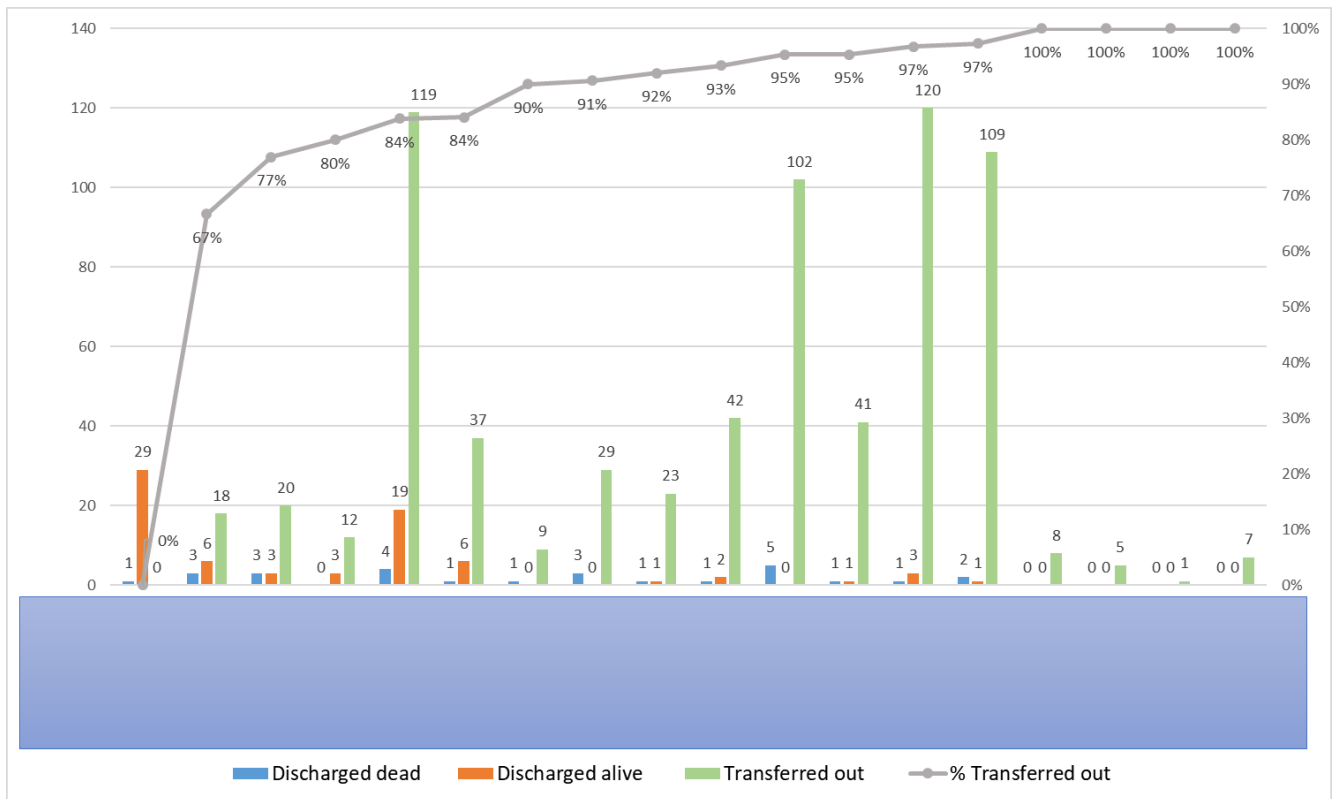
E. Audit filter 5

Trauma patients with an ISS greater than 15 who are discharged from non-state designated trauma centers.

1. Summary of findings for audit filter 5

There were only 101 (0.16%) patients out of a total of 61,691 in 2012-2016 trauma data, who had ISS >15 and were discharged from non-designated hospitals (Figure 45 – Hospital names are unrevealed). Of those 101 patients, 27 (26.7%) arrived dead or died in the ER, which made the number even smaller. The details of discharged patients were examined for the non-designated hospitals with lower transfer rates. The PIPS workgroup decided the hospitals’ performance was satisfactory.

Figure 45 Audit filter 5 - Trauma patients with ISS>15 who were discharged from non-designated hospitals



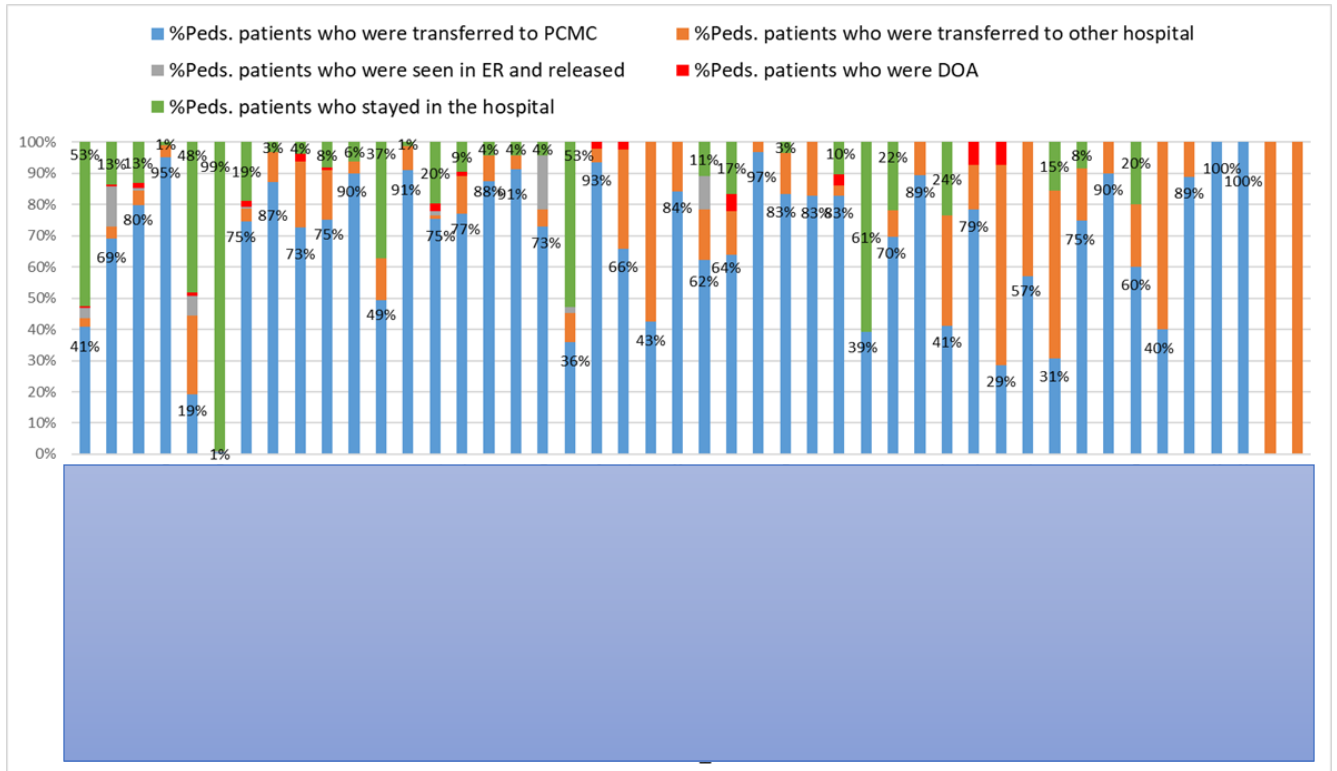
F. Audit filter 6

Trauma patients younger than 15 years old (children) who either had an ED Glasgow Coma Score (GCS)* less than or equal to 13, were intubated, or ISS greater than 15 and were not transferred to a regional pediatric trauma center.* See Appendix H

1. Summary of findings for audit filter 6

The analysis used 2012-2016 UTR data (n=61,818). There were 3,364 patients younger than age 15 who were originally admitted to a hospital that was not a regional pediatric trauma center. Of those, 2,185 (65%) were subsequently transferred to a regional pediatric trauma center, 328 (10%) were transferred to other hospitals, 86 (3%) were seen in the ED and released, 27 (1%) were dead on arrival or died in ED, and 738 (22%) remained in the hospital (Figure 46 – Hospital names are unrevealed). Of those 738, 29 (4%) had ED GCS <=13, 26(4%) were intubated, and 42(6%) had an ISS >15. Seventy-four (10%) had more than one of the three conditions. Out of the 74, three patients died. The PIPS workgroup reviewed the three cases and determined that they were explicable.

Figure 46 Audit filter 6 - Admission and transfer of pediatric patients



G. Audit filter 7

Trauma patients who meet the criteria of steps 1 and 2 of the CDC Trauma Field Triage Guidelines are transported to the highest level trauma center within the region. (NEMESIS* v3.4 data element elnjury.03)

*National Emergency Medical Services Information System

1. Summary of findings for audit filter 7

The analysis used 2012-2016 UTR data (n=61,818). Since elnjury.03 is a new data element for EMS agencies, completeness and accuracy of the data were not optimum for the analysis. The State PIPS workgroup will work to educate EMS agencies to enhance data quality of EMS data for the purposes of patient care performance improvement and patient safety.

H. Audit filter 8

Trauma patients who die at non-designated trauma centers more than one hour after ED arrival, stratified by presenting hospital identifier.

1. Summary of findings for audit filter 8

The analysis used 2012-2016 UTR data (n=61,818). All hospitals (regardless of designation) were examined for this performance measure. There were a total of 176 (0.28%) patients from 30 hospitals who fell under the specified category (Figure 47 – Hospital names are unrevealed). For the 176 patients, falls (63, 36%), motor vehicle incidents (37, 21%), gunshot wounds (34, 19%), pedestrian incidents (10, 6%), and motorcycle incidents (8, 5%) were the top five causes of death (Figure 48). For most of the patients who died, more than half of the injuries had an ISS greater than 15 (Figure 49). Forty-nine (78%) out of the 63 who died as a result of falls were older than age 65. After close examination, 24 (70.6%) out of the 34 gunshot wound patients died of self-inflicted injuries. Given the small number of patients and their injury severities, the PIPS workgroup decided the state hospitals’ performance was satisfactory and any issues concerning individual cases should be discussed at the regional level.

