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Population Health

2018–2022

Utah traumatic injury report

Office of Emergency Medical Services and Preparedness
Utah Department of Health and Human Services

Utah traumatic injury report 2018–2022

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Technical notes

- Utah Trauma Registry (UTR) data[1] and Annual Estimates of the Resident Population Data[2] (U.S. Census Bureau, Population Division, 2022) were used for this report.
- Per capita rate of traumatic injury incidents and fatality were calculated as per 1,000 people based on the 2018−2022 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 fatality rates of trauma patients in this report are not exactly comparable with those of local or national statistics which use other inclusion criteria.
- This report used the definition of "year" as the year the 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 2022) was used for the chart to give a better historical perspective on the trend for the subject.
- Due to missing data, the total count of patients may vary slightly depending on the variables used to group them (sex, age group, cause code, etc.).
- Injury severity score (ISS) based on the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) was used for this report.
- Injury severity score (ISS), which ranges from 0 to 75 (Appendix C), is 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
- There was a transition in the medical coding system, ICD-9 to ICD-10, in 2015. The injury severity score (ISS) was originally based on ICD-9 coding then modified to adjust for ICD-10 in 2016 and thereafter. Due to the changes, the average ISS of Utah trauma patients

[1] Utah Trauma Registry Data 2001-2022. (2023). [Data file]. Salt Lake City: Intermountain Injury Control and Research Center.
[2] Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2022. Retrieved from https://www.census.gov/programs-surveys/popest/data/data-sets.html

dropped about 2 points, which resulted in reductions of serious to critical injuries (ISS >15) by the measurement (Appendix H).

- Local trauma patients were identified by their county of residence in Utah. Trauma patients with “Other” or “NA” in the field were considered out-of-state residents. Blank and “Unknown” in the field were both considered unknown.
- Length of stay (LOS) in the hospital for causes of traumatic injuries with higher fatality rates (often with ISS >15) may be shorter since a patient who is deceased in the emergency department will not stay in the hospital.
- The injury severity score (ISS) may be lower for traumatic injuries with higher fatality rates (often with ISS >15) since a patient who is critically injured, arrived dead, or deceased in the emergency department may not have further diagnostic procedures on which the ISS is calculated.
- Age groups are defined as follows:

  Pediatric−ages 0 to 14

  Adult−ages 15 to 64

  Geriatric−ages 65 and older
- Acronyms, abbreviations, and terms used in this report are shown in the following list.

Organizations	ASCOT	American College of Surgeons Committee on Trauma
	EMSP	Office of Emergency Medical Services and Preparedness
	IICRC	Intermountain Injury Control and Research Center
	NEMSIS	National Emergency Medical Services Information System
	NTDB	National Trauma Data Bank
	PIPS	Performance Improvement and Patient Safety (workgroup)
	TSAC	Trauma System Advisory Committee
	DHHS	Utah Department of Health and Human Services
	UTR	Utah Trauma Registry
Injury scales and scores	AIS	Abbreviated injury scale (Appendix C)
	GCS	Glasgow coma scale (Appendix H)
	ISS	Injury severity score (Appendix C)
	RTS	Revised trauma score (Appendix H)
	TRISS	Trauma and injury severity score (Appendix H)
Injury causes	Animal	Animal-related injuries
	Assault	Assaulted by another person (excludes gunshot wound)
	Bike	Injuries caused while riding a bicycle
	Burn	Burns
	Caught	Caught between objects
	Exp	Explosion
	Fall	Falls (from one level to another or ground level)
	GSW	Gunshot wounds
	Hang	Injuries caused by hanging
	MC	Motorcycle crash (includes motorcycle vs. motor vehicle)

Acronyms, abbreviations, and terms (Continued)

Injury causes	MV	Motor vehicle crash
	Other	Other
	OV	Other vehicular crash (includes ATV, 3-wheel, or 4-wheel)
	Ped	Pedestrian injuries
	Sport	Sporting injuries
	Stab	Cut, sliced, and pierced injuries
	Struck	Injuries caused by being struck by or against an object
Data values	Min	Minimum
	Max	Maximum
	Avg	Average
Hospital-related terms	ED	Emergency department
	LOS	Length of stay (in days at the hospital)
Anatomical locations of injury	ABD	Abdomen/pelvic contents
	Chest	Thorax/spine
	External	External body wounds (lacerations, bruises, bumps, etc.)
	Extremity	Extremities/pelvic girdle
	Face	Face
	Head	Head/neck

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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 fatality and disability in Americans between the ages of one and 44 years old[3]. Annually, more than 140,000 people die and approximately 80,000 are permanently disabled as a result of injury in the United States[4]. Between 2018 and 2022 in Utah, about 16,000 severe traumatic injury cases were recorded each year, resulting in a 2.5% fatality rate (approximately 403 fatalities per year).

The Utah Department of Health (became the Utah Department of Health and Human Services in July 2022) organized a Trauma System Task Force in 1993 to develop a state trauma system plan. The plan was adopted in 1995 and served as a road map and a report to help policymakers, health care providers, and community organizations establish a coordinated and integrated approach to trauma care and prevention. Utah Health Code 26-8a-252 was enacted in 2000 to mandate 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 fatality 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 assess its impact on trauma fatality and morbidity. In order to collect data from all hospitals, the Utah Department of Health and Human Services 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.

Use 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, along with trauma care and EMS specialists, used the audit filters to assess key issues in trauma patient care using UTR data. Based on the state PIPS reports, the TSAC has issued a number of recommendations to further enhance the effectiveness of the system. The IICRC also created the trauma dashboard and trauma cube, online data visualization and analytic tools, for Utah

[3] 10 Leading Causes of Fatality Reports, 2018-2020, All Races, Both Sexes. Retrieved from https://wisqars.cdc.gov/cgi-bin/broker.exe.
[4] National Trauma Data Standard Data Dictionary: Introduction. Retrieved from https://www.facs.org/media/qmme1ktp/2023-data-dictionary-1-19-23.pdf.

hospitals. These data visualization tools enable hospitals to quantitatively assess their own trauma patient care (Appendix G).

Since 2001, the UTR has accumulated a total of 257,239 traumatic injury cases, which used the state's hospital resources. Of those, a total of 80,176 cases were recorded between 2018 and 2022.

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.

2018–2022 Statewide traumatic injury

- Patient inclusion criteria associated with the Utah Trauma Registry limit registry inclusion to patients who suffer more severe injuries (Appendix B).
- The Utah Trauma Registry accumulated 257,239 trauma records between 2001 and 2022.
- A total of 80,176 traumatic injuries were recorded in the UTR between 2018 and 2022.
- The COVID-19 pandemic and its quarantine policy impacted people's lifestyles and activities from late 2019 to 2022. Such changes in lifestyle, including closures of schools, public places, and workplaces, less commuting by motor vehicles or public transit systems, and stopping or postponing gatherings and events) may be reflected in the trends of traumatic injuries during the 2018 to 2022 assessment period.
- Along with population growth in Utah (3,153,550 in 2018 to 3,380,800 in 2022), per capita (per 1,000 residents) traumatic injury incidents have increased; 4.6 per 1,000 in 2018 to 5.4 per 1,000 in 2022 (Figure 1).
- Although the number of trauma patients is increasing, the statewide trauma fatality rate has been decreasing steadily. The fatality rate dropped from 4.1% to 3.2% between 2001 and 2013, and from 3.2% to 2.6% between 2018 and 2022 (Figure 2).
- Although only 12% of Utah's population, estimated by the Census Bureau, was aged 65 and older between 2018 and 2022, 41% of UTR data consisted of geriatric patients. On the other hand, trauma patients' proportions were smaller than census estimates for the pediatric (census estimate 24% vs. UTR 12%) and the adult (census estimate 65% vs. UTR 48%) populations (Figure 3).
- Twelve percent of all trauma patients between 2018 and 2022 were from out-of-state. (Figure 4).
- Between 2018 and 2022, males experienced more traumatic injuries than females in the pediatric (61% vs. 39%) and adult (68% vs. 32%) age groups. The opposite was true for the geriatric age group (41% vs. 59%) (Figure 5).
- Between 2018 and 2022, the percentage of trauma patients who arrived at receiving hospitals by ground ambulance was relatively unchanged (from 56.6% to 55.3%). Those who arrived by air ambulance decreased by 1.9% (from 7.4% to 5.5%) between 2018 and

2022, and by 16% (from 21.5% to 5.5%) between 2001 and 2022. The use of other means (privately operated vehicles, commercial rides, public transportation, law enforcement, etc.) increased 1.1% (from 37.6% to 38.7%) between 2018 and 2022, and 12.7% between 2001 and 2022 (from 26% to 38.7%) (Figure 6).

- Geriatric fall data were added to UTR in 2008. Falls are the most common cause of traumatic injuries that make up more than half of injury data in UTR.
- Traumatic injury due to motor vehicle incidents decreased by 3% (from 12% to 9%) between 2018 and 2022 and 13% (from 22% to 9%) between 2001 and 2022 (Figure 7).
- The top 10 causes of traumatic injury in Utah between 2018 and 2022 were incidents involving a fall, motor vehicle, sport, motorcycle, bicycle, other vehicles (e.g., ATV), being struck by an object, assault, animal, and pedestrian (Table 1).
- The average ages for the top 10 injury causes were younger than age 43, except for falls, which was age 64. Pedestrian incidents had the highest fatality rate (7.2%), average ISS (10.3), and the longest average stay (4.5 days) in the hospital (Table 1).
- Between 2018 and 2022, the majority (95%) of all injuries were caused by blunt force trauma. Burn (0.4%) and penetrating (5%) trauma made up much smaller percentages (Figure 8).
- About 35% of traumatic injuries happened at home. Streets (18%) and recreation areas (12%) (national and state parks, hiking, biking, boating, swimming, skiing, camping areas, etc.) were the second and third most common places (Figure 9).
- About 95% of all traumatic injuries are minor to moderate in severity (ISS <=15) with fatality rates of 1% to 3%. Although the number of cases is smaller, serious to critical injuries (ISS >=16) have higher fatality rates of 11% to 16% (Figure 10).
- Hanging and gunshot wounds (including self-inflicted and accidental injuries) were the two most deadly injuries between 2018 and 2022. The fatality rates were about 25% and 21% respectively (Table 2).
- Commercial insurance (45%) and Medicare (37%) paid for 82% of all trauma patients between 2018 and 2022 (Figure 11).
- Geographically, traumatic injury occurs more often in rural areas in Utah. Garfield, Summit, Grand, Rich, and Juab counties had the top five per capita (per 1,000 residents) trauma incidents between 2018 and 2022 (Figure 12).
- When we examined the severity of traumatic injuries, Rich, Garfield, Juab, Summit, and Kane counties had the top five per capita trauma incidents with ISS greater than 15 (Figure 13).
- Other vehicle (e.g., ATV) incidents had the highest fatality rate (2.5%) in Garfield County. Pedestrian incidents had the highest average ISS (12). Motor vehicle incidents had the longest average hospital stay (8.7 days) (Table 3).

- About one-third (29.2%) of injuries occurred on streets in Garfield County, followed by recreation (26.8%) areas and homes (22.9%) (Figure 14).
- Forty percent of trauma patients in Garfield County were from out-of-state (Figure 15).
- In Summit County, sporting injuries were the most common injuries (34.4%), followed by falls (28.8%) and incidents involving bikes (16.2%). Motorcycle incidents had the highest average ISS (9.9), longest average hospital stay (4.7 days), and the highest fatality rate (4.3%) (Table 4).
- More than half (56.8%) of the injuries in Summit County happened in recreation areas, followed by homes (17.7%), and streets (12.7%) (Figure 16).
- Forty percent of trauma patients in Summit County were from out-of-state. (Figure 17).
- In Grand County, motor vehicle incidents had the highest fatality rate (1.9%). Sporting injuries had the highest average ISS (9.8) and the longest average hospital stay (2.8 days) (Table 5).
- Grand County had higher percentages (about 53%) of "other" and "unknown" locations. These may include remote areas not otherwise categorized as a specified location (Figure 18).
- In Grand County, the residence of 83% of trauma patients was unknown (Figure 19).
- In Rich County, motor vehicle incidents had the highest fatality rate (30.8) and the highest average ISS (13.1). Injuries caused by being struck by an object had the longest average hospital stay (5.8 days) (Table 6).
- In Rich County, 54% of traumatic injuries occurred in "unknown" locations. Home (12%) and recreation areas (18%) were the second and third most common places (Figure 20).
- Eighty-six percent of trauma patients in Rich County were Utah residents (Figure 21).
- In Juab County, the fatality rate was the highest (13%) for gunshot wounds. Motor vehicle incidents had the highest average ISS (10.7) and the longest average hospital stay (4.5 days) (Table 7).
- About 30% of traumatic injuries in Juab County occurred in recreation areas, followed by home (25%), and streets (23%) (Figure 22).
- The majority (93%) of trauma patients in Juab County were Utah residents. Six percent were from out-of-state. (Figure 23).
- Between 2018 and 2022, 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 2018 and 2022, 2,917 (3.6%) patients out of 80,176 were transferred from out-of-state to Utah hospitals. Level I hospitals in the Central region received about 84% (2,451) of all out-of-state patients. Idaho, Nevada, and Wyoming are the top three states from which Utah received trauma patients.
- Between 2018 and 2022, 384 (0.5%) out of 80,176 trauma patients were transferred to out-of-state hospitals. Southeast (283, 73.7%) and southwest (94, 24.5%) were the two major regions that transferred patients to nearby states. Colorado and Nevada were the top two destination states (Table 10).
- The majority (95%) of trauma patients who were transferred to out-of-state hospitals needed a higher level of care (Figure 25).