Figure 47 Audit filter 8 - Number of patients who died one hour after ED arrival by hospital

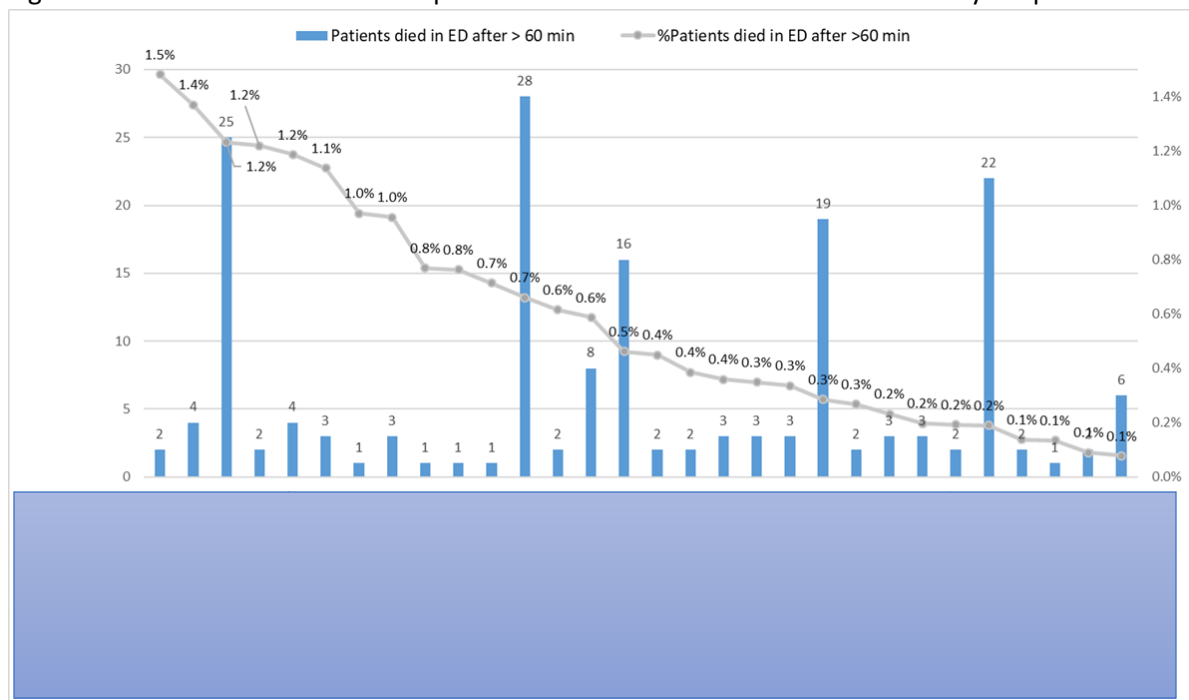


Figure 48 Audit filter 8 - Causes for the trauma patients who died more than one hour after ED arrival.

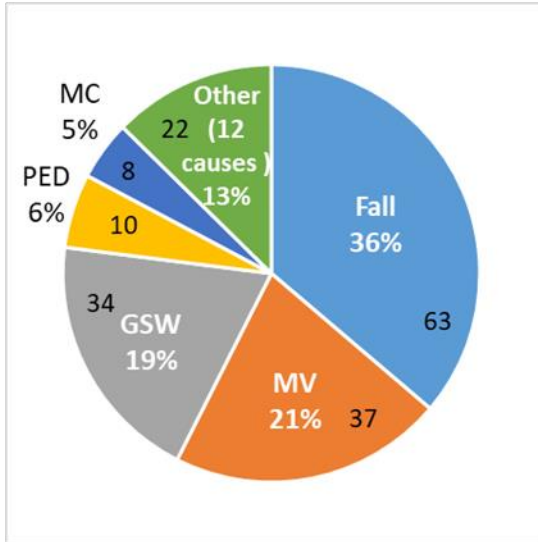
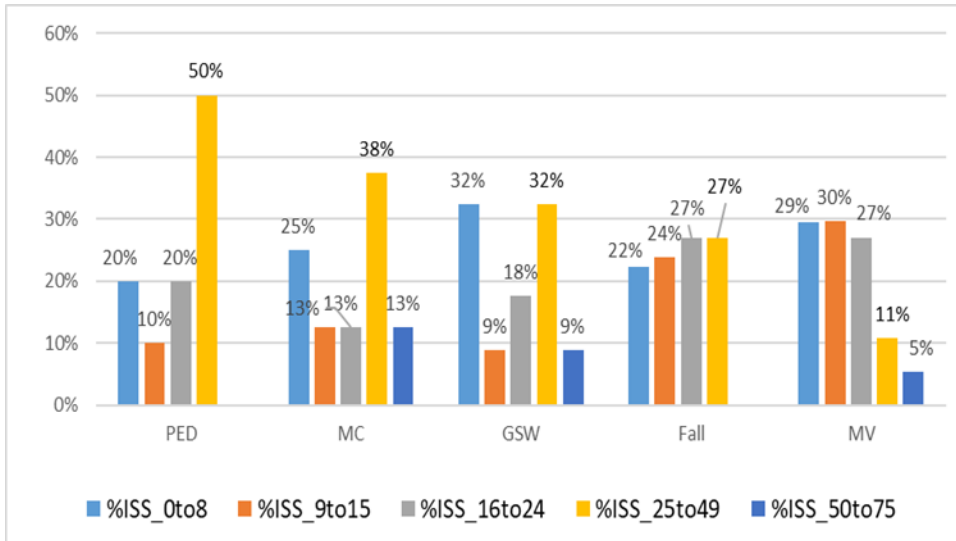


Figure 49 Audit filter 8 - Injury severity for the top 5 causes for patients who died one hour after ED arrival



Appendix A – Utah Trauma System



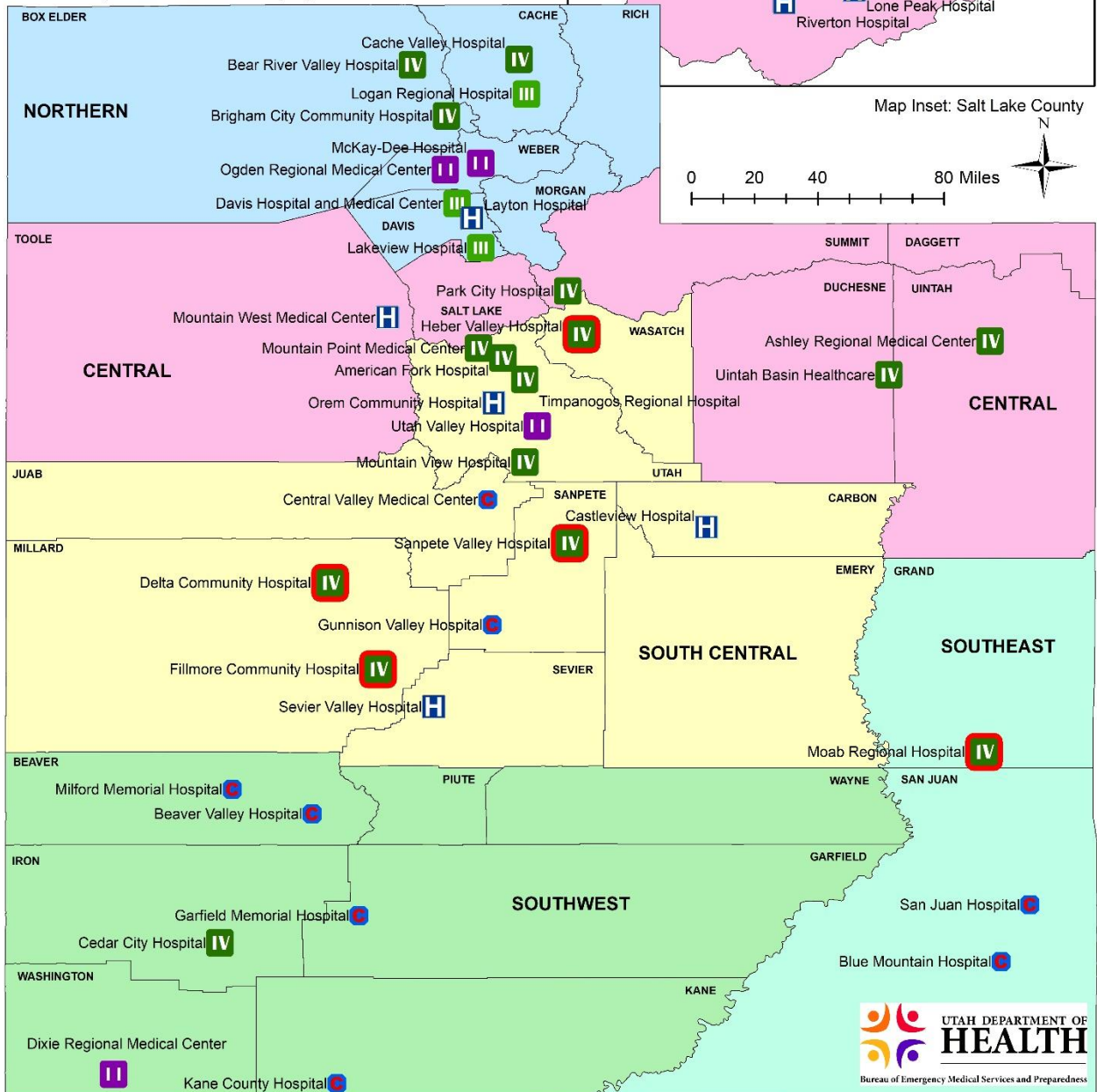
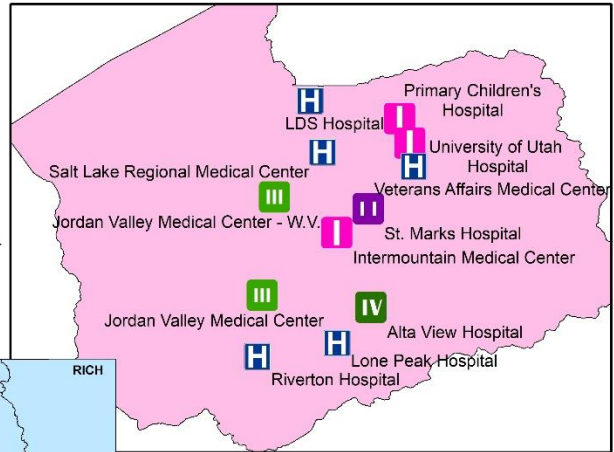
Trauma Performance Improvement Regions

Trauma Care Designation

- I Level I
 - II Level II
 - III Level III
 - IV Level IV
 - IV Level IV & CAH
 - H Resource Hospital
 - H Resource & CAH
- (CAH - Critical Access Hospital)

Trauma Performance Improvement Regions

- NORTHERN
- CENTRAL
- SOUTH CENTRAL
- SOUTHWEST
- SOUTHEAST
- SOUTHWEST



Bureau of Emergency Medical Services and Preparedness

April 2019

List of Hospitals and Designation by Trauma Region

Trauma Region	Hospital Name	Designation
CENTRAL	Intermountain Medical Center	Level I
CENTRAL	Primary Children's Hospital	Level I
CENTRAL	University of Utah Hospital	Level I
CENTRAL	St. Mark's Hospital	Level II
CENTRAL	Jordan Valley Medical Center	Level III
CENTRAL	Jordan Valley Medical Center - West Valley	Level III
CENTRAL	Alta View Hospital	Level IV
CENTRAL	Ashley Regional Medical Center	Level IV
CENTRAL	Park City Hospital	Level IV
CENTRAL	Uintah Basin Healthcare	Level IV
CENTRAL	LDS Hospital	Resource
CENTRAL	Lone Peak Hospital	Resource
CENTRAL	Mountain West Medical Center	Resource
CENTRAL	Riverton Hospital	Resource
CENTRAL	Salt Lake Regional Medical Center	Resource
CENTRAL	Veterans Affairs Medical Center	Resource
NORTHERN	McKay-Dee Hospital	Level II
NORTHERN	Ogden Regional Medical Center	Level II
NORTHERN	Davis Hospital and Medical Center	Level III
NORTHERN	Lakeview Hospital	Level III
NORTHERN	Logan Regional Hospital	Level III
NORTHERN	Bear River Valley Hospital	Level IV
NORTHERN	Brigham City Community Hospital	Level IV
NORTHERN	Cache Valley Hospital	Level IV
NORTHERN	Layton Hospital	Resource
SOUTH CENTRAL	Utah Valley Hospital	Level II
SOUTH CENTRAL	American Fork Hospital	Level IV
SOUTH CENTRAL	Mountain Point Medical Center	Level IV
SOUTH CENTRAL	Mountain View Hospital	Level IV
SOUTH CENTRAL	Timpanogos Regional Hospital	Level IV
SOUTH CENTRAL	Delta Community Hospital	Level IV & CAH
SOUTH CENTRAL	Fillmore Community Hospital	Level IV & CAH
SOUTH CENTRAL	Heber Valley Hospital	Level IV & CAH
SOUTH CENTRAL	Sanpete Valley Hospital	Level IV & CAH
SOUTH CENTRAL	Castleview Hospital	Resource
SOUTH CENTRAL	Orem Community Hospital	Resource
SOUTH CENTRAL	Sevier Valley Hospital	Resource
SOUTH CENTRAL	Central Valley Medical Center	Resource & CAH
SOUTH CENTRAL	Gunnison Valley Hospital	Resource & CAH

List of Hospitals and Designation by Trauma Region (Continued)

SOUTHEAST	Moab Regional Hospital	Level IV & CAH
SOUTHEAST	Blue Mountain Hospital	Resource & CAH
SOUTHEAST	San Juan Hospital	Resource & CAH
SOUTHWEST	Dixie Regional Medical Center	Level II
SOUTHWEST	Cedar City Hospital	Level IV
SOUTHWEST	Beaver Valley Hospital	Resource & CAH
SOUTHWEST	Garfield Memorial Hospital	Resource & CAH
SOUTHWEST	Kane County Hospital	Resource & CAH
SOUTHWEST	Milford Memorial Hospital	Resource & CAH

Trauma Center Levels

Level I

- Admit at least 1,200 trauma patients yearly or have 240 admissions with an Injury Severity Score of more than 15.
- Maintain a surgically directed critical care service including 24-hour pre- and post-anesthesia services, an operating room available within 15 minutes, radiology, ICU team coverage, a full spectrum of surgical specialists, medical consultants, support services, 24-hour laboratory services and adequate blood supply, medical social workers available 24 hours a day and advanced practitioners.
- Orthopedic care must be overseen by an individual who has completed a fellowship in orthopedic traumatology approved by the Orthopedic Trauma Association.
- Cardiothoracic surgery capabilities must be available 24 hours per day and should have cardiopulmonary bypass equipment.
- Participate in the training of residents and be a leader in education and outreach activities including providing continuous rotations for senior residents, providing emergency medicine and surgical specialty residency programs, providing an acute care surgery fellowship, and offering continuing education for trauma nurses and continuing medical education for trauma surgeons.
- Establish a successful trauma research program with a minimum of 20 peer-reviewed articles published in specified journals OR 10 peer-reviewed articles published in specified journals and the demonstration of four specified trauma-related scholarly activities.
- Led by an ICU physician boarded in surgical critical care.

Level I & II

- Qualified attending surgeons must participate in major therapeutic decisions, be present in the emergency department for major resuscitations, be present at operative procedures, and be actively involved in the critical care of all seriously injured patients.
- A resident in postgraduate year 4 or 5 or an attending emergency physician who is part of the trauma team may be approved to begin resuscitation while awaiting the arrival of the attending surgeon but cannot independently fulfill the responsibilities of, or substitute for, the attending surgeon.
- The trauma surgeon on call must be dedicated to a single trauma center while on duty.
- In addition, a published backup call schedule for trauma surgery must be available.

- The trauma director must have responsibility and authority for determining each general surgeon's ability to participate on the trauma panel based on an annual review.
- A surgeon must be present in the emergency department on patient arrival, with adequate notification from the field.
- The surgeon's presence must be in compliance at least 80 percent of the time.
- Participate in regional disaster management plans and exercises.

Level III

- Level III trauma centers can provide prompt assessment, resuscitation, emergency operations, and stabilization and also arrange for transfer to a facility that can provide definitive trauma care when needed.
- Provide continuous general surgical coverage.
- The trauma director must have responsibility and authority for determining each general surgeon's ability to participate on the trauma panel based on an annual review.
- A surgeon must be present in the emergency department on patient arrival, with adequate notification from the field.
- The surgeon's presence must be in compliance at least 80 percent of the time.
- Participate in regional disaster management plans and exercises.

Level IV

- Provide the initial evaluation and assessment of injured patients, and transfer patients pursuant to a well-defined transfer plan.
- Ensure 24-hour emergency coverage by a physician or mid-level provider.
- Be continuously available for resuscitation, with coverage by a registered nurse and physician or mid-level provider, and it must have a physician director.
- Providers must maintain current Advanced Trauma Life Support® certification as part of their competencies in trauma.
- Attend a minimum of 8 hours of trauma-related continuing medical education (CME) per year.
- Develop and regularly review collaborative treatment and transfer guidelines with input from higher-level trauma centers in the region.
- Participate in regional and statewide trauma system meetings and committees that provide oversight.
- Act as the local trauma authority, and provide training for prehospital and hospital-based providers.
- A surgeon must be present in the emergency department on patient arrival, with adequate notification from the field.
- The surgeon's presence must be in compliance at least 80 percent of the time.
- Participate in regional disaster management plans and exercises.

Source: Trauma Center Association of America: Trauma center levels defined. Retrieved from <https://www.traumacenters.org/page/TraumaCentersLevels>

Critical Access Hospital (CAH)

A Medicare-participating hospital can become certified and remain certified as a CAH by meeting the following regulatory requirements (this list is not all-inclusive but indicates some of the basic criteria):

- Located in a state that established a rural health plan for MRHFPs (Medicare Rural Hospital Flexibility Program - as of February 2018, only Connecticut, Delaware, Maryland, New Jersey, and Rhode Island have not established MRHFP State Rural Plans).
- Located in a rural area or an area treated as rural under a special provision that allows treating qualified hospital providers in urban areas as rural (refer to 42 CFR 412.103 regulations). A CAH has a 2-year transition period to reclassify as rural if its location changes to an urban area due to changes in Office of Management and Budget (OMB) designation.
- Furnishes 24-hour emergency services, 7 days a week, using either on-site or on-call staff, with specific on-site, on-call staff response times.
- Does not exceed 25 inpatient beds also used for swing bed services. It may operate a distinct part rehabilitation and/or psychiatric unit, each with up to 10 beds. CAHs with distinct part units (DPUs) must follow all hospital Condition of Participation (CoP) and CAH CoP.
- Report an annual average acute care inpatient length of stay (LOS) of 96 hours or less (excluding swing bed services and DPU beds). Medicare does not assess this requirement on initial certification and only applies after CAH certification.
- A CAH that has not been designated by a state as a necessary provider prior to December 31, 2005, must be located more than a 35-mile drive (or in the case of mountainous terrain or in areas with only secondary roads available, a 15-mile drive) from any other CAH or hospital.

Source: Centers for Medicare & Medicaid Services: Critical access hospital. Retrieved from <https://www.cms.gov/outreach-and-education/medicare-learning-network-mln/mlnproducts/downloads/critaccesshospfctshst.pdf>

Resource Hospital

Resource Hospitals are designated by the State EMS Committee to provide on-line medical directions for EMS providers. The EMS Committee has designated all acute care hospitals and the Veteran's Administration (VA) hospital in Utah as resource hospitals.

Source: Utah Bureau of Emergency Medical Services and Preparedness, Strategic Plan, January 1, 2015 – December 31, 2019. Retrieved from <https://bemsp.utah.gov/bemsp/wp-content/uploads/sites/34/2016/08/2015-2019-BEMSP-Strategic-Plan.pdf>

Utah Administrative Code R426-9-1000 lists Resource Hospital Minimum Designation Requirements as follows:

A Resource Hospital shall meet the following minimum requirements for designation:

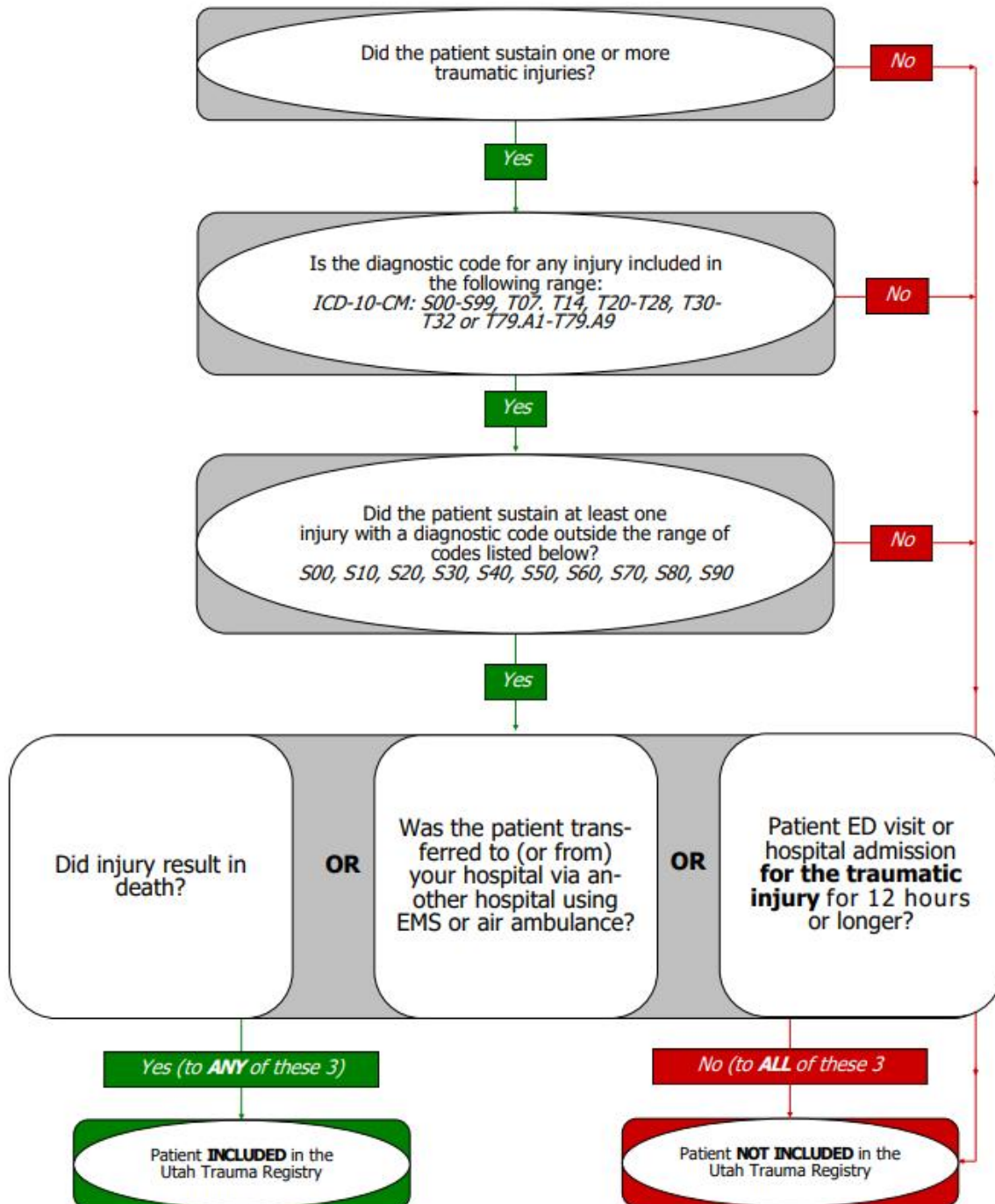
- (1) Be licensed in Utah or another state as a general acute hospital or be a Veteran's Administration hospital operating in Utah;
- (2) Have the ability to communicate with other EMS providers operating in the area;
- (3) Provide on-line medical control for all pre-hospital EMS providers who request assistance for patient care, 24 hours-a-day, seven days a week;