2018–2022 Pediatric trauma patients

- The top 10 causes for traumatic injury in pediatric patients were incidents involving a fall, being struck by an object, bicycle, motor vehicle, other vehicles (e.g., ATV), sport, animal, pedestrian, motorcycle, and assault (Figure 26).
- In pediatric patients, falls (50.1%) are the most common cause of traumatic injuries followed by being struck by an object (7.2%), and incidents involving a bicycle (6.6%) (Figure 26).
- Between 2001 and 2022, traumatic injuries due to motor vehicle incidents decreased by 10% and pedestrian incidents decreased by 5% in pediatric patients while injuries caused by a fall increased by 17% and being struck by 7%. Decreases in pediatric sporting injuries (from 10% to 4%) and injuries due to motor vehicle incidents (from 10% to 5%) in the past five years may also reflect the effects of activity restrictions and quarantine policy of the COVID-19 pandemic (Figure 27).
- The external part of the body was the most commonly injured body region (lacerations, bruises, etc.) for pediatric patients for the top five causes of traumatic injury involving a fall, being struck, bicycle, motor vehicle, and other vehicle between 2018 and 2022 followed by the head and extremities (Table 11).
- Between 2018 and 2022, assaults had the highest average ISS (9.6), longest average stay in the hospital (5 days), and the highest fatality rate (8.6%) among the top 10 causes in pediatric patients, exceeding motor vehicle and pedestrian incidents (Table 12).
- Between 2018–2022, 97% of pediatric patients had minor (62.4%) and moderate (34.6%) injuries. Serious and severe injuries had the highest fatality rates (Figure 28).
- Traumatic injuries per 1,000 increased from 1.9 to 3 in the pediatric population between 2018 and 2022, and fatality increased from 0.02 to 0.04 (Figure 29).
- Gunshot wounds had the highest fatality rate (12.9%) for pediatric patients followed by assaults (8.6%) and pedestrian incidents (4.7%) (Table 13).

- Commercial insurance (69%) and Medicaid (22%) paid for 91% of pediatric trauma patients between 2018 and 2022 (Figure 30).

2018–2022 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).
- Falls (32.2%), motor vehicle (15.8%), and motorcycle incidents (7.9%) comprised more than half (55.9%) of all injuries for adult trauma patients (Figure 31).
- In contrast to falls which increased by 6% between 2001 (30%) and 2022 (36%), motor vehicle incidents have decreased steadily (33% in 2001, 20% in 2018, and 16% in 2022). The decline in motor vehicle incidents in the past five years may reflect lifestyle changes due to the COVID-19 pandemic. Bicycle incidents have slightly increased (3% in 2001, 7% in 2022). Other causes remained relatively stable (Figure 31).
- For the top five causes of injury (incidents involving a fall, motor vehicle, motorcycle, sport, and bicycle) extremities are the most commonly injured body regions, followed by external (lacerations, bruises, bumps, etc.) and chest regions (Table 14).
- Among the top 10 injury causes, gunshot wounds had the highest fatality rate (20.8%) and youngest average age (31.7). Motorcycle incidents had the highest average ISS (9.8) followed by motor vehicle incidents (ISS 9.7). Motor vehicle incidents had the longest average stay in the hospital (4.2 days) followed by motorcycle incidents (3.9 days) (Table 15).
- Between 2018 and 2022, 92.4% of adults had minor (55.2%) and moderate (37.2%) injuries. Severe (15.6%) and critical injuries (13%) had the highest fatality rates **(**Figure 33).
- The per capita injury rate slightly increased between 2018 and 2022 (from 3.5 per 1,000 to 3.8 per 1,000). On average, adult per capita fatality is about 3 times higher than pediatric patients (adult 0.09 per 1,000 vs. pediatric 0.03 per 1,000) (Figure 34).
- Hanging and gunshot wounds (including self-inflicted and accidental injuries) were the most lethal injuries among adults with a fatality rate of 32.5% and 22.3% respectively (Table 16).
- Commercial insurance (67%), Medicaid (12%), and self-pay (11%) paid for 90% of adult trauma care (Figure 35).

2018–2022 Geriatric trauma patients

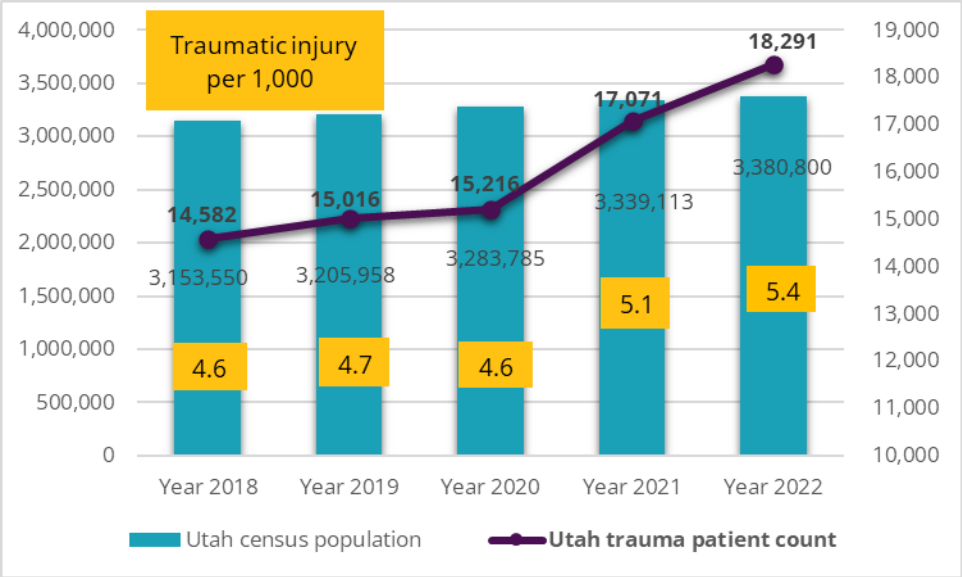
- Eighty-five percent of all geriatric trauma was caused by a fall (including ground-level falls). Motor vehicle incidents were the second most common cause but to a much lesser degree (5.4%) (Figure 36).

- Since geriatric fall was added to the trauma inclusion criteria in 2008, falls are the major cause of geriatric trauma. The rate of falls remained relatively stable between 2018 and 2022. Motor vehicle incidents have declined by more than half since 2001 (13% to 5%). Other injury causes remained stable (Figure 37).
- Extremities are the most commonly injured body regions (34.5%) in falls, often representing geriatric ground level falls which result in a hip fracture, followed by external (26.1%) and head (18.7%) regions. External (29.3%), chest (27.7%), and extremities (19%) comprised 76% of injured body regions in motor vehicle incidents (Table 17).
- Falls are the most common traumatic injury (87%) which occur in geriatric patients. Motorcycle incidents have the highest average ISS (10.5) and longest average hospital stay (4.4 days). Pedestrian incidents had the highest fatality rate (10.3%) (Table 18).
- Compared with pediatric and adult patients, geriatric patients had more moderate injuries (pediatric [34.6%], adult [37.2%], and geriatric [53.2%]) than minor injuries (pediatric [64.2%], adult [55.2%], and geriatric [44%]). Also different from pediatric and adult patient groups, the fatality rates in geriatric patients increase as the ISS scores increase, with the highest fatality rate (28.6%) in the critical injury category (Figure 28, Figure 33, and Figure 38).
- The per capita incident of traumatic injury (5-year average of 17.3 per 1,000) in geriatric patients is about 4.8 times higher than adults (5-year average of 3.6 per 1,000) (Figure 34) and 7.2 times higher than pediatric patients (5-year average of 2.4 per 1,000) (Figure 29). The per capita fatality for geriatric trauma patients (5-year average of 0.5 per 1,000) is about 5.5 times higher than adults (5-year average of 0.09 per 1,000) and 25 times higher than pediatric patients (5-year average of 0.02 per 1,000). At the same time, the number of fatalities per capita for geriatric patients decreased between 2018 and 2022 (0.56 per 1,000 in 2018 and 0.45 per 1,000 in 2022) (Figure 29, Figure 34, and Figure 39).
- Gunshot wounds are the most lethal injuries (fatality rate 26.5%), followed by burns (14.3%) and pedestrian incidents (10.3%) (Table 19).
- Medicare (84%) and commercial insurance (13%) paid for 97% of geriatric trauma care between 2018 and 2022 (Figure 40).

I. 2018–2022 Statewide traumatic injury

A. 2018–2022 Utah census population and traumatic injury incidents

Figure 1. 2018–2022 Utah census population and per capita traumatic injury incidents

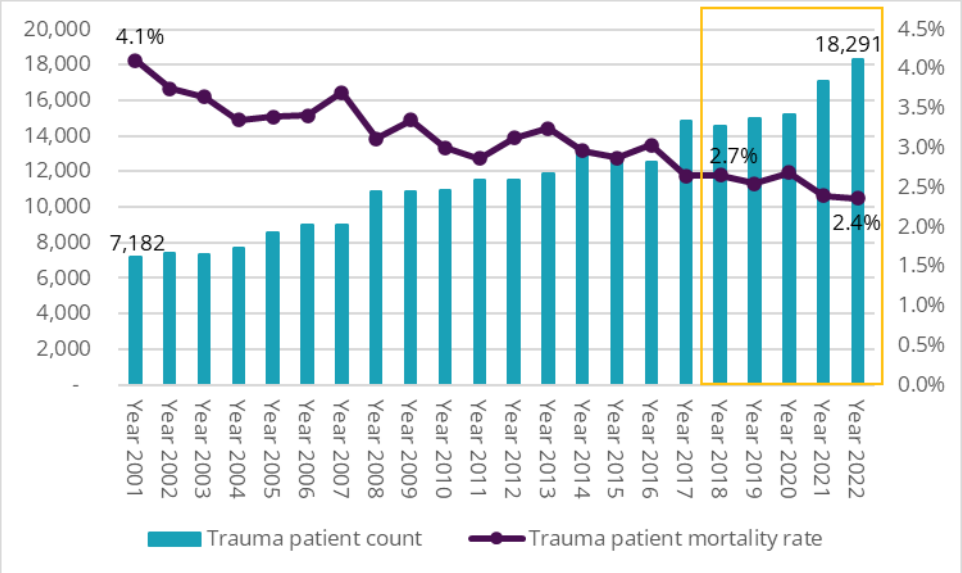


Source: annual estimates of the resident population as of July 1, 2022. U.S. Census Bureau.

Along with population growth in Utah (3,153,550 in 2018 to 3,380,800 in 2022), per capita (per 1,000 residents) traumatic injury incidents have increased; 4.6 per 1,000 in 2018 to 5.4 per 1,000 in 2022.

B. 2018–2022 All trauma patients and fatality rate

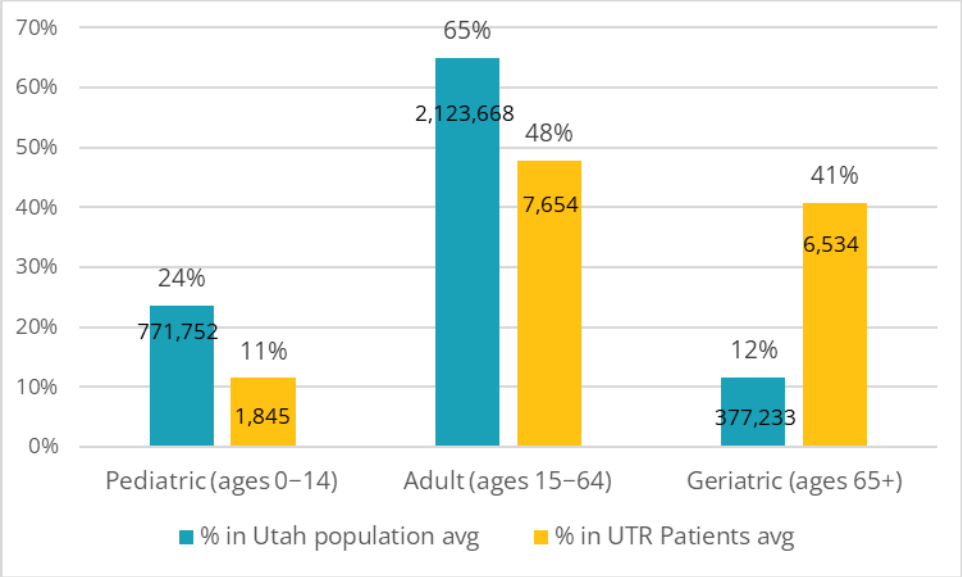
Figure 2. 2018–2022 Number of all trauma patients and fatality rate



Although the number of trauma patients is increasing, the statewide trauma fatality rate has been decreasing steadily. The fatality rate dropped from 4.1% to 2.7% between 2001 and 2018, and 2.7% to 2.4% between 2018 and 2022.

C. 2018–2022 Utah census and UTR patient population by age group (5-Year average)

Figure 3. 2018–2022 Utah census population and all trauma patients by age group (5-year average)

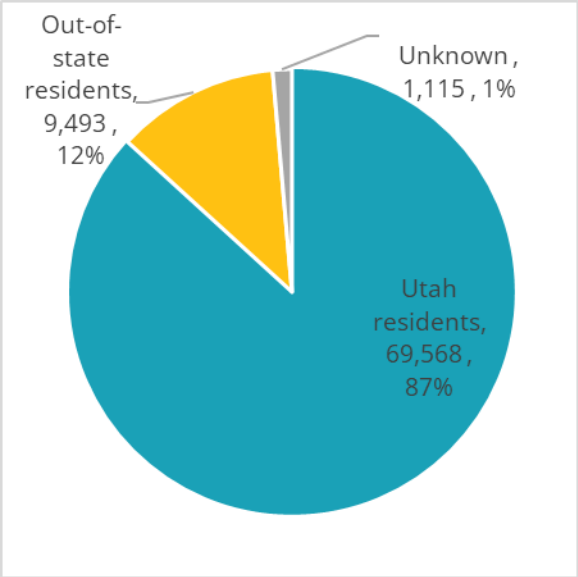


Source: annual estimates of the resident population as of July 1, 2023. U.S. Census Bureau.

Although only 12% of Utah's population, estimated by the Census Bureau, was aged 65 and older between 2018 and 2022, 41% of UTR data consisted of geriatric patients. On the other hand, trauma patients' proportions were smaller than census estimates for the pediatric (census estimate 24% vs. UTR 11%) and the adult (census estimate 65% vs. UTR 48%) populations.

D. 2018–2022 Residence of all trauma patients

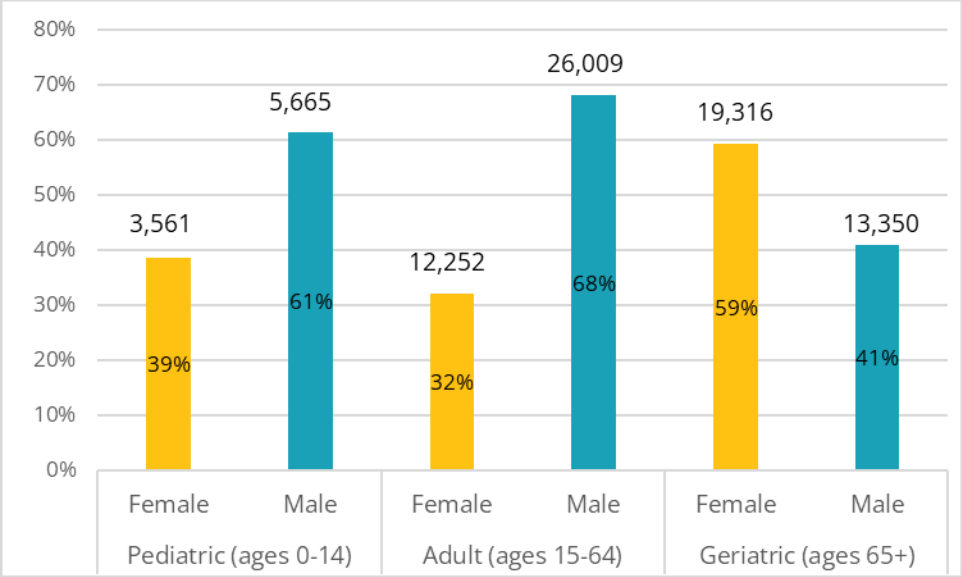
Figure 4. 2018–2022 Residence of all trauma patients



Twelve percent of all trauma patients between 2018 and 2022 were from out-of- state.

E. 2018–2022 All trauma patients by sex and age group

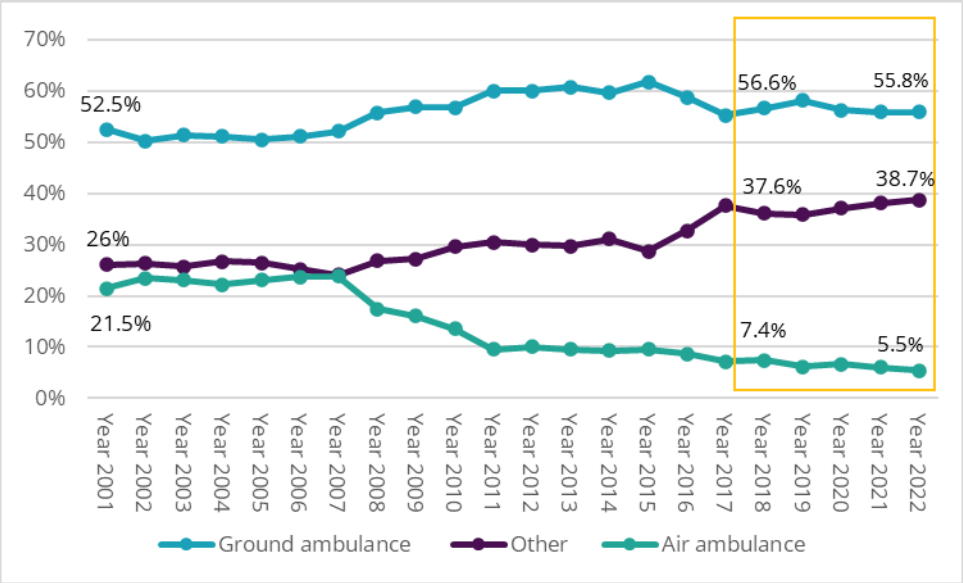
Figure 5. 2018–2022 Number of all trauma patients by sex and age group



Between 2018 and 2022, males experienced more traumatic injuries than females in pediatric (61% vs. 39%) and adult (68% vs. 32%) age groups. The opposite was true for the geriatric age group (41% vs. 59%).

F. 2001–2022 Transport method trend

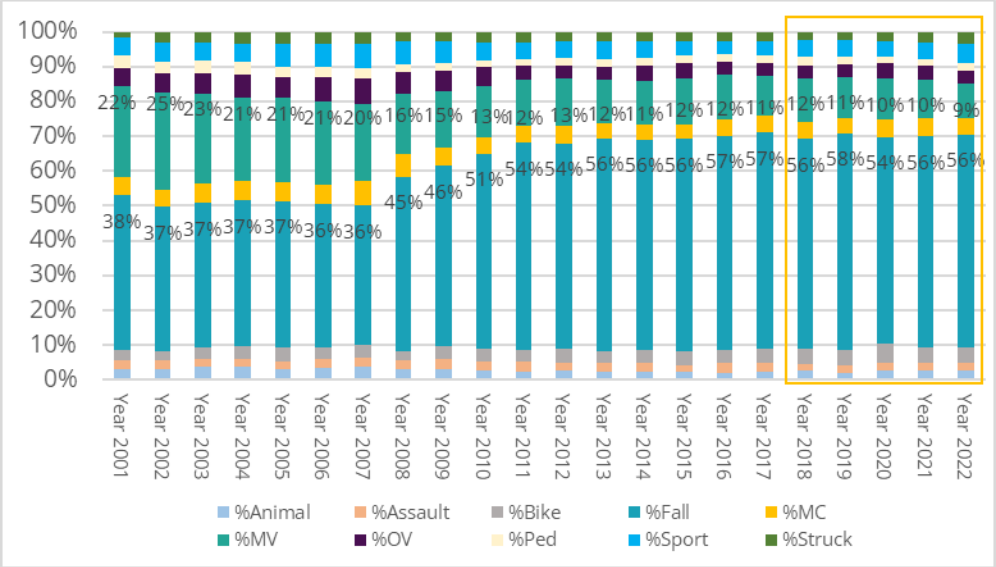
Figure 6. 2001–2022 Transport method trend for all trauma patients



Between 2018 and 2022, the percentage of trauma patients who arrived at receiving hospitals by ground ambulance was relatively unchanged (from 56.6% to 55.3%). Those who arrived by air ambulance decreased by 1.9% (from 7.4% to 5.5%) between 2018 and 2022, and by 16% (from 21.5% to 5.5%) between 2001 and 2022. The use of other means (privately operated vehicles, commercial ride, public transport, law enforcement, etc.) increased 1.1% (from 37.6% to 38.7%) between 2018 and 2022, and 12.7% between 2001 and 2022 (from 26% to 38.7%).

G. 2001–2022 Top 10 causes of traumatic injury trends

Figure 7. 2001–2022 Top 10* causes of traumatic injury trends for all trauma patients



*Top 10 causes included about 91% (n=233,960) of all trauma patients (n=257,239) between 2001 and 2022.

Geriatric fall data were added to UTR in 2008. Falls are the most common cause of traumatic injuries and make up more than half of data in UTR. Traumatic injury due to motor vehicle incidents decreased by 3% (from 12% to 9%) between 2018 and 2022 and 13% (from 22% to 9%) between 2001 and 2022.

H. 2018–2022 Top 10 causes of traumatic injury: fatality rate, average age, ISS, and LOS

Table 1. 2018–2022 Top 10* causes of traumatic injury, fatality, average age, ISS, and LOS for all trauma patients

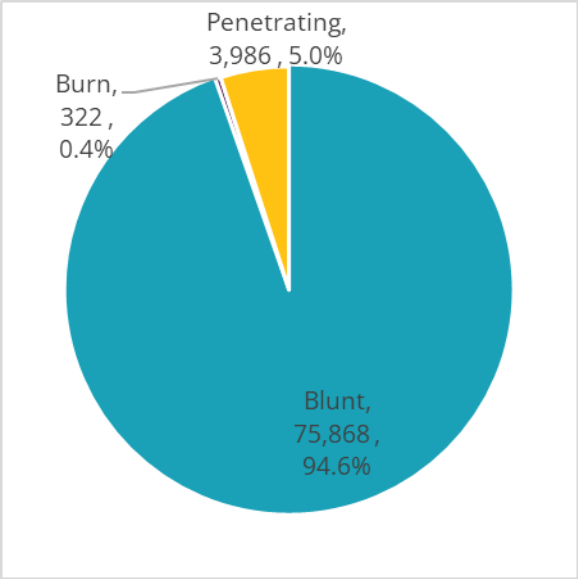
Cause	Count	Percentage	Fatality	Fatality rate	Avg age	Avg ISS	Avg LOS
Fall	44,861	56.0%	919	2.0%	64.0	7.2	3.1
MV	8,376	10.4%	348	4.2%	41.8	9.5	4.1
Sport	3,619	4.5%	15	0.4%	38.7	6.8	2.1
MC	3,558	4.4%	104	2.9%	27.3	9.7	3.8
Bike	3,442	4.3%	37	1.1%	35.4	8.1	2.3
OV	2,871	3.6%	39	1.4%	38.1	8.4	3.0
Struck	2,066	2.6%	14	0.7%	34.4	6.3	2.1
Animal	1,793	2.2%	10	0.6%	33.6	6.9	2.1
Assault	1,645	2.1%	34	2.1%	35.0	6.9	2.7
Ped	1,607	2.0%	116	7.2%	39.7	10.3	4.5

*Top 10 causes included about 92% (73,838) of all trauma patients (n= 80,176) between 2018 and 2022.

The average ages for the top 10 injury causes were younger than age 42, except for falls, which was age 64. Pedestrian incidents have the highest fatality rate (7.2%), average ISS (10.3), and the longest average stay (4.5 days) in the hospital.

I. 2018–2022 Types of traumatic injuries

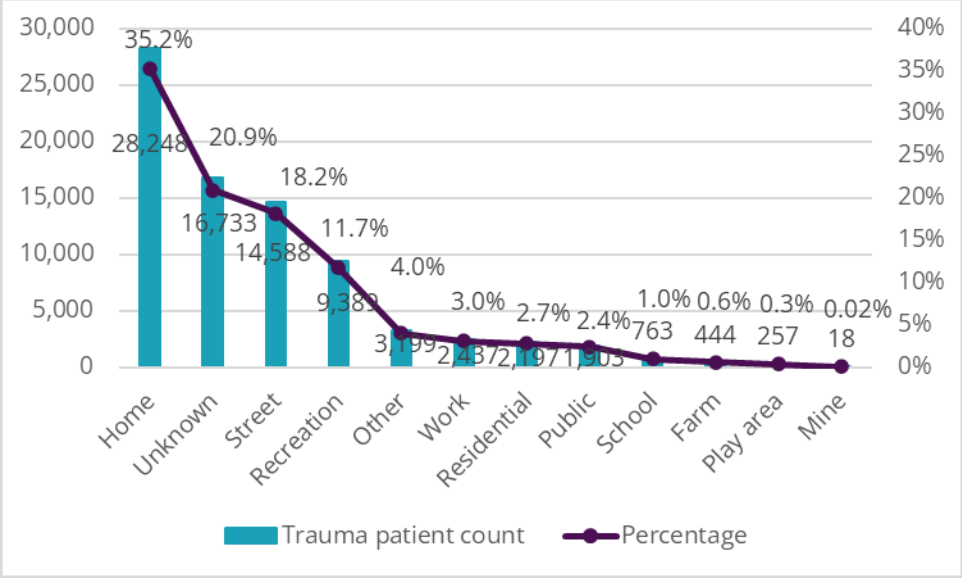
Figure 8. 2018–2022 Types of traumatic injuries



Between 2018 and 2022, the majority (95%) of all injuries were caused by blunt force trauma. Burn (0.4%) and penetrating (5%) trauma made up much smaller percentages.