- (4) Create and abide by written pre-hospital emergency patient care protocols for use in providing on-line medical control for pre-hospital EMS providers;
- (5) Train new staff on the protocols before the new staff is permitted to provide on-line medical control and annually review protocols with physician and nursing staff;
- (6) Annually provide in-service training on the protocols to all physicians and nurses who provide on-line medical control;
- (7) Make the protocols immediately available to staff for reference;
- (8) Provide on-line medical control which shall include:
 - (a) direct voice communication with a physician; or
 - (b) a registered nurse or physician's assistant, who shall to be licensed in Utah, who is in voice contact with a physician;
- (9) Implement a quality improvement process which shall include:
 - (a) representatives from local EMS providers that routinely transport patients to the resource hospital;
 - (b) quarterly meetings; and
 - (c) minutes of the quality improvement meetings which are available for Department review;
- (10) Identify a coordinator for the pre-hospital quality improvement process;
- (11) Cooperate with the pre-hospital EMS providers' off-line medical directors in the quality review process, including granting access to hospital medical records of patients served by the particular pre-hospital EMS provider;
- (12) Participate in local and regional forums for performance improvement; and
- (13) Assist the Department in evaluating EMS system effectiveness by submitting to the Department, in an electronic format quarterly data specified by the Department.
- (14) Designated Trauma Centers are deemed to meet the Resource Hospital standards and are exempt from requirements outlined in this section.
- (15) The resource hospital designation and re-designation shall be for a period of three years.

Source: Utah Administrative Code. Retrieved from <https://rules.utah.gov/publicat/code/r426/r426-009.htm#T10>

Appendix B – UTR Trauma data inclusion criteria

2018 Utah Trauma Registry Inclusion Criteria



Source: Utah Trauma Registry: 2018 Utah trauma registry inclusion criteria. Retrieved from https://www.utahtrauma.org/publicResources/documents/inclusionflowchart_2018.pdf

Appendix C – Injury Severity Score (ISS) and Abbreviated Injury Scale (AIS)

INJURY SEVERITY SCORE (ISS)

The Injury Severity Score (ISS) is an anatomical scoring system that provides an overall score for patients with multiple injuries. Each injury is assigned an AIS and is allocated to one of six body regions (Head, Face, Chest, Abdomen, Extremities (including Pelvis), External). Only the highest AIS score in each body region is used. The 3 most severely injured body regions have their score squared and added together to produce the ISS score.

An example of the ISS calculation is shown below:

Region	Injury Description	AIS	Square Top Three
Head & Neck	Cerebral Contusion	3	9
Face	No Injury	0	
Chest	Flail Chest	4	16
Abdomen	Minor Contusion of Liver Complex Rupture Spleen	2 5	25
Extremity	Fractured femur	3	
External	No Injury	0	
Injury Severity Score:			50

The ISS score takes values from 0 to 75. If an injury is assigned an AIS of 6 (unsurvivable injury), the ISS score is automatically assigned to 75. The ISS score is virtually the only anatomical scoring system in use and correlates linearly with mortality, morbidity, hospital stay and other measures of severity.

ABBREVIATED INJURY SCALE

The Abbreviated Injury Scale (AIS) is an anatomical scoring system first introduced in 1969. Since this time it has been revised and updated against survival so that it now provides a reasonably accurate ranking of the severity of injury. The latest incarnation of the AIS score is the 1998 revision. The AIS is monitored by a scaling committee of the Association for the Advancement of Automotive Medicine.

Injuries are ranked on a scale of 1 to 6, with 1 being minor, 5 severe, and 6 a nonsurvivable injury. This represents the 'threat to life' associated with an injury and is not meant to represent a comprehensive measure of severity. The AIS is not an injury scale, in that the difference between AIS1 and AIS2 is not the same as that between AIS4 and AIS5. There are many similarities between the AIS scale and the Organ Injury Scales of the AAST.

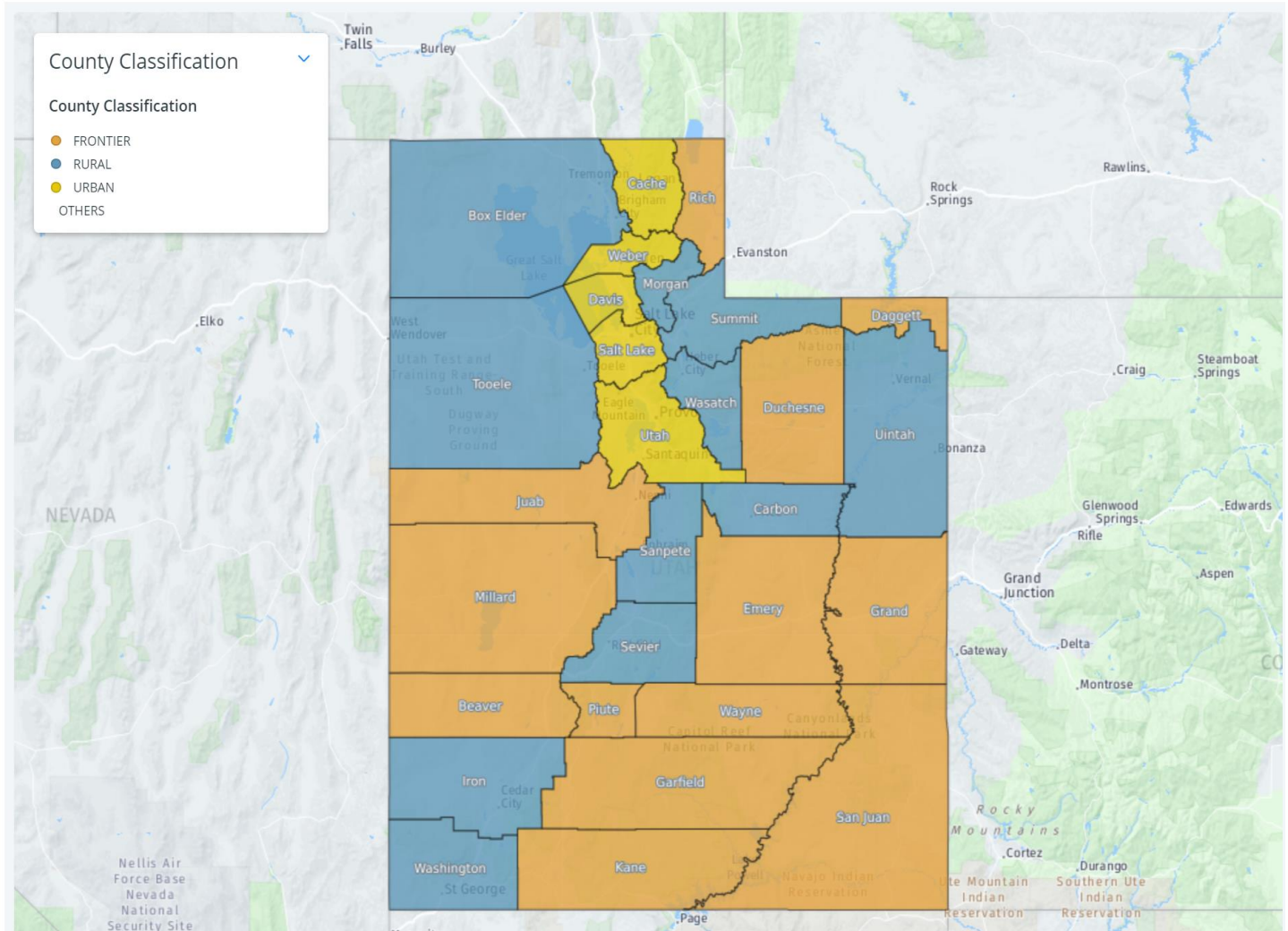
Injury	AIS Score
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Unsurvivable

Source: Injury Severity Scoring. Retrieved from https://www.surgicalcriticalcare.net/Resources/injury_severity_scoring.pdf

Appendix D – County Classification

County Classifications Map

This is an interactive map of the 29 counties in Utah as defined by their Urban, Rural and Frontier status. Urban counties have a population density of > 100 people per sq. mile; Rural counties have a population density of <99 and > 6 people per sq. mile and Frontier counties have < 6 people per sq. mile.



Source: County classifications. Retrieved from <https://ruralhealth.health.utah.gov/portal/county-classifications-map/>

Appendix E – 2013-2017 Per capita Traumatic Injury by County and Age Group

Source: Annual Estimates of the Resident Population as of July 1, 2017. U.S. Census Bureau.

2013-2017 5-year per capita average traumatic injury incident ranking for counties

County	2013			2014			2015			2016			2017			2013-2017 per capita average	5-year Per capita average ranking
	Population estimate	Traumatic injury count	Traumatic Injury per 1000	Population estimate	Traumatic injury count	Traumatic Injury per 1000	Population estimate	Traumatic injury count	Traumatic Injury per 1000	Population estimate	Traumatic injury count	Traumatic Injury per 1000	Population estimate	Traumatic injury count	Traumatic Injury per 1000		
Beaver	6,462	73	11.3	6,426	38	5.9	6,344	57	9.0	6,454	47	7.3	6,386	57	8.9	8.5	8
Box Elder	50,734	254	5.0	51,302	248	4.8	51,821	310	6.0	52,974	229	4.3	54,079	328	6.1	5.2	14
Cache	117,043	370	3.2	117,867	399	3.4	119,748	399	3.3	122,342	384	3.1	124,438	499	4.0	3.4	25
Carbon	20,908	101	4.8	20,621	109	5.3	20,366	101	5.0	20,371	63	3.1	20,295	46	2.3	4.1	18
Daggett	1,139	6	5.3	1,123	10	8.9	1,106	12	10.8	1,081	5	4.6	1,029	8	7.8	7.5	10
Davis	322,306	688	2.1	328,778	1038	3.2	334,834	767	2.3	341,329	830	2.4	347,637	992	2.9	2.6	29
Duchesne	19,973	109	5.5	20,214	99	4.9	20,766	117	5.6	20,315	79	3.9	20,026	102	5.1	5.0	17
Emery	10,759	46	4.3	10,637	51	4.8	10,356	44	4.2	10,222	27	2.6	10,077	27	2.7	3.7	22
Garfield	5,033	63	12.5	5,012	51	10.2	4,978	48	9.6	5,000	60	12.0	5,078	74	14.6	11.8	2
Grand	9,374	74	7.9	9,469	80	8.4	9,547	91	9.5	9,656	123	12.7	9,674	114	11.8	10.1	3
Iron	46,532	163	3.5	47,050	176	3.7	48,139	194	4.0	49,796	160	3.2	51,001	210	4.1	3.7	23
Juab	10,262	103	10.0	10,411	107	10.3	10,545	102	9.7	11,003	87	7.9	11,250	104	9.2	9.4	5
Kane	7,122	29	4.1	7,169	35	4.9	7,046	33	4.7	7,326	69	9.4	7,567	50	6.6	5.9	12
Millard	12,546	103	8.2	12,537	120	9.6	12,628	101	8.0	12,682	139	11.0	12,863	143	11.1	9.6	4
Morgan	10,206	29	2.8	10,590	38	3.6	11,030	33	3.0	11,373	34	3.0	11,873	41	3.5	3.2	26
Piute	1,487	14	9.4	1,467	18	12.3	1,492	11	7.4	1,463	6	4.1	1,420	16	11.3	8.9	7
Rich	2,264	17	7.5	2,274	23	10.1	2,298	17	7.4	2,306	28	12.1	2,391	20	8.4	9.1	6
Salt Lake	1,080,830	4160	3.8	1,091,271	4339	4.0	1,104,372	4476	4.1	1,121,379	4289	3.8	1,135,649	4666	4.1	4.0	19
San Juan	14,988	47	3.1	15,052	51	3.4	15,238	53	3.5	15,329	53	3.5	15,356	32	2.1	3.1	27
Sanpete	28,128	189	6.7	28,307	225	7.9	28,686	206	7.2	29,303	188	6.4	30,035	181	6.0	6.9	11
Sevier	20,752	115	5.5	20,734	117	5.6	20,857	108	5.2	21,147	110	5.2	21,316	128	6.0	5.5	13
Summit	38,461	453	11.8	39,099	428	10.9	39,599	447	11.3	40,390	532	13.2	41,106	556	13.5	12.1	1
Tooele	60,640	302	5.0	61,448	340	5.5	62,641	286	4.6	64,599	317	4.9	67,456	346	5.1	5.0	16
Uintah	35,690	107	3.0	36,905	131	3.5	37,776	146	3.9	36,194	133	3.7	35,150	149	4.2	3.7	24
Utah	551,633	1463	2.7	560,909	1394	2.5	573,038	1509	2.6	590,475	1366	2.3	606,425	1931	3.2	2.7	28
Wasatch	26,673	112	4.2	27,906	136	4.9	29,273	162	5.5	30,571	183	6.0	32,106	168	5.2	5.2	15
Washington	147,077	540	3.7	151,179	489	3.2	154,731	577	3.7	159,237	514	3.2	165,662	836	5.0	3.8	21
Wayne	2,717	21	7.7	2,695	25	9.3	2,684	19	7.1	2,685	23	8.6	2,719	20	7.4	8.0	9
Weber	238,222	800	3.4	240,219	1077	4.5	242,978	903	3.7	247,319	901	3.6	251,769	981	3.9	3.8	20

2013-2017 5-year per capita average serious (ISS >15) traumatic injury incident ranking for counties

County	2013			2014			2015			2016			2017			2013-2017 Serious (ISS>15) traumatic injury per capita average	5-year Serious (ISS>15) traumatic injury per capita average ranking
	Population estimate	Serious (ISS>15) traumatic injury count	Serious (ISS>15) traumatic Injury per 1000	Population estimate	Serious (ISS>15) traumatic injury count	Serious (ISS>15) traumatic Injury per 1000	Population estimate	Serious (ISS>15) traumatic injury count	Serious (ISS>15) traumatic Injury per 1000	Population estimate	Serious (ISS>15) traumatic injury count	Serious (ISS>15) traumatic Injury per 1000	Population estimate	Serious (ISS>15) traumatic injury count	Serious (ISS>15) traumatic Injury per 1000		
Beaver	6,462	17	2.6	6,426	6	0.9	6,344	11	1.7	6,454	3	0.5	6,386	33	5.2	2.2	6
Box Elder	50,734	58	1.1	51,302	55	1.1	51,821	63	1.2	52,974	18	0.3	54,079	143	2.6	1.3	13
Cache	117,043	81	0.7	117,867	116	1.0	119,748	111	0.9	122,342	20	0.2	124,438	262	2.1	1.0	19
Carbon	20,908	22	1.1	20,621	24	1.2	20,366	19	0.9	20,371	12	0.6	20,295	23	1.1	1.0	20
Daggett	1,139	3	2.6	1,123	4	3.6	1,106	1	0.9	1,081	0	0.0	1,029	2	1.9	1.8	8
Davis	322,306	151	0.5	328,778	156	0.5	334,834	116	0.3	341,329	49	0.1	347,637	426	1.2	0.5	28
Duchesne	19,973	24	1.2	20,214	34	1.7	20,766	29	1.4	20,315	4	0.2	20,026	41	2.0	1.3	12
Emery	10,759	18	1.7	10,637	14	1.3	10,356	7	0.7	10,222	3	0.3	10,077	14	1.4	1.1	15
Garfield	5,033	11	2.2	5,012	10	2.0	4,978	7	1.4	5,000	1	0.2	5,078	24	4.7	2.1	7
Grand	9,374	5	0.5	9,469	10	1.1	9,547	9	0.9	9,656	2	0.2	9,674	34	3.5	1.3	14
Iron	46,532	30	0.6	47,050	41	0.9	48,139	39	0.8	49,796	6	0.1	51,001	92	1.8	0.9	23
Juab	10,262	22	2.1	10,411	32	3.1	10,545	22	2.1	11,003	9	0.8	11,250	44	3.9	2.4	5
Kane	7,122	4	0.6	7,169	7	1.0	7,046	6	0.9	7,326	0	0.0	7,567	19	2.5	1.0	18
Millard	12,546	27	2.2	12,537	26	2.1	12,628	19	1.5	12,682	8	0.6	12,863	83	6.5	2.6	3
Morgan	10,206	10	1.0	10,590	7	0.7	11,030	7	0.6	11,373	2	0.2	11,873	12	1.0	0.7	26
Piute	1,487	4	2.7	1,467	3	2.0	1,492	4	2.7	1,463	3	2.1	1,420	8	5.6	3.0	1
Rich	2,264	8	3.5	2,274	6	2.6	2,298	3	1.3	2,306	3	1.3	2,391	9	3.8	2.5	4
Salt Lake	1,080,830	759	0.7	1,091,271	814	0.7	1,104,372	827	0.7	1,121,379	265	0.2	1,135,649	1734	1.5	0.8	24
San Juan	14,988	4	0.3	15,052	5	0.3	15,238	6	0.4	15,329	1	0.1	15,356	13	0.8	0.4	29
Sanpete	28,128	24	0.9	28,307	37	1.3	28,686	36	1.3	29,303	13	0.4	30,035	84	2.8	1.3	11
Sevier	20,752	28	1.3	20,734	35	1.7	20,857	25	1.2	21,147	13	0.6	21,316	50	2.3	1.4	9
Summit	38,461	110	2.9	39,099	105	2.7	39,599	82	2.1	40,390	32	0.8	41,106	194	4.7	2.6	2
Tooele	60,640	44	0.7	61,448	54	0.9	62,641	66	1.1	64,599	34	0.5	67,456	127	1.9	1.0	17
Uintah	35,690	18	0.5	36,905	29	0.8	37,776	34	0.9	36,194	5	0.1	35,150	74	2.1	0.9	21
Utah	551,633	228	0.4	560,909	236	0.4	573,038	242	0.4	590,475	68	0.1	606,425	795	1.3	0.5	27
Wasatch	26,673	22	0.8	27,906	23	0.8	29,273	34	1.2	30,571	16	0.5	32,106	56	1.7	1.0	16
Washington	147,077	105	0.7	151,179	87	0.6	154,731	73	0.5	159,237	17	0.1	165,662	421	2.5	0.9	22
Wayne	2,717	3	1.1	2,695	7	2.6	2,684	1	0.4	2,685	2	0.7	2,719	5	1.8	1.3	10
Weber	238,222	143	0.6	240,219	147	0.6	242,978	152	0.6	247,319	60	0.2	251,769	379	1.5	0.7	25