J. 2018–2022 Locations where traumatic injury occurred

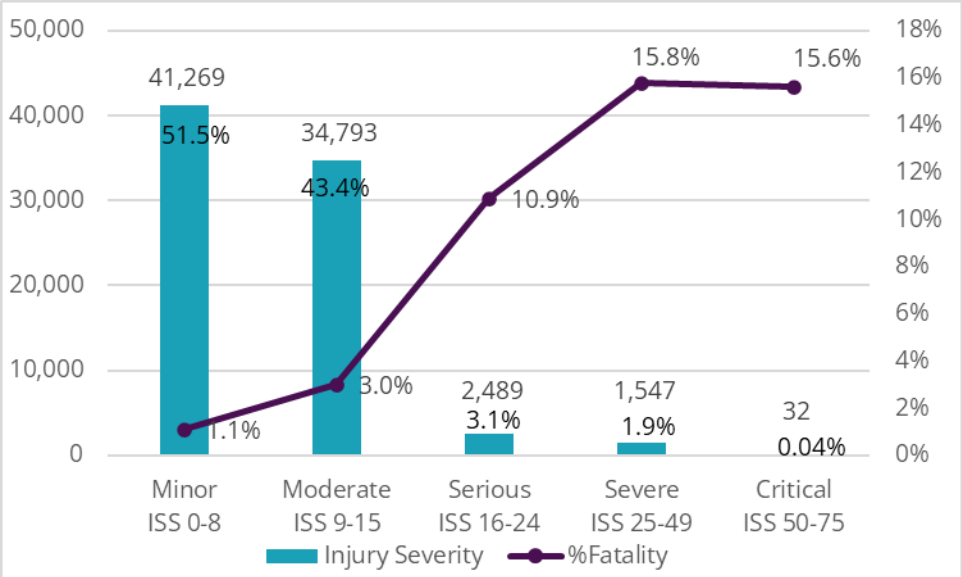
Figure 9. 2018–2022 Locations where traumatic injuries occurred



About 35% of traumatic injuries happened at home. Besides unknown locations, streets (18%) and recreation areas (12%) national and state parks, hiking, biking, boating, swimming, skiing, and camping areas, were the second and third most common places.

K. 2018–2022 Injury severity and fatality rate

Figure 10. 2018–2022 Injury severity and fatality rate of all trauma patients



About 95% of all traumatic injuries were minor to moderate in severity (ISS <=15) with fatality rates of 1% to 2.8%. Although the numbers of cases are smaller, serious to critical injuries (ISS >=16) have the higher fatality rates that are about 10% to 16% (Figure 10)

L. 2018–2022 Top 10 lethal injuries

Table 2. 2018–2022 Top 10* lethal injuries

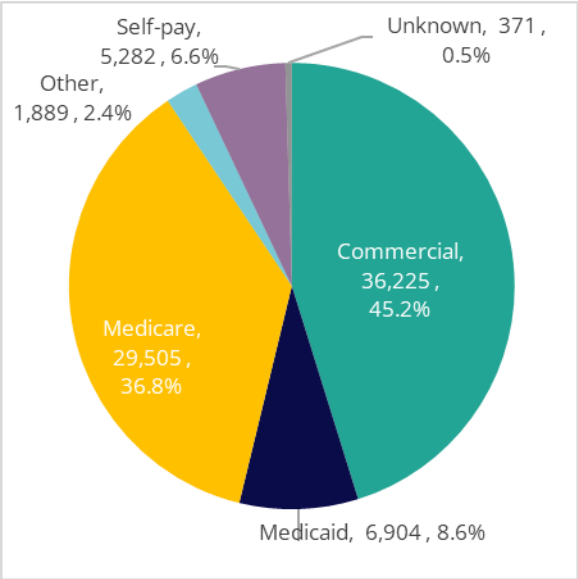
Ranking	Cause	Outcome	Count	%Outcome	Total
1	Hang	Alive	56	74.7%	75
		Dead	19	25.3%	
2	GSW	Alive	1,100	79.3%	1,388
		Dead	288	20.7%	
3	Exp	Alive	108	92.3%	117
		Dead	9	7.7%	
4	Ped	Alive	1,491	92.8%	1,607
		Dead	116	7.2%	
5	Burn	Alive	301	95.3%	316
		Dead	15	4.7%	
6	MV	Alive	8,027	95.8%	8,375
		Dead	348	4.2%	
7	MC	Alive	3,451	97.1%	3,555
		Dead	104	2.9%	
8	Assault	Alive	1,611	97.9%	1,645
		Dead	34	2.1%	
9	Fall	Alive	43,931	98.0%	44,850
		Dead	919	2.0%	
10	Stab	Alive	1,490	98.4%	1,514
		Dead	24	1.6%	

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

Hanging and gunshot wounds (including both self-inflicted and accidental injuries) were the 2 most deadly injuries between 2018 and 2022. The fatality rates were about 25% and 21% respectively.

M. 2018–2022 Payers for all trauma patients

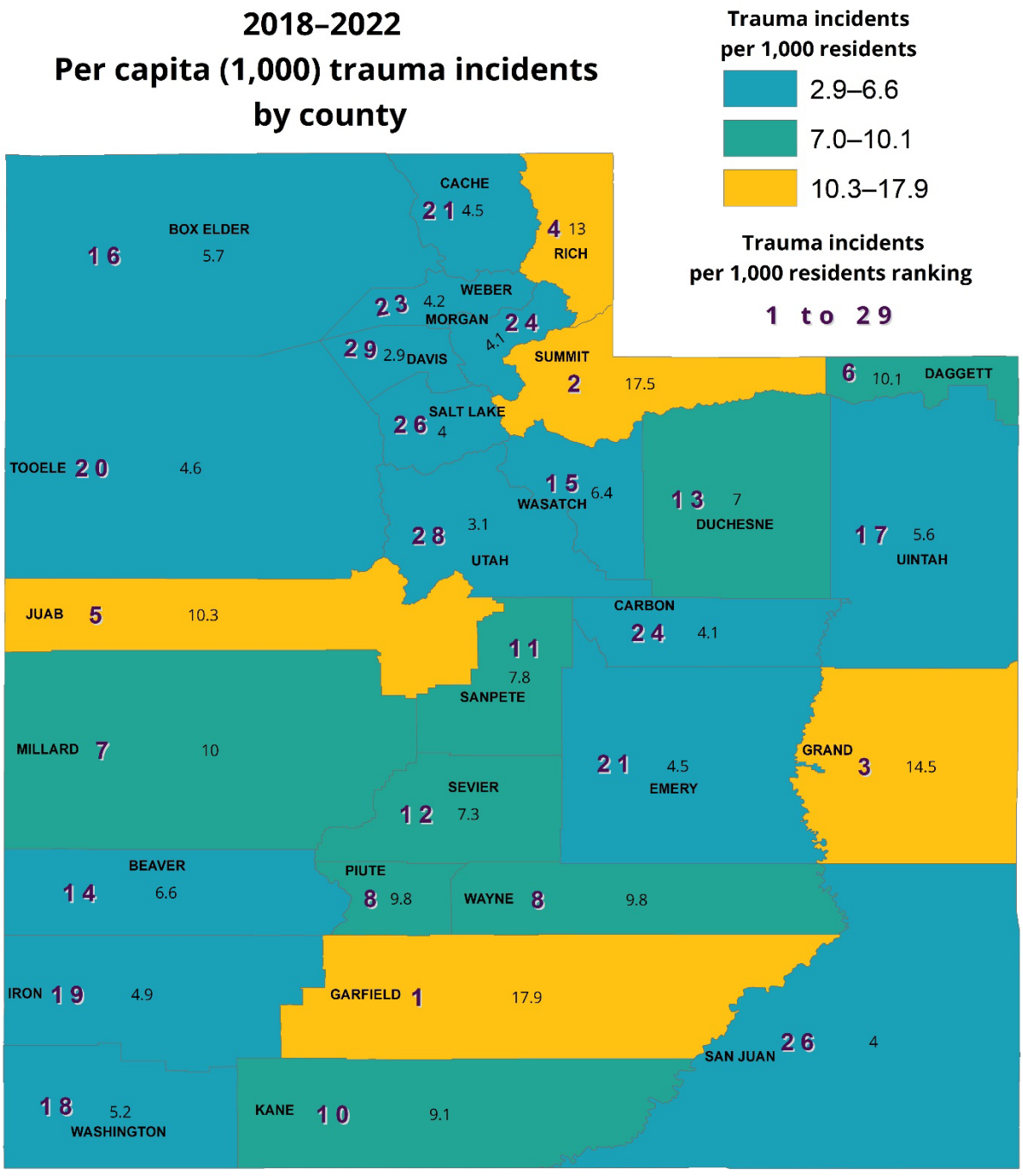
Figure 11. 2018–2022 Payers for all trauma patients



Commercial insurance (45.2%) and Medicare (36.8%) paid for 82% of all trauma patients between 2018 and 2022.

N. 2018–2022 Per capita average trauma incidents by county

Figure 12. 2018–2022 Per capita average trauma incidents by county

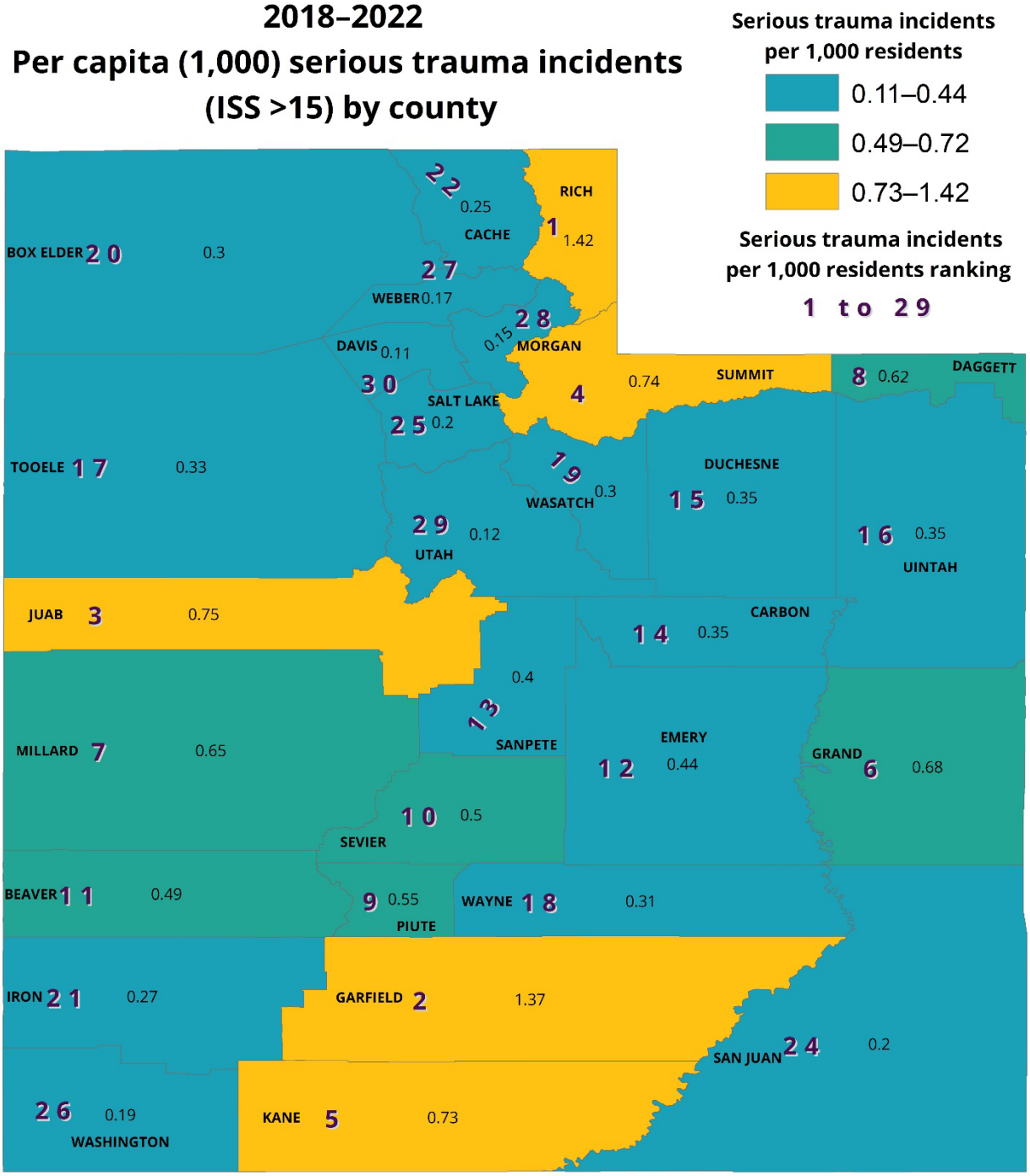


Garfield County ranked first in per capita average trauma incidents between 2018 and 2022. The top 5 counties (Garfield, Summit, Grand, Rich, and Juab) are all rural or frontier counties based on the county classification (Appendix D).

Source: Annual Estimates of the Resident Population as of July 1, 2022. U.S. Census Bureau

O. 2018–2022 Per capita average serious trauma incidents (ISS >15) by county

Figure 13. 2018–2022 Per capita average serious trauma incidents (ISS >15) by county



Rich County ranked first in per capita serious trauma incidents between 2018 and 2022. The top 5 counties (Rich, Garfield, Juab, Summit, and Kane) are all rural or frontier counties, based on the county classification (Appendix D).