2013 Per capita traumatic injury incident ranking for counties by age group

2013																	
County	Age 0-14 population	Age 0-14 Traumatic injury count	Age 0-14 Traumatic injury per 1000	Age 0-14 Ranking	Age 15-64 population	Age 15-64 Traumatic injury count	Age 15-64 Traumatic injury per 1000	Age 15-64 Ranking	Age 65+ population	Age 65+ Traumatic injury count	Age 65+ Traumatic injury per 1000	Age 65+ Ranking	Total population	Total Traumatic injury count	Total Traumatic injury per 1000	Total Ranking	
Beaver	1754	3	1.7	17	3849	46	12.0	2	859	24	27.9	3	6462	73	11.3	3	
Box Elder	14059	22	1.6	21	30664	133	4.3	15	6011	99	16.5	8	50734	254	5.0	14	
Cache	31118	64	2.1	14	76265	162	2.1	27	9660	144	14.9	12	117043	370	3.2	24	
Carbon	4834	13	2.7	10	13036	56	4.3	16	3038	32	10.5	22	20908	101	4.8	16	
Daggett	237	0	0.0	29	676	4	5.9	10	226	2	8.8	26	1139	6	5.3	13	
Davis	92090	85	0.9	26	201470	266	1.3	29	28746	336	11.7	19	322306	687	2.1	29	
Duchesne	5901	16	2.7	9	11983	68	5.7	11	2089	25	12.0	18	19973	109	5.5	12	
Emery	2832	7	2.5	11	6418	24	3.7	18	1509	15	9.9	25	10759	46	4.3	17	
Garfield	1022	3	2.9	8	3073	31	10.1	4	938	29	30.9	1	5033	63	12.5	1	
Grand	1762	2	1.1	23	6145	49	8.0	8	1467	23	15.7	9	9374	74	7.9	7	
Iron	11426	22	1.9	15	29947	73	2.4	24	5159	68	13.2	17	46532	163	3.5	22	
Juab	2988	13	4.4	5	6133	74	12.1	1	1141	16	14.0	15	10262	103	10.0	4	
Kane	1395	3	2.2	13	4187	15	3.6	19	1540	11	7.1	28	7122	29	4.1	19	
Millard	3251	16	4.9	3	7364	46	6.2	9	1931	41	21.2	4	12546	103	8.2	6	
Morgan	2981	0	0.0	29	6088	17	2.8	22	1137	12	10.6	21	10206	29	2.8	27	
Piute	321	2	6.2	2	828	7	8.5	5	338	5	14.8	14	1487	14	9.4	5	
Rich	576	2	3.5	6	1308	11	8.4	6	380	4	10.5	23	2264	17	7.5	9	
Salt Lake	261922	430	1.6	20	717669	1969	2.7	23	101239	1761	17.4	6	1080830	4160	3.8	20	
San Juan	4013	7	1.7	16	9124	30	3.3	20	1851	10	5.4	29	14988	47	3.1	25	
Sanpete	6394	30	4.7	4	18271	86	4.7	13	3463	73	21.1	5	28128	189	6.7	10	
Sevier	5313	9	1.7	18	12278	59	4.8	12	3161	47	14.9	13	20752	115	5.5	11	
Summit	8391	55	6.6	1	26446	294	11.1	3	3624	104	28.7	2	38461	453	11.8	2	
Tooele	17789	54	3.0	7	37920	171	4.5	14	4931	77	15.6	10	60640	302	5.0	15	
Uintah	10408	13	1.2	22	22032	66	3.0	21	3250	28	8.6	27	35690	107	3.0	26	
Utah	165618	173	1.0	24	347701	696	2.0	28	38314	594	15.5	11	551633	1463	2.7	28	
Wasatch	7525	17	2.3	12	16692	70	4.2	17	2456	25	10.2	24	26673	112	4.2	18	
Washington	35492	36	1.0	25	84026	185	2.2	26	27559	319	11.6	20	147077	540	3.7	21	
Wayne	629	0	0.0	29	1604	13	8.1	7	484	8	16.5	7	2717	21	7.7	8	
Weber	59193	98	1.7	19	153262	347	2.3	25	25767	354	13.7	16	238222	799	3.4	23	

2014 Per capita traumatic injury incident ranking for counties by age group

2014																
County	Age 0-14 population	Age 0-14 Traumatic injury	Age 0-14 Traumatic injury per 1000	Age 0-14 Ranking	Age 15-64 population	Age 15-64 Traumatic injury	Age 15-64 Traumatic injury per 1000	Age 15-64 Ranking	Age 65+ population	Age 65+ Traumatic injury	Age 65+ Traumatic injury per 1000	Age 65+ Ranking	Total population	Total Traumatic injury	Total Traumatic injury per 1000	Total Ranking
Beaver	1710	4	2.3	14	3830	18	4.7	16	886	16	18.1	6	6426	38	5.9	11
Box Elder	14111	28	2.0	17	31043	127	4.1	17	6148	93	15.1	14	51302	248	4.8	18
Cache	31236	61	2.0	18	76594	182	2.4	26	10037	156	15.5	12	117867	399	3.4	26
Carbon	4673	19	4.1	6	12815	50	3.9	18	3133	40	12.8	19	20621	109	5.3	14
Daggett	227	2	8.8	1	664	4	6.0	10	232	4	17.2	8	1123	10	8.9	8
Davis	92672	177	1.9	20	206079	396	1.9	27	30027	465	15.5	13	328778	1038	3.2	28
Duchesne	5938	10	1.7	23	12147	65	5.4	12	2129	24	11.3	23	20214	99	4.9	15
Emery	2774	10	3.6	9	6314	24	3.8	19	1549	17	11.0	24	10637	51	4.8	19
Garfield	1005	1	1.0	26	3042	29	9.5	7	965	21	21.8	4	5012	51	10.2	4
Grand	1782	7	3.9	7	6158	48	7.8	8	1529	25	16.4	10	9469	80	8.4	9
Iron	11533	12	1.0	25	30146	77	2.6	25	5371	87	16.2	11	47050	176	3.7	22
Juab	3030	14	4.6	5	6195	79	12.8	1	1186	14	11.8	22	10411	107	10.3	3
Kane	1376	5	3.6	8	4235	22	5.2	13	1558	8	5.1	29	7169	35	4.9	16
Millard	3244	10	3.1	11	7305	86	11.8	3	1988	24	12.1	20	12537	120	9.6	6
Morgan	3102	6	1.9	19	6306	18	2.9	23	1182	14	11.8	21	10590	38	3.6	23
Piute	316	0	0.0	29	805	8	9.9	6	346	10	28.9	1	1467	18	12.3	1
Rich	563	2	3.6	10	1325	16	12.1	2	386	5	13.0	18	2274	23	10.1	5
Salt Lake	261519	485	1.9	21	724252	2049	2.8	24	105500	1805	17.1	9	1091271	4339	4.0	21
San Juan	3942	5	1.3	24	9213	31	3.4	20	1897	15	7.9	28	15052	51	3.4	25
Sanpete	6294	33	5.2	3	18429	112	6.1	9	3584	80	22.3	3	28307	225	7.9	10
Sevier	5205	12	2.3	15	12337	60	4.9	14	3192	45	14.1	16	20734	117	5.6	12
Summit	8406	44	5.2	4	26733	288	10.8	4	3960	96	24.2	2	39099	428	10.9	2
Tooele	17800	50	2.8	12	38429	185	4.8	15	5219	105	20.1	5	61448	340	5.5	13
Uintah	10851	19	1.8	22	22679	65	2.9	22	3375	47	13.9	17	36905	131	3.5	24
Utah	166838	132	0.8	28	354090	672	1.9	28	39981	590	14.8	15	560909	1394	2.5	29
Wasatch	7775	17	2.2	16	17496	94	5.4	11	2635	25	9.5	26	27906	136	4.9	17
Washington	35839	31	0.9	27	86027	155	1.8	29	29313	303	10.3	25	151179	489	3.2	27
Wayne	615	5	8.1	2	1594	16	10.0	5	486	4	8.2	27	2695	25	9.3	7
Weber	59185	152	2.6	13	154561	460	3.0	21	26473	465	17.6	7	240219	1077	4.5	20

2015 Per capita traumatic injury incident ranking for counties by age group

2015																
County	Age 0-14 population	Age 0-14 Traumatic injury	Age 0-14 Traumatic injury per 1000	Age 0-14 Ranking	Age 15-64 population	Age 15-64 Traumatic injury	Age 15-64 Traumatic injury per 1000	Age 15-64 Ranking	Age 65+ population	Age 65+ Traumatic injury	Age 65+ Traumatic injury per 1000	Age 65+ Ranking	Total population	Total Traumatic injury	Total Traumatic injury per 1000	Total Ranking
Beaver	1656	10	6.0	3	3792	28	7.4	8	896	19	21.2	4	6344	57	8.98	6
Box Elder	14101	37	2.6	11	31432	143	4.5	14	6288	130	20.7	5	51821	310	5.98	12
Cache	31403	56	1.8	15	77852	182	2.3	25	10493	161	15.3	13	119748	399	3.33	26
Carbon	4539	5	1.1	23	12633	55	4.4	18	3194	41	12.8	18	20366	101	4.96	16
Daggett	213	3	14.1	1	662	3	4.5	16	231	6	26.0	1	1106	12	10.85	2
Davis	93389	96	1.0	24	210207	290	1.4	29	31238	381	12.2	20	334834	767	2.29	29
Duchesne	6148	20	3.3	8	12427	72	5.8	10	2191	25	11.4	23	20766	117	5.63	13
Emery	2608	6	2.3	12	6152	16	2.6	23	1596	22	13.8	16	10356	44	4.25	19
Garfield	962	3	3.1	10	3007	23	7.6	6	1009	22	21.8	3	4978	48	9.64	4
Grand	1770	0	0.0	29	6199	61	9.8	3	1578	29	18.4	8	9547	90	9.43	5
Iron	11773	16	1.4	20	30677	109	3.6	20	5689	69	12.1	21	48139	194	4.03	21
Juab	3007	15	5.0	4	6304	75	11.9	1	1234	12	9.7	27	10545	102	9.67	3
Kane	1332	0	0.0	29	4140	21	5.1	11	1574	12	7.6	28	7046	33	4.68	17
Millard	3293	7	2.1	13	7297	54	7.4	7	2038	40	19.6	6	12628	101	8.00	7
Morgan	3254	5	1.5	17	6538	13	2.0	27	1238	15	12.1	22	11030	33	2.99	27
Piute	317	1	3.2	9	817	4	4.9	12	358	6	16.8	11	1492	11	7.37	9
Rich	574	0	0.0	29	1337	13	9.7	4	387	4	10.3	26	2298	17	7.40	8
Salt Lake	261499	380	1.5	19	732817	2174	3.0	21	110056	1922	17.5	10	1104372	4476	4.05	20
San Juan	3929	6	1.5	18	9351	26	2.8	22	1958	21	10.7	25	15238	53	3.48	25
Sanpete	6206	27	4.4	5	18739	110	5.9	9	3741	69	18.4	7	28686	206	7.18	10
Sevier	5177	6	1.2	22	12452	58	4.7	13	3228	44	13.6	17	20857	108	5.18	15
Summit	8375	52	6.2	2	26965	296	11.0	2	4259	99	23.2	2	39599	447	11.29	1
Tooele	17825	24	1.3	21	39381	179	4.5	15	5435	83	15.3	14	62641	286	4.57	18
Uintah	11132	21	1.9	14	23202	83	3.6	19	3442	42	12.2	19	37776	146	3.86	22
Utah	168384	116	0.7	26	362981	707	1.9	28	41673	686	16.5	12	573038	1509	2.63	28
Wasatch	8061	29	3.6	6	18332	81	4.4	17	2880	52	18.1	9	29273	162	5.53	14
Washingtc	35636	35	1.0	25	88083	205	2.3	26	31012	337	10.9	24	154731	577	3.73	23
Wayne	589	2	3.4	7	1584	14	8.8	5	511	3	5.9	29	2684	19	7.08	11
Weber	59063	91	1.5	16	156664	402	2.6	24	27251	410	15.0	15	242978	903	3.72	24