Source: Annual Estimates of the Resident Population as of July 1, 2022. U.S. Census Bureau

P. 2018–2022 Trauma incidents details for the top 5 counties

1. Garfield County

a) 2018–2022 Garfield County: top 10 causes of traumatic injury, fatality, average age, ISS, and LOS

Table 3. 2018–2022 Top 10* causes of traumatic injury, fatality, average age, ISS, and LOS in Garfield County

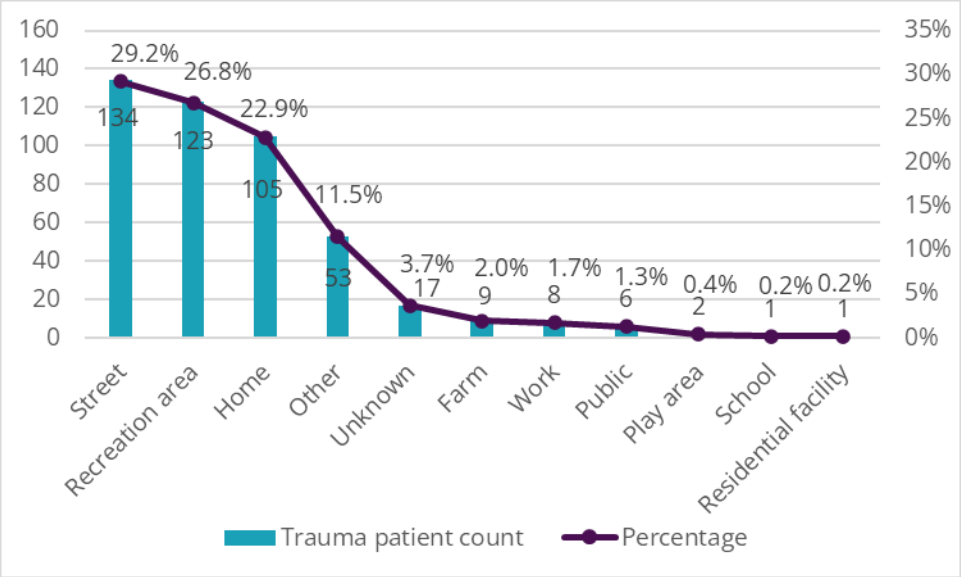
Cause	Count	Percentage	Fatality	Fatality rate	Avg age	Avg ISS	Avg LOS
Fall	180	39.2%	1	0.6%	64.8	7.3	1.9
MV	77	16.8%	1	1.3%	51.6	10.5	8.7
Animal	61	13.3%	1	1.6%	46.3	9.7	2.0
MC	46	10.0%	1	2.2%	54.0	9.6	3.1
OV	40	8.7%	0	0%	38.1	7.4	2.8
Bike	15	3.3%	0	0%	50.9	6.7	2.2
Struck	12	2.6%	0	0%	29.4	4.9	0.8
Machine	7	1.5%	0	0%	41.6	3.9	1.3
Other	5	1.1%	0	0%	44.2	4.0	0.6
Ped	3	0.7%	0	0%	29.7	12.0	1.0

*Top 10 causes included 97% (446) of all trauma patients (n=459) in Garfield County between 2018 and 2022.

Other vehicle (e.g., ATV) incidents had the highest fatality rate (2.5%) in Garfield County. Pedestrian incidents had the highest average ISS (12). Motor vehicle incidents had the longest average hospital stay (8.7 days).

b) 2018–2022 Garfield County: Injury locations

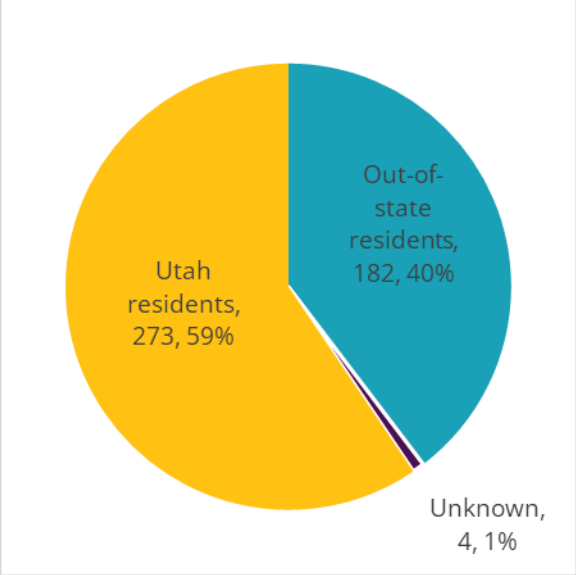
Figure 14. 2018–2022 Locations where traumatic injuries occurred in Garfield County



About one-third (29.2%) of injuries in Garfield County occurred on streets, followed by recreation areas (26.8%) and homes (22.9%).

c) 2018–2022 Garfield County: Residence of trauma patients

Figure 15. 2018–2022 Residence of trauma patients in Garfield County



In Garfield County, 40% percent of trauma patients were from out-of-state.

2. Summit County

a) 2018–2022 Summit County: Top 10 causes of traumatic injury, fatality, average age, ISS, and LOS

Table 4. 2018–2022 Top 10* causes of traumatic injury, fatality, average age, ISS, and LOS in Summit County

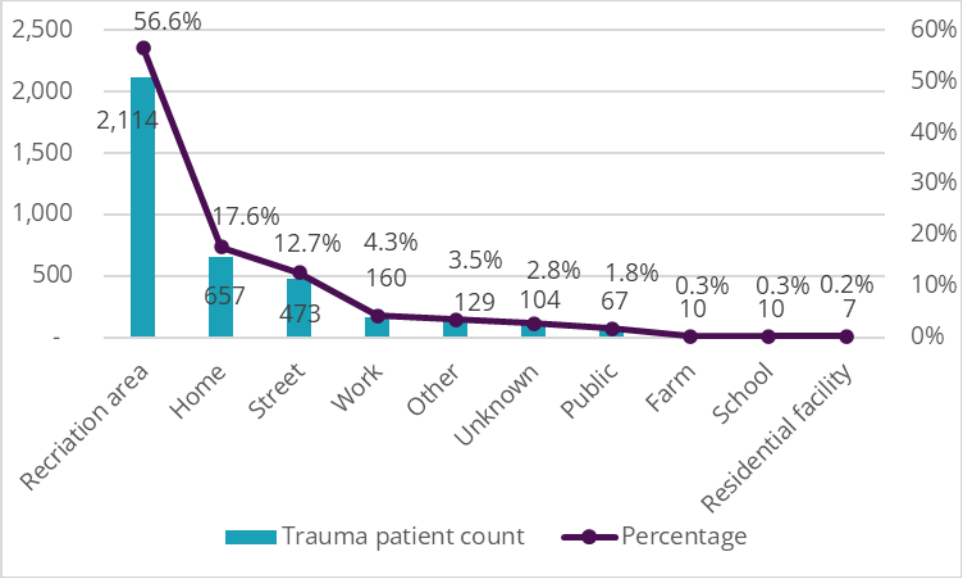
Cause	Count	Percentage	Fatality	Fatality rate	Avg age	Avg ISS	Avg LOS
Sport	1,282	34.4%	8	0.6%	45.0	7.0	1.8
Fall	1,074	28.8%	11	1.0%	55.2	7.0	2.0
Bike	603	16.2%	3	0.5%	44.8	8.2	1.8
MV	179	4.8%	3	1.7%	45.3	9.8	3.0
Struck	162	4.3%	2	1.2%	33.7	6.0	1.4
OV	155	4.2%	1	0.6%	38.8	8.2	2.2
Animal	77	2.1%	0	0.0%	47.3	6.9	1.5
MC	70	1.9%	3	4.3%	42.2	9.9	4.7
Machine	33	0.9%	0	0.0%	42.8	3.5	1.0
Ped	22	0.6%	3	13.6%	33.7	7.5	2.0

*Top 10 causes included about 98% (3,657) of all trauma patients (n=3,732) in Summit County between 2018 and 2022.

In Summit County, sports injuries were the most common injuries (34.4%), followed by falls (28.8%) and incidents involving bikes (16.2%). Motorcycle incidents had the highest average ISS (9.9), longest average hospital stay (4.7 days), and the highest fatality rate (4.3%).

b) 2018–2022 Summit County: Injury locations

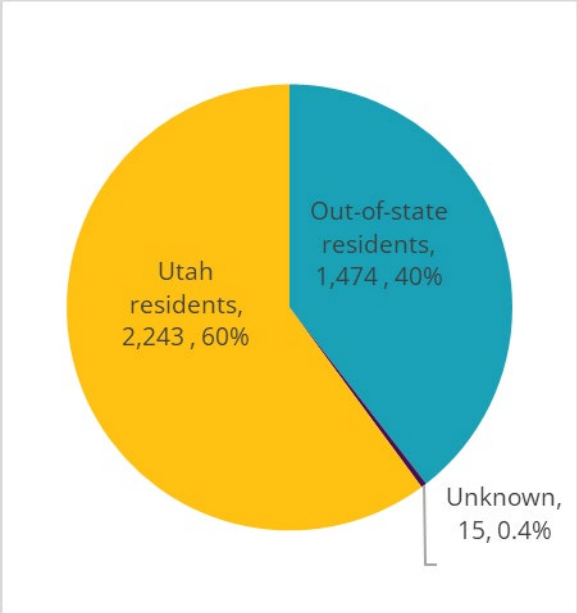
Figure 16. 2018–2022 Locations where traumatic injuries occurred in Summit County



More than half (56.6%) of the injuries in Summit County happened in recreation areas, followed by homes (17.7%) and streets (12.7%).

c) 2018–2022 Summit County: Residence of trauma patients

Figure 17. 2018–2022 Residence of trauma patients in Summit County



In Summit County, 40% of trauma patients were from out-of-state.

3. Grand County

a) 2018–2022 Grand County: Top 10 causes of traumatic injury, fatality, average age, ISS, and LOS

Table 5. 2018–2022 Top 10* causes of traumatic injury, fatality, average age, ISS, and LOS in Grand County

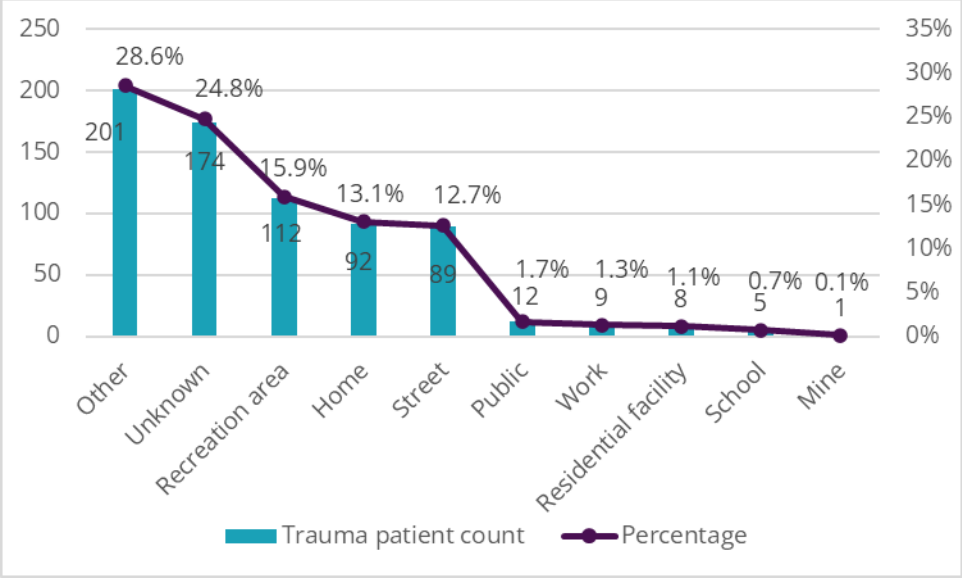
Cause	Count	Percentage	Fatality	Fatality rate	Avg age	Avg ISS	Avg LOS
Fall	272	38.7%	1	0.4%	62.7	7.5	2.2
Bike	107	15.2%	0	0%	47.7	7.0	1.8
MC	101	14.4%	0	0%	45.5	8.7	1.8
OV	60	8.5%	0	0%	39.9	6.3	1.1
MV	54	7.7%	1	1.9%	42.4	7.4	1.7
Animal	20	2.8%	0	0%	40.8	7.1	1.8
Other	14	2.0%	0	0%	48.3	4.8	0.8
Sport	12	1.7%	0	0%	30.8	9.8	2.8
Stab	11	1.6%	0	0%	29.9	1.4	0.8
Ped	10	1.4%	0	0%	35.8	7.6	0.6

*Top 10 causes included about 94% (661) of all trauma patients (n=703) between 2018 and 2022 in Grand County.

In Grand County, motor vehicle incidents had the highest fatality rate (1.9%). Sporting injuries had the highest average ISS (9.8) and the longest average hospital stay (2.8 days).

b) 2018–2022 Grand County: Injury locations

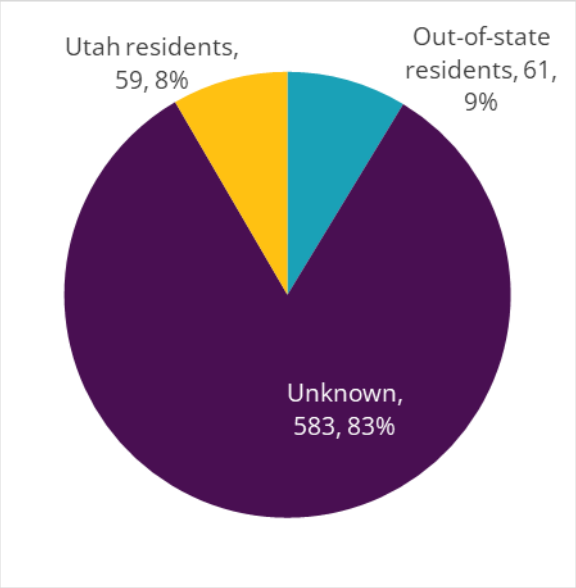
Figure 18. 2018–2022 Locations where traumatic injuries occurred in Grand County



Grand County had higher percentages (about 53%) of "other" and "unknown" locations. These may include remote areas not otherwise categorized as a specified location.

c) 2018–2022 Grand County: Residence of trauma patients

Figure 19. 2018–2022 Residence of trauma patients in Grand County



In Grand County, the residence of 83% of trauma patients was unknown.

4. Rich County

a) 2018–2022 Rich County: Top 10 causes of traumatic injury, fatality, average age, ISS, and LOS

Table 6. 2018–2022 Top 10* causes of traumatic injury, fatality, average age, ISS, and LOS in Rich County

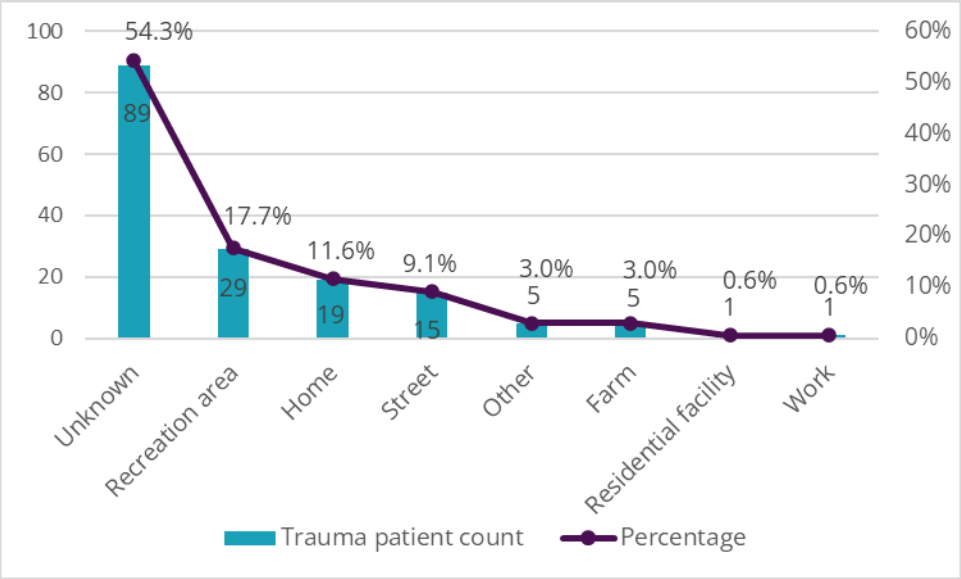
Cause	Count	Percentage	Fatality	Fatality rate	Avg age	Avg ISS	Avg LOS
Fall	64	39.0%	0	0%	47.5	8.4	2.2
OV	32	19.5%	0	0%	34	8.2	2
MV	16	9.8%	4	25%	42.5	13.1	2.4
Animal	13	7.9%	0	0%	35	7.4	1.3
Sport	9	5.5%	0	0%	37.3	9	4.6
Bike	7	4.3%	0	0%	16.7	6.9	1.1
MC	7	4.3%	0	0%	41.7	8	3.3
Struck	5	3.0%	0	0%	24.8	12	5.8
Ped	3	1.8%	0	0%	31.3	6	3.7
Machine	2	1.2%	0	0%	38	3	0.5

*Top 10 causes included about 96% (158) of all trauma patients (n=164) between 2018 and 2022 in Rich County.

In Rich County, motor vehicle incidents had the highest fatality rate (25%) and the highest average ISS (13.1). Injuries caused by being struck by an object had the longest average hospital stay (5.8 days).

b) 2018–2022 Rich County: Injury locations

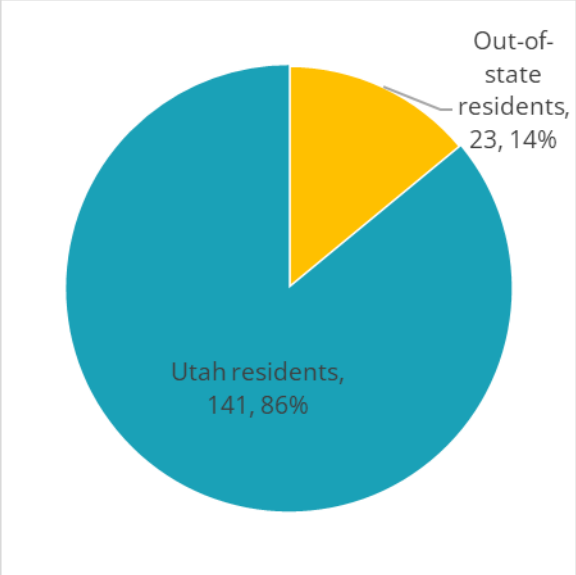
Figure 20. 2018–2022 Locations where traumatic injuries occurred in Rich County



In Rich County, 54% of traumatic injury locations were “unknown.” Recreation areas (18%) and homes (12%) were the second and third most common places.

c) 2018–2022 Rich County: Residence of trauma patients

Figure 21. 2018–2022 Residence of trauma patients in Rich County



In Rich County, 86% of trauma patients were Utah residents.

5. Juab County

a) 2018–2022 Juab County: Top 10 causes of traumatic injury, fatality, average age, ISS, and LOS

Table 7. 2018–2022 Top 10* causes of traumatic injury, fatality, average age, ISS, and LOS in Juab County

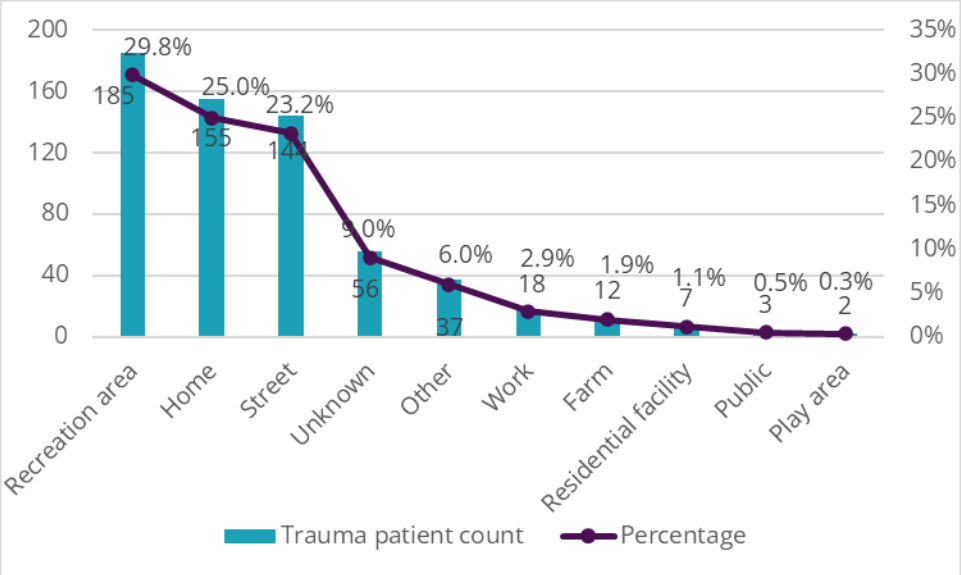
Cause	Count	Percentage	Fatality	Fatality rate	Avg age	Avg ISS	Avg LOS
Fall	195	31.5%	4	2.1%	60.2	7.0	3.5
OV	130	21.0%	1	0.8%	34.8	9.2	3.3
MV	103	16.6%	7	6.8%	39.8	10.7	4.5
MC	100	16.1%	3	3%	33.2	9.1	3.0
Animal	24	3.9%	1	4.2%	31.5	7.0	3.1
Struck	12	1.9%	0	0%	27.3	8.0	2.2
Bike	11	1.8%	0	0%	17.7	6.3	1.9
Other	10	1.6%	0	0%	38.9	2.9	1.0
GSW	8	1.3%	1	12.5%	36.1	3.3	3.3
Stab	7	1.1%	0	0%	24.9	1.4	0.9

*Top 10 causes included about 97% (600) of all trauma patients (n=620) between 2018 and 2022 in Juab County.

In Juab County, the fatality rate was the highest (13%) for gunshot wounds. Motor vehicle incidents had the highest average ISS (10.7) and the longest average hospital stay (4.5 days).

b) 2018–2022 Juab County: Injury locations

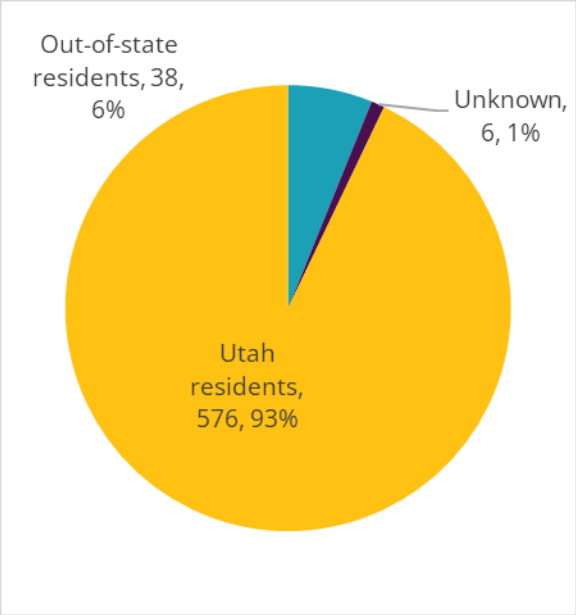
Figure 22. 2018–2022 Locations where traumatic injuries occurred in Juab County



About 30% of traumatic injuries in Juab County occurred in recreation areas, followed by home (25%) and streets (23%).

c) 2018–2022 Juab County: Residence of trauma patients

Figure 23. 2018–2022 Residence of trauma patients in Juab County



The majority (93%) of trauma patients in Juab County were Utah residents. Only 6% were from out-of-state.

Q. 2018–2022 Trauma patient transfer

1. Transfer of trauma patients in Utah

a) Transfer destinations

Table 8. 2018–2022 Transfer of trauma patients in Utah

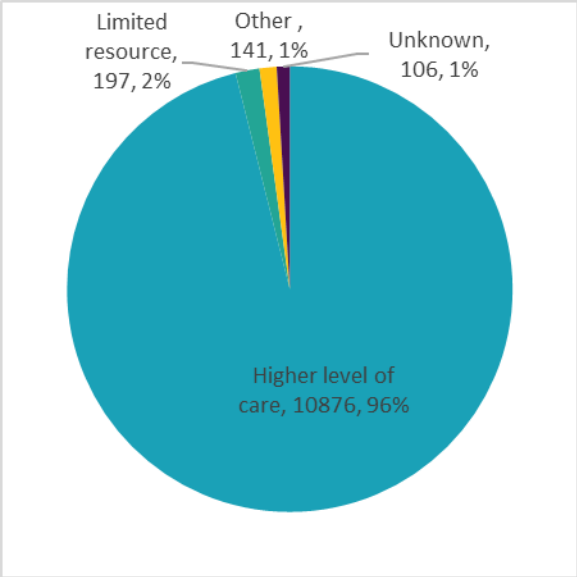
	Transfer destination hospital level[I]							
Hospital level[*]	Level I	Level II	Level III	Level IV	Resource	CAH	Other[‖]	Total
Level I	262	2	1	18	9	0	6	298
Level II	780	9	7	3	6	0	2	807
Level III	672	621	3	4	4	0	2	1,306
Level IV	3,216	1,989	22	84	50	12	11	5,384
Resource	1,269	820	11	22	17	13	4	2,156
CAH	138	446		73	23	8	1	689
Other[‡]	139	420	108	12	1	0	0	680
Total	6,476	4,307	152	216	110	33	26	11,320
%	57.2%	38.0%	1.3%	1.9%	1.0%	0.3%	0.2%	

*Hospital level where the patient was originally brought in
†Hospital level where the patient was transferred to
ǂFree-standing emergency departments
‖Mental health facility, home, hospice, or other non-hospital facility

Between 2018 and 2022, out of 80,176 patients, 11,320 (14.1%) were admitted to a hospital then transferred to another hospital in Utah. The majority of those patients were transferred to Level I (57.2%) or Level II (38%) trauma center (see Appendix A for hospital level designation definitions).

b) Transfer reasons

Figure 24. 2018–2022 Transfer reasons for trauma patients in Utah



Of those trauma patients who were transferred to another Utah hospital, 96% of them needed a higher level of care or a more specialized level of care depending on the types of injuries and/or patient's age (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 hospitals that received transferred trauma patients	Out-of-state hospitals transferred trauma patients to Utah hospitals	Count	%
Central	Level I	Arizona hospital	11	0.4%
		Colorado hospital	47	1.6%
		Idaho hospital	579	19.8%
		Montana hospital	248	8.5%
		Nevada hospital	559	19.2%
		New Mexico hospital	7	0.2%
		Other out-of-state hospital	36	1.2%
		Wyoming hospital	964	33%
	Level II	Colorado hospital	1	0.03%
		Idaho hospital	1	0.03%
		Nevada hospital	20	0.7%
		Wyoming hospital	29	1.0%
	Level IV	Wyoming hospital	1	0.0%
Northern	Level II	Idaho hospital	48	1.6%
		Other out-of-state hospital	8	0.3%
		Wyoming hospital	33	1.1%
	Level III	Idaho hospital	12	0.4%
		Other out-of-state hospital	10	0.3%
	Level IV	Idaho hospital	7	0.2%
Southcentral	Level II	Colorado hospital	2	0.1%
		Nevada hospital	3	0.1%
		Other out-of-state hospital	2	0.1%
		Wyoming hospital	3	0.1%
	Level IV	Other out-of-state hospital	1	0.03%
Southwest	Level II	Arizona hospital	84	2.9%
		Nevada hospital	188	6.4%
		Other out-of-state hospital	11	0.4%
	Level IV	Nevada hospital	1	0.03%
		Other out-of-state hospital	1	0.03%
		Total	2,917	100%

Between 2018 and 2022, 2,917 (3.6%) patients out of 80,176 were transferred from out-of-state to Utah hospitals. Level I hospitals in the central region received about 84% (2,451) of all out-of-state patients. Idaho, Nevada, and Wyoming were the top three states that transferred trauma patients to Utah.