2016 Per capita traumatic injury incident ranking for counties by age group

2016																
County	Age 0-14 population	Age 0-14 Traumatic injury	Age 0-14 Traumatic injury per 1000	Age 0-14 Ranking	Age 15-64 population	Age 15-64 Traumatic injury	Age 15-64 Traumatic injury per 1000	Age 15-64 Ranking	Age 65+ population	Age 65+ Traumatic injury	Age 65+ Traumatic injury per 1000	Age 65+ Ranking	Total population	Total Traumatic injury	Total Traumatic injury per 1000	Total Ranking
Beaver	1720	2	1.2	20	3797	25	6.6	9	937	20	21.3	4	6454	47	7.3	9
Box Elder	14232	28	2.0	13	32164	109	3.4	17	6578	92	14.0	16	52974	229	4.3	15
Cache	31815	70	2.2	12	79554	167	2.1	25	10973	147	13.4	17	122342	384	3.1	24
Carbon	4512	6	1.3	17	12569	37	2.9	18	3290	20	6.1	28	20371	63	3.1	25
Daggett	204	0	0.0	29	634	3	4.7	13	243	2	8.2	24	1081	5	4.6	14
Davis	94253	76	0.8	22	214415	296	1.4	29	32661	458	14.0	15	341329	830	2.4	28
Duchesne	5956	6	1.0	21	12117	50	4.1	16	2242	23	10.3	21	20315	79	3.9	17
Emery	2532	2	0.8	23	6036	14	2.3	23	1654	11	6.7	27	10222	27	2.6	27
Garfield	953	5	5.2	4	2974	28	9.4	7	1073	27	25.2	2	5000	60	12.0	4
Grand	1785	5	2.8	10	6197	84	13.6	1	1674	34	20.3	7	9656	123	12.7	2
Iron	12185	9	0.7	25	31577	75	2.4	22	6034	76	12.6	18	49796	160	3.2	23
Juab	3160	11	3.5	8	6545	63	9.6	6	1298	13	10.0	22	11003	87	7.9	8
Kane	1391	8	5.8	3	4281	33	7.7	8	1654	28	16.9	9	7326	69	9.4	6
Millard	3296	12	3.6	7	7303	80	11.0	5	2083	47	22.6	3	12682	139	11.0	5
Morgan	3335	4	1.2	19	6736	11	1.6	28	1302	19	14.6	12	11373	34	3.0	26
Piute	288	0	0.0	29	795	5	6.3	10	380	1	2.6	29	1463	6	4.1	16
Rich	569	5	8.8	1	1335	18	13.5	2	402	5	12.4	19	2306	28	12.1	3
Salt Lake	262273	331	1.3	18	744035	2059	2.8	19	115071	1899	16.5	10	1121379	4289	3.8	18
San Juan	3930	15	3.8	6	9395	17	1.8	26	2004	21	10.5	20	15329	53	3.5	21
Sanpete	6205	19	3.1	9	19207	87	4.5	15	3891	82	21.1	5	29303	188	6.4	10
Sevier	5203	20	3.8	5	12612	63	5.0	12	3332	27	8.1	25	21147	110	5.2	12
Summit	8317	49	5.9	2	27466	342	12.5	3	4607	141	30.6	1	40390	532	13.2	1
Tooele	17969	28	1.6	16	40890	189	4.6	14	5740	100	17.4	8	64599	317	4.9	13
Uintah	10489	25	2.4	11	22138	56	2.5	21	3567	52	14.6	13	36194	133	3.7	19
Utah	170872	112	0.7	26	376092	616	1.6	27	43511	638	14.7	11	590475	1366	2.3	29
Wasatch	8294	16	1.9	14	19144	103	5.4	11	3133	64	20.4	6	30571	183	6.0	11
Washington	35868	27	0.8	24	90519	198	2.2	24	32850	289	8.8	23	159237	514	3.2	22
Wayne	564	0	0.0	29	1584	19	12.0	4	537	4	7.4	26	2685	23	8.6	7
Weber	59642	103	1.7	15	159597	404	2.5	20	28080	394	14.0	14	247319	901	3.6	20

2017 Per capita traumatic injury incident ranking for counties by age group

2017																
County	Age 0-14 population	Age 0-14 Traumatic injury	Age 0-14 Traumatic injury per 1000	Age 0-14 Ranking	Age 15-64 population	Age 15-64 Traumatic injury	Age 15-64 Traumatic injury per 1000	Age 15-64 Ranking	Age 65+ population	Age 65+ Traumatic injury	Age 65+ Traumatic injury per 1000	Age 65+ Ranking	Total population	Total Traumatic injury	Total Traumatic injury per 1000	Total Ranking
Beaver	1725	5	2.9	12	3728	28	7.5	8	933	24	25.7	4	6386	57	8.9	7
Box Elder	14495	49	3.4	9	32694	145	4.4	12	6890	134	19.4	7	54079	328	6.1	12
Cache	32041	71	2.2	15	80950	208	2.6	23	11447	220	19.2	8	124438	499	4.0	22
Carbon	4460	9	2.0	18	12395	26	2.1	26	3440	11	3.2	29	20295	46	2.3	28
Daggett	205	3	14.6	1	570	2	3.5	17	254	3	11.8	24	1029	8	7.8	9
Davis	94984	132	1.4	25	218427	366	1.7	29	34226	494	14.4	18	347637	992	2.9	26
Duchesne	5840	15	2.6	13	11848	65	5.5	11	2338	22	9.4	26	20026	102	5.1	17
Emery	2416	4	1.7	22	5982	12	2.0	28	1679	11	6.6	27	10077	27	2.7	27
Garfield	946	6	6.3	3	2973	32	10.8	4	1159	36	31.1	1	5078	74	14.6	1
Grand	1780	10	5.6	4	6144	77	12.5	2	1750	27	15.4	14	9674	114	11.8	3
Iron	12444	20	1.6	23	32184	98	3.0	20	6373	92	14.4	17	51001	210	4.1	20
Juab	3225	11	3.4	8	6696	75	11.2	3	1329	18	13.5	22	11250	104	9.2	6
Kane	1481	0	0.0	29	4373	30	6.9	9	1713	20	11.7	25	7567	50	6.6	11
Millard	3369	4	1.2	27	7353	78	10.6	5	2141	60	28.0	2	12863	142	11.0	5
Morgan	3460	3	0.9	28	7059	18	2.5	24	1354	20	14.8	15	11873	41	3.5	24
Piute	258	1	3.9	6	759	8	10.5	6	403	7	17.4	12	1420	16	11.3	4
Rich	585	3	5.1	5	1375	11	8.0	7	431	6	13.9	21	2391	20	8.4	8
Salt Lake	261689	465	1.8	21	753958	2217	2.9	21	120002	1984	16.5	13	1135649	4666	4.1	21
San Juan	3913	5	1.3	26	9347	19	2.0	27	2096	8	3.8	28	15356	32	2.1	29
Sanpete	6247	20	3.2	10	19714	77	3.9	16	4074	84	20.6	5	30035	181	6.0	13
Sevier	5162	11	2.1	17	12751	53	4.2	14	3403	64	18.8	9	21316	128	6.0	14
Summit	8233	69	8.4	2	27980	358	12.8	1	4893	129	26.4	3	41106	556	13.5	2
Tooele	18544	43	2.3	14	42820	182	4.3	13	6092	121	19.9	6	67456	346	5.1	16
Uintah	9939	22	2.2	16	21482	73	3.4	19	3729	54	14.5	16	35150	149	4.2	19
Utah	173368	268	1.5	24	387302	846	2.2	25	45755	817	17.9	11	606425	1931	3.2	25
Wasatch	8623	26	3.0	11	20027	80	4.0	15	3456	62	17.9	10	32106	168	5.2	15
Washington	36410	71	2.0	20	94442	325	3.4	18	34810	440	12.6	23	165662	836	5.0	18
Wayne	576	2	3.5	7	1579	10	6.3	10	564	8	14.2	20	2719	20	7.4	10
Weber	60113	119	2.0	19	162818	449	2.8	22	28838	413	14.3	19	251769	981	3.9	23

Appendix F – Utah Health Codes

Title 26 Utah Health Code

Chapter 8a Utah Emergency Medical Services System Act

26-8a-252. Department duties.

In connection with the statewide trauma system established in Section 26-8a-250, the department shall:

- (1) establish a statewide trauma system plan that:
 - (a) identifies statewide trauma care needs, objectives, and priorities;
 - (b) identifies the equipment, facilities, personnel training, and other things necessary to create and maintain a statewide trauma system; and
 - (c) organizes and coordinates trauma care within defined geographic areas;
- (2) support the statewide trauma system by:
 - (a) facilitating the coordination of prehospital, acute care, and rehabilitation services and providers through state regulation and oversight;
 - (b) facilitating the ongoing evaluation and refinement of the statewide trauma system;
 - (c) providing educational programs;
 - (d) encouraging cooperation between community organizations, health care facilities, public health officials, emergency medical service providers, and rehabilitation facilities for the development of a statewide trauma system;
 - (e) implementing a quality assurance program using information from the statewide trauma registry established pursuant to Section 26-8a-253;
 - (f) establishing trauma center designation requirements in accordance with Section 26-8a-254; and
 - (g) developing standards so that:
 - (i) trauma centers are categorized according to their capability to provide care;
 - (ii) trauma victims are triaged at the initial point of patient contact; and
 - (iii) trauma patients are sent to appropriate health care facilities.

26-8a-253. Statewide trauma registry and quality assurance program.

- (1) The department shall:
 - (a) establish and fund a statewide trauma registry to collect and analyze information on the incidence, severity, causes, and outcomes of trauma;

- (b) establish, by rule, the data elements, the medical care providers that shall report, and the time frame header and format for reporting;
- (c) use the data collected to:
 - (i) improve the availability and delivery of prehospital and hospital trauma care;
 - (ii) assess trauma care delivery, patient care outcomes, and compliance with the requirements of this chapter and applicable department rules; and
 - (iii) regularly produce and disseminate reports to data providers, state government, and the public; and
- (d) support data collection and abstraction by providing:
 - (i) a data collection system and technical assistance to each hospital that submits data; and
 - (ii) funding or, at the discretion of the department, personnel for collection and abstraction for each hospital not designated as a trauma center under the standards established pursuant to Section 26-8a-254.
- (2)
 - (a) Each hospital shall submit trauma data in accordance with rules established under Subsection (1).
 - (b) A hospital designated as a trauma center shall submit data as part of the ongoing quality assurance program established in Section 26-8a-252.
- (3) The department shall assess:
 - (a) the effectiveness of the data collected pursuant to Subsection (1); and
 - (b) the impact of the statewide trauma system on the provision of trauma care.
- (4) Data collected under this section shall be subject to Chapter 3, Health Statistics.
- (5) No person may be held civilly liable for having provided data to the department in accordance with this section.

26-8a-201. Public awareness efforts.