3. Transfer of trauma patients from Utah to out-of-state hospitals by trauma region

a) Transfer destinations

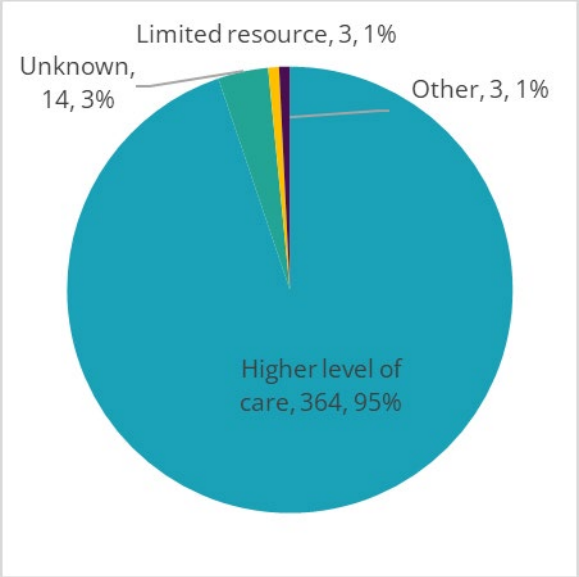
Table 10. Transfer of trauma patients from Utah to out-of-state hospitals by trauma regions

Trauma region	Level of Utah hospital that transferred trauma patients to out-of-state hospital	Destination hospital for patient transfer	Count	%
Central	Level I	Other out-of-state hospital	1	0.3%
	Level IV	Other out-of-state hospital	2	0.5%
	Resource	Colorado hospital	1	0.3%
Northern	Level II	Idaho hospital	1	0.3%
	Level IV	Idaho hospital	1	0.3%
Southcentral	Resource	Other out-of-state hospital	1	0.3%
Southeast	CAH	Other out-of-state hospital	1	0.3%
		Colorado hospital	72	18.8%
		Arizona hospital	1	0.3%
		New Mexico hospital	1	0.3%
	Level IV	Colorado hospital	207	53.9%
		New Mexico hospital	1	0.3%
Southwest	CAH	Colorado hospital	2	0.5%
		Nevada hospital	4	1.0%
		Arizona hospital	1	0.3%
	Level II	Nevada hospital	78	20.3%
	Level IV	Nevada hospital	6	1.6%
		Other out-of-state hospital	1	0.3%
	Resource	Nevada hospital	2	0.5%
		Total	384	100%

Between 2018 and 2022, 384 (0.5%) out of 80,176 trauma patients were transferred to out-of-state hospitals. Southeast (283, 73.7%) and southwest (94, 24.5%) 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. 2018–2022 Transfer reasons for trauma patients who were transferred to out-of-state hospitals

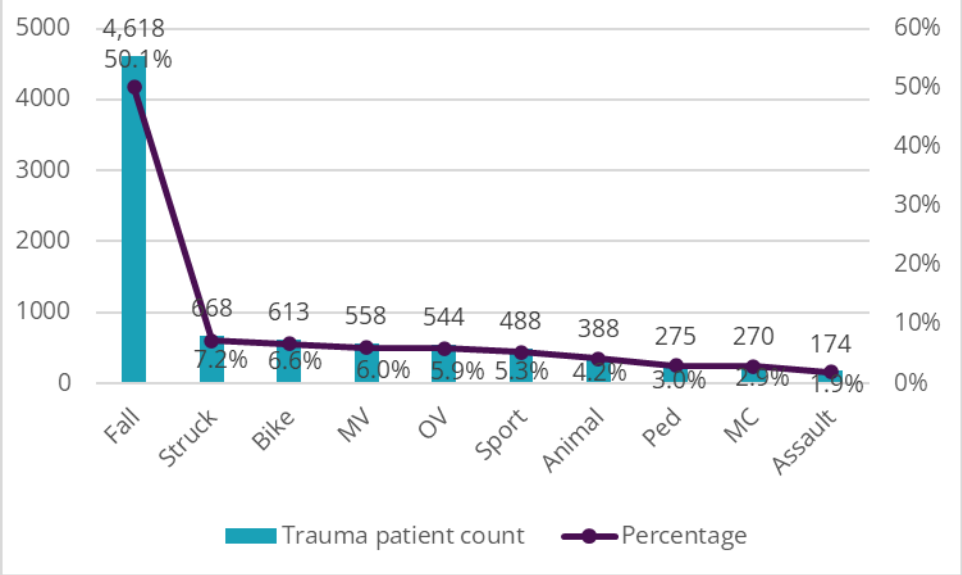


The majority (95%) of trauma patients who were transferred to out-of-state hospitals needed a higher level of care.

II. 2018–2022 Pediatric trauma patients

A. 2018–2022 Top 10 injury causes for pediatric trauma patients

Figure 26. 2018–2022 Top 10* injury causes for pediatric trauma patients

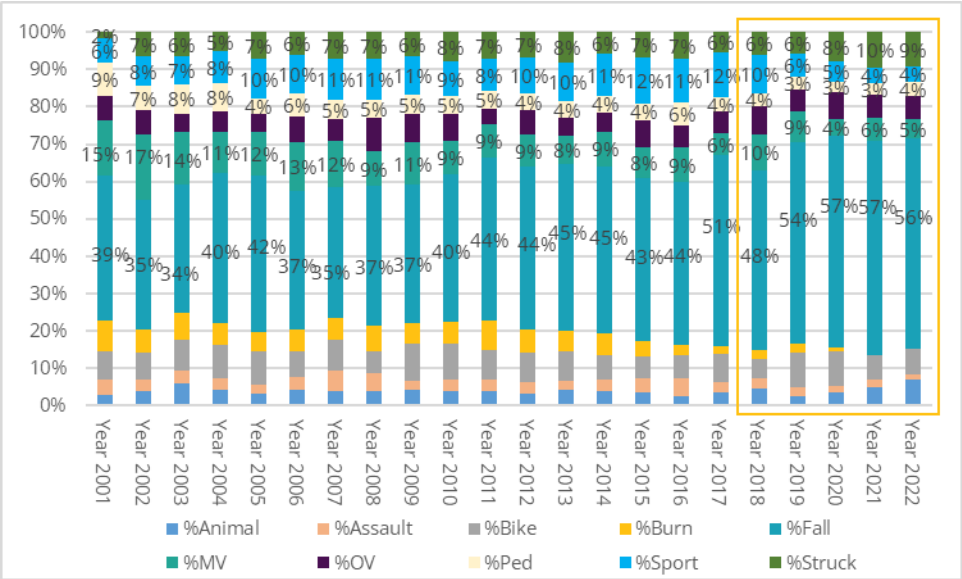


*Top 10 causes included 93% (8,596) of all pediatric trauma patients (n=9,226) between 2018 and 2022.

In pediatric patients, falls (50.1%) were the most common cause of traumatic injuries followed by being struck by an object (7.2%), and incidents involving a bicycle (6.6%).

B. 2001–2022 Trend for top 10 injury causes for pediatric trauma patients

Figure 27. 2001–2022 Trend for top 10 injury causes for pediatric trauma patients



In the past 22 years (between 2001 and 2022), traumatic injuries due to motor vehicles decreased by 10% and pedestrian incidents by 5% in pediatric patients. Injuries caused by a fall increased by 17% and being struck by an object grew by 7%. However, decreases in pediatric sporting injuries (from 10% to 4%) and injuries due to motor vehicle incidents (from 10% to 5%) in the past 5 years (between 2018 and 2022) may also reflect the effects of activity restrictions and the quarantine policy of the COVID-19 pandemic.

C. 2018–2022 Most commonly injured body regions by top 5 causes for pediatric patients

Table 11. 2018–2022 Most commonly injured body regions by top 5 causes for pediatric patients

Ranking	FALL	Total	%	STRUCK	Total	%	BIKE	Total	%	MV	Total	%	OV	Total	%
1	Extremity	3,785	40.4%	Head	487	29.4%	External	812	39.6%	External	1,103	37.1%	External	893	37.3%
2	Head	2,911	31.1%	External	461	27.9%	Extremity	431	21.0%	Head	596	20.0%	Extremity	579	24.2%
3	External	1,733	18.5%	Extremity	350	21.1%	Head	401	19.6%	Extremity	414	13.9%	Head	437	18.3%
4	Chest	344	3.7%	Face	201	12.1%	Face	156	7.6%	Chest	403	13.5%	Chest	212	8.9%
5	Face	326	3.5%	ABD	95	5.7%	ABD	151	7.4%	ABD	277	9.3%	Face	150	6.3%
6	ABD	264	2.8%	Chest	61	3.7%	Chest	99	4.8%	Face	183	6.1%	ABD	122	5.1%

The external part of the body (lacerations, bruises, etc.) was the most commonly injured body region for pediatric patients for the top five causes of traumatic injury involving a fall, being struck, bicycle, motor vehicle, and other vehicle between 2018 and 2022 followed by the head and extremities.

D. 2018–2022 Pediatric fatality, average age, ISS, and LOS for top 10 injury causes

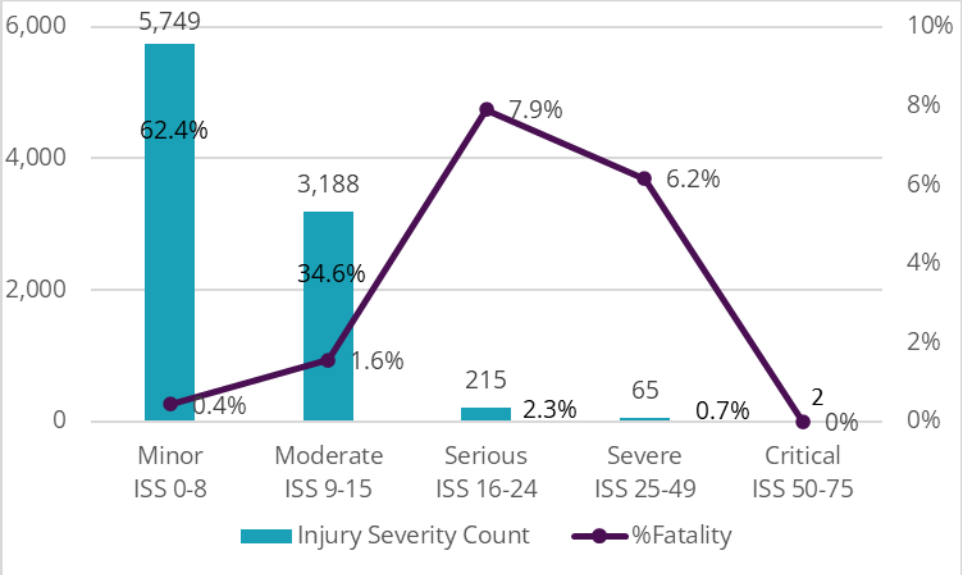
Table 11. 2018–2022 Fatality, average age, ISS, and LOS for pediatric top 10 causes of traumatic injury

Cause	Count	Percentage	Fatality	Fatality rate	Avg Age	Avg ISS	Avg LOS
Fall	4,618	53.7%	2	0.04%	6.0	5.7	1.0
Struck	668	7.8%	6	0.9%	7.6	6.0	1.3
Bike	613	7.1%	3	0.5%	9.7	6.6	1.4
MV	558	6.5%	23	4.1%	8.3	9.1	3.5
OV	544	6.3%	10	1.8%	10.5	7.8	2.0
Sport	488	5.7%	0	0%	10.7	5.8	0.8
Animal	388	4.5%	1	0.3%	7.4	4.8	1.1
Ped	275	3.2%	13	4.7%	8.2	9.3	2.7
MC	270	3.1%	2	0.7%	11.4	7.6	1.5
Assault	174	2.0%	15	8.6%	2.2	9.6	5.0

Between 2018 and 2022, assaults had the highest average ISS (9.6), longest average stay in the hospital (5 days), and the highest fatality rate (8.6%) among the top 10 causes in pediatric patients, exceeding motor vehicle and pedestrian incidents.