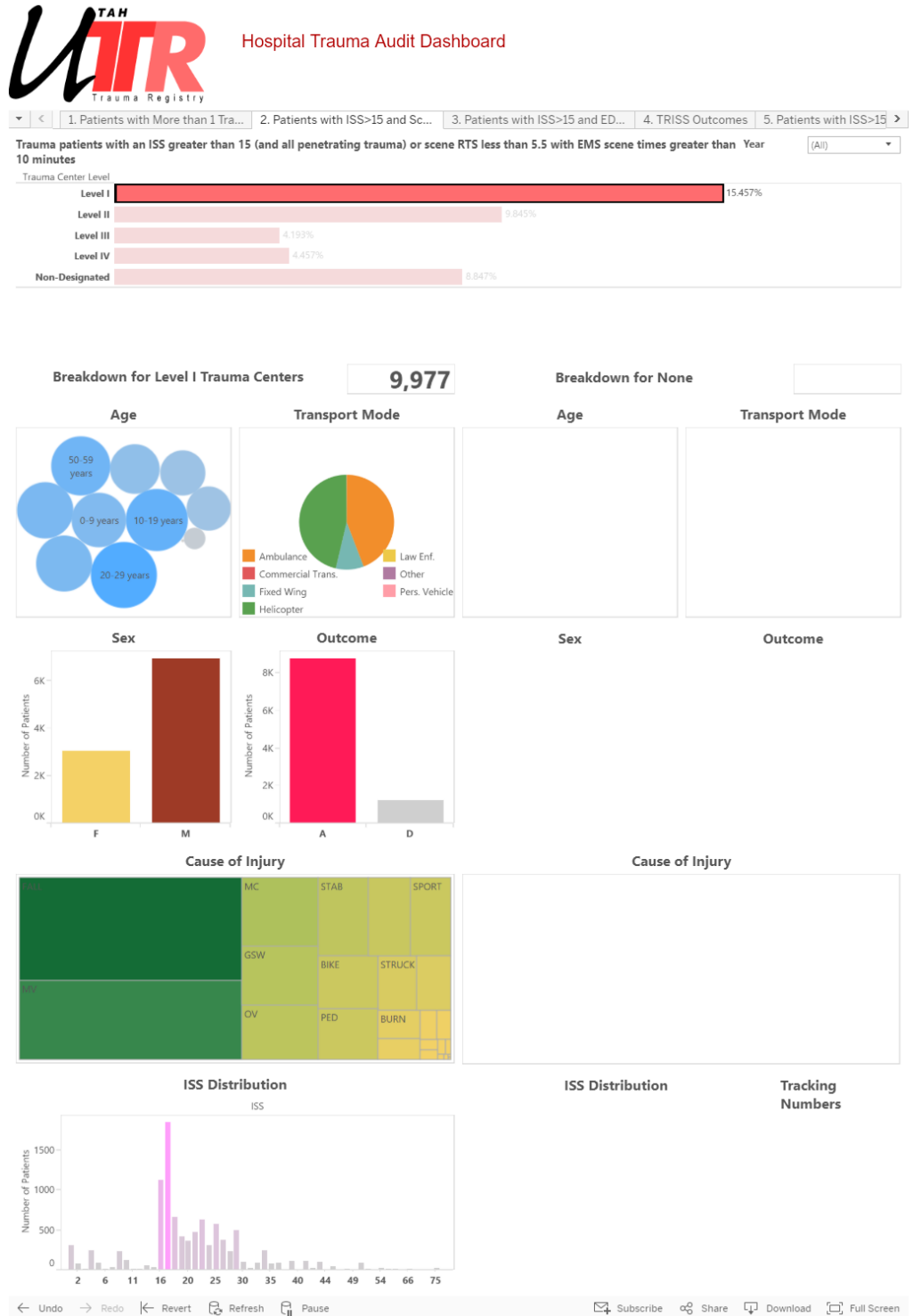
The department may:

- (1) develop programs to inform the public of the emergency medical service system; and
- (2) develop and disseminate emergency medical training programs for the public, which emphasize the prevention and treatment of injuries and illnesses.

Source: Utah Health Code. Retrieved from https://le.utah.gov/xcode/Title26/Chapter8A/26-8a.html?v=C26-8a_1800010118000101

Appendix G – Utah Trauma Dashboard and Trauma Cube

Trauma Dashboard

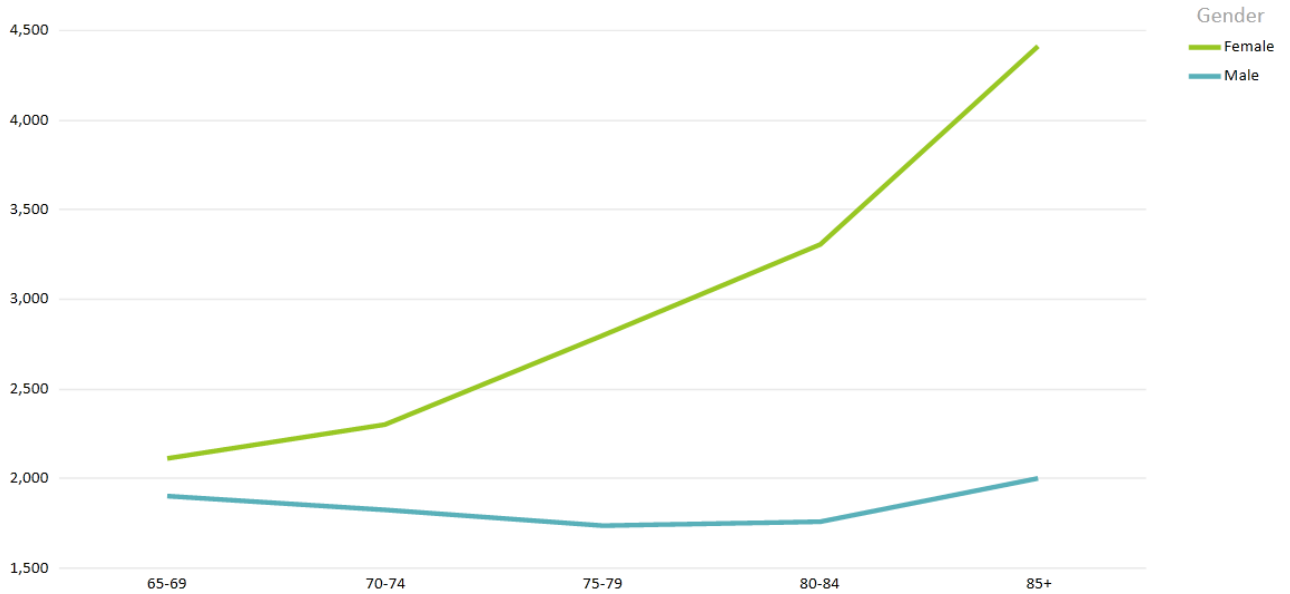


Source: Hospital Trauma Audit Dashboard. Retrieved from <https://www.utahtrauma.org/registryMembers/hospitalaudit.html>

Trauma Cube

Geriatric Fall 2013-2017 by Age and Gender

Count of Records by Age Category, and Gender



Source: Data Cubes. Retrieved from <https://portal.utahdccc.org/sites/UTR>

Appendix H – Trauma and Injury Severity (TRISS) Score, Revised Trauma Score (RTS), and Glasgow Coma Score (GCS)

TRAUMA SCORE - INJURY SEVERITY SCORE : TRISS

The Trauma Score – Injury Severity Score (TRISS) determines the probability of survival (Ps) of a patient from the ISS and RTS using the following formulae:

$$Ps = 1 / (1 + e^{-b})$$

Where 'b' is calculated from:

$$b = b_0 + b_1(RTS) + b_2(ISS) + b_3(AgeIndex)$$

The coefficients b0 - b3 are derived from multiple regression analysis of the Major Trauma Outcome Study (MTOS) database. AgeIndex is 0 if the patient is below 54 years of age or 1 if 55 years and over. b0 to b3 are coefficients which are different for blunt and penetrating trauma. If the patient is less than 15, the blunt index for b3 (Age) is used regardless of mechanism.

	Blunt	Penetrating
b0	-0.4499	-2.5355
b1	0.8085	0.9934
b2	-0.0835	-0.0651
b3	-1.7430	-1.1360

REVISED TRAUMA SCORE

The Revised Trauma Score (RTS) is a physiological scoring system, with high inter-rater reliability and demonstrated accuracy in predicting death. It is scored from the first set of data obtained on the patient, and consists of Glasgow Coma Scale, Systolic Blood Pressure and Respiratory Rate.

Glasgow Coma Scale (GCS)	Systolic Blood Pressure (SBP)	Respiratory Rate (RR)	Coded Value
13-15	>89	10-29	4
9-12	76-89	>29	3
6-8	50-75	6-9	2
4-5	1-49	1-5	1
3	0	0	0

$$RTS = 0.9368 GCS + 0.7326 SBP + 0.2908 RR$$

Values for the RTS are in the range 0 to 7.8408. The RTS is heavily weighted towards the Glasgow Coma Scale to compensate for major head injury without multisystem injury or major physiological changes. A threshold of RTS < 4 has been proposed to identify those patients who should be treated in a trauma center, although this value may be somewhat low.

GLASGOW COMA SCORE

The Glasgow Coma Score (GCS) is scored between 3 and 15, 3 being the worst, and 15 the best. It is composed of three parameters : Best Eye Response, Best Verbal Response, Best Motor Response, as given below:

- | <u>Best Eye Response (4)</u> | <u>Best Verbal Response (5)</u> | <u>Best Motor Response (6)</u> |
|----------------------------------|---------------------------------|--------------------------------|
| 1. No eye opening | 1. No verbal response | 1. No motor response |
| 2. Eye opening to pain | 2. Incomprehensible sounds | 2. Extension to pain |
| 3. Eye opening to verbal command | 3. Inappropriate words | 3. Flexion to pain |
| 4. Eyes open spontaneously | 4. Confused | 4. Withdrawal from pain |
| | 5. Orientated | 5. Localising pain |
| | | 6. Obeys Commands |

GLASGOW PEDIATRIC COMA SCORE

The Pediatric GCS is scored between 3 and 15, 3 being the worst, and 15 the best. It is composed of three parameters : Best Eye Response, Best Verbal Response, Best Motor Response, as given below:

- | <u>Best Eye Response (4)</u> | <u>Best Verbal Response (5)</u> | <u>Best Motor Response (6)</u> |
|----------------------------------|---|--------------------------------|
| 1. No eye opening | 1. No vocal response | 1. No motor response |
| 2. Eye opening to pain | 2. Inconsolable, agitated | 2. Extension to pain |
| 3. Eye opening to verbal command | 3. Inconsistently consolable, moaning | 3. Flexion to pain |
| 4. Eyes open spontaneously | 4. Cries but is consolable, inappropriate interactions | 4. Withdrawal from pain |
| | 5. Smiles, oriented to sounds, follows objects, interacts | 5. Localising pain |
| | | 6. Obeys Commands |

Source: Injury Severity Scoring. Retrieved from https://www.surgicalcriticalcare.net/Resources/injury_severity_scoring.pdf