E. 2018–2022 Pediatric injury severity and fatality rate

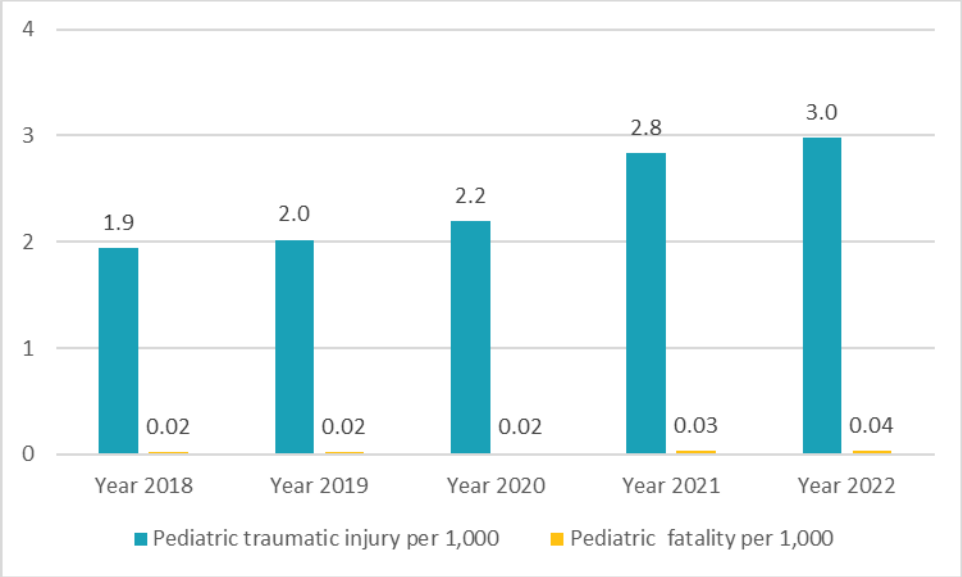
Figure 28. 2018–2022 Pediatric injury severity and fatality rate



Between 2018–2022, 97% of pediatric patients had minor (62.4%) and moderate (34.6%) injuries. Serious and severe injuries had the highest fatality rates.

F. 2018–2022 Pediatric per capita traumatic injury incidents and fatality

Figure 29. 2018–2022 Pediatric per capita traumatic injury incidents and fatality



Traumatic injuries per 1,000 increased from 1.9 to 3 in the pediatric population between 2018 and 2022 and so has the fatality rate (from 0.02 to 0.04).

G. 2018–2022 Top 10 lethal injuries for pediatric patients

Table 12. 2018–2022 Top 10* lethal injuries for pediatric patients

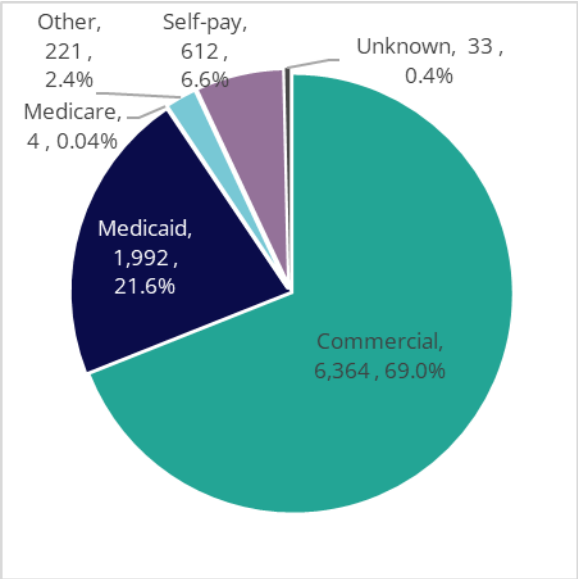
Ranking	Cause	Outcom	Count	%	Total
1	GSW	Alive	54	87.1%	62
		Dead	8	12.9%	
2	Assault	Alive	159	91.4%	174
		Dead	15	8.6%	
3	Ped	Alive	262	95.3%	275
		Dead	13	4.7%	
4	MV	Alive	535	95.9%	558
		Dead	23	4.1%	
5	Stab	Alive	88	96.7%	91
		Dead	3	3.3%	
6	OV	Alive	534	98.2%	544
		Dead	10	1.8%	
7	Caught	Alive	139	98.6%	141
		Dead	2	1.4%	
8	Struck	Alive	661	99.1%	667
		Dead	6	0.9%	
9	MC	Alive	267	99.3%	269
		Dead	2	0.7%	
10	Bike	Alive	610	99.5%	613
		Dead	3	0.5%	

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

Gunshot wounds had the highest fatality rate (12.9%) for pediatric patients followed by assaults (8.6%) and pedestrian incidents (4.7%).

H. 2018–2022 Payers for pediatric trauma patients

Figure 30. 2018–2022 Payers for pediatric trauma patients

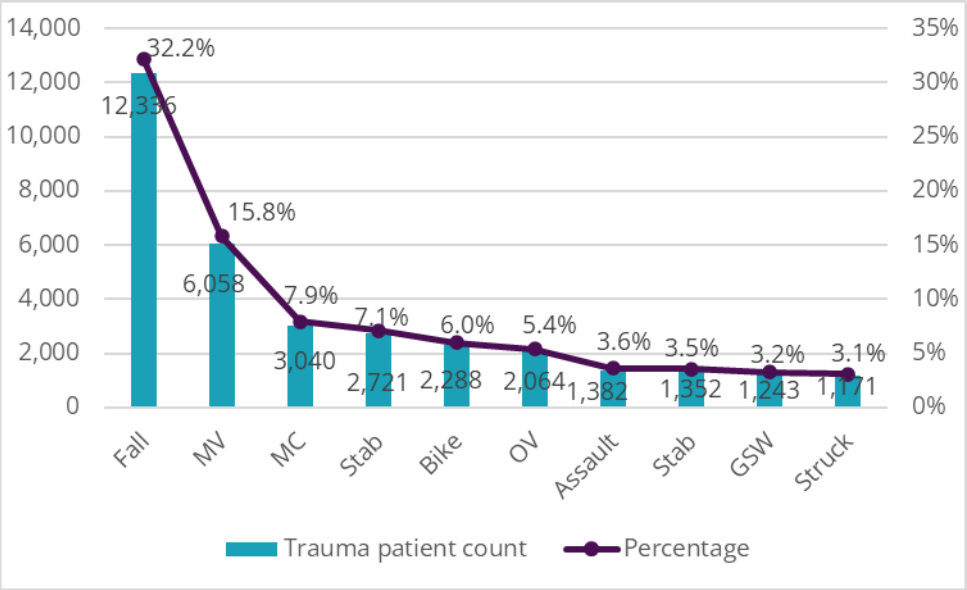


Commercial insurance (69%) and Medicaid (22%) paid for 91% of pediatric trauma patients between 2018 and 2022.

III. 2018–2022 Adult trauma patients

A. 2018–2022 Top 10 injury causes for adult trauma patients

Figure 31. 2018–2022 Top 10* injury causes for adult trauma patients

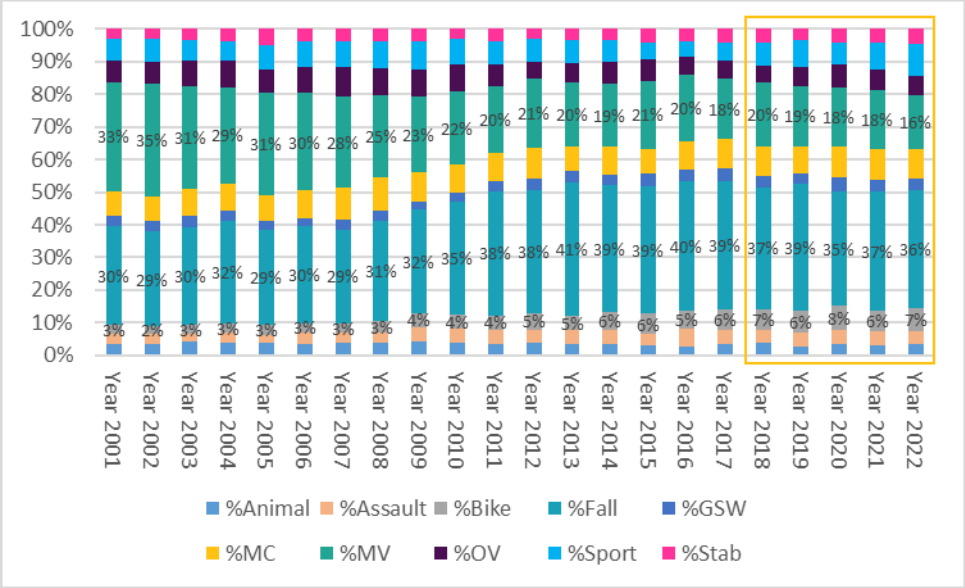


*Top 10 causes included about 88% (33,655) of all adult patients (n=38,296) between 2018 and 2022.

Falls (32.2%), motor vehicle (15.8%), and motorcycle incidents (7.9%) comprised more than half (55.9%) of all injuries for adult trauma patients.

B. 2001–2022 Trend for top 10 Injury causes for adult trauma patients

Figure 32. 2001–2022 Trend for top 10 injury causes for adult trauma patients



In contrast to falls which increased by 6% between 2001 (30%) and 2022 (36%), motor vehicle incidents have been decreasing steadily (33% in 2001, 20% in 2018, and 16% in 2022). Bicycle incidents have been slightly increasing (3% in 2001, 7% in 2022). However, the decline in motor vehicle incidents in the past 5 years may reflect lifestyle changes due to the COVID-19 pandemic. Other causes remained relatively stable.

C. 2018–2022 Most commonly injured body regions by top 5 causes for adult trauma patients

Table 13. 2018–2022 Most commonly injured body regions by top 5 causes for adult trauma patients

Ranking	FALL	Total	%	MV	Total	%	MC	Total	%	SPORT	Total	%	BIKE	Total	%
1	Extremity	12,767	35.1%	External	8,816	26.9%	Extremity	5,210	31.3%	Extremity	3,002	41.9%	External	3,079	31.2%
2	External	7,470	20.5%	Extremity	7,084	21.6%	External	4,391	26.3%	Chest	1,333	18.6%	Chest	2,220	22.5%
3	Head	7,203	19.8%	Chest	6,805	20.7%	Chest	3,245	19.5%	Head	1,045	14.6%	Extremity	2,061	20.9%
4	Chest	4,706	12.9%	Head	5,112	15.6%	Head	1,988	11.9%	External	873	12.2%	Head	1,382	14.0%
5	ABD	2,337	6.4%	ABD	3,345	10.2%	ABD	1,121	6.7%	ABD	660	9.2%	Face	633	6.4%
6	Face	1,919	5.3%	Face	1,672	5.1%	Face	716	4.3%	Face	245	3.4%	ABD	500	5.1%

For the top 5 causes of injury (incidents involving a fall, motor vehicle, motorcycle, sport, and bicycle) extremities are the most commonly injured body regions, followed by external (laceration, bruises, bump, etc.) and chest.

D. 2018–2022 Fatality, average age, ISS, and LOS for top 10 causes for adult trauma patients

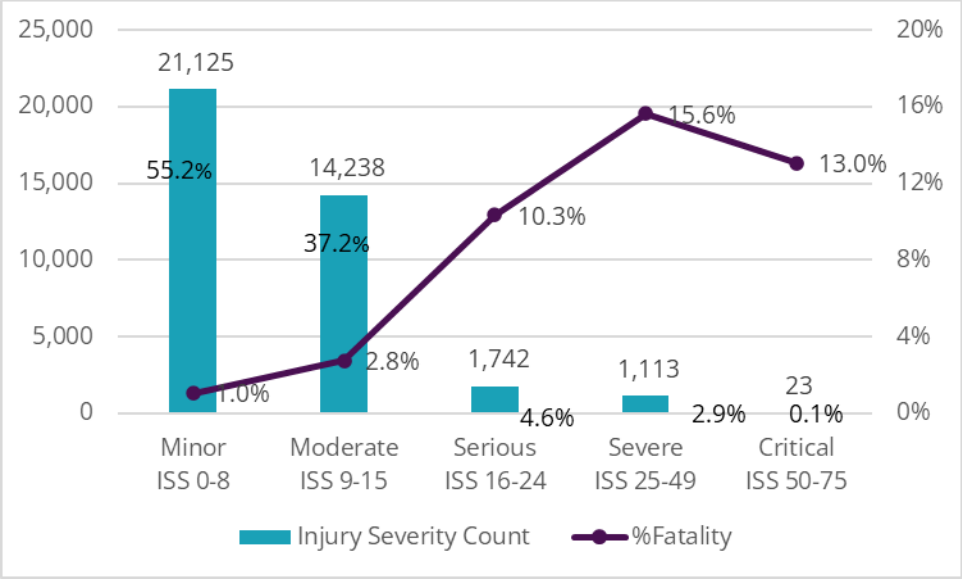
Table 14. 2018–2022 Fatality, average age, ISS, and LOS for top 10 causes for adult patients

Cause	Count	Percentage	Fatality	Fatality rate	Avg age	Avg ISS	Avg LOS
Fall	12,336	36.7%	180	1.5%	46.7	7.2	3.1
MV	6,058	18.0%	217	3.6%	35.8	9.7	4.2
MC	3,040	9.0%	88	2.9%	37.1	9.8	3.9
Sport	2,721	8.1%	13	0.5%	35.3	6.9	2.3
Bike	2,288	6.8%	20	0.9%	42.6	8.3	2.4
OV	2,064	6.1%	22	1.1%	36.8	8.5	3.2
Assault	1,382	4.1%	18	1.3%	37.5	6.4	2.3
Stab	1,352	4.0%	21	1.6%	34.5	3.8	2.3
GSW	1,243	3.7%	258	20.8%	31.7	8.5	3.8
Struck	1,171	3.5%	6	0.5%	35.6	6.6	2.4

Among the top 10 injury causes, gunshot wounds had the highest fatality rate (20.8%) and youngest average age (31.7). Motorcycle incidents had the highest average ISS (9.8) followed by motor vehicle incidents (ISS 9.7). Motor vehicle incidents had the longest average stay in the hospital (4.2 days) followed by motorcycle incidents (3.9 days).

E. 2018–2022 Adult injury severity and fatality rate

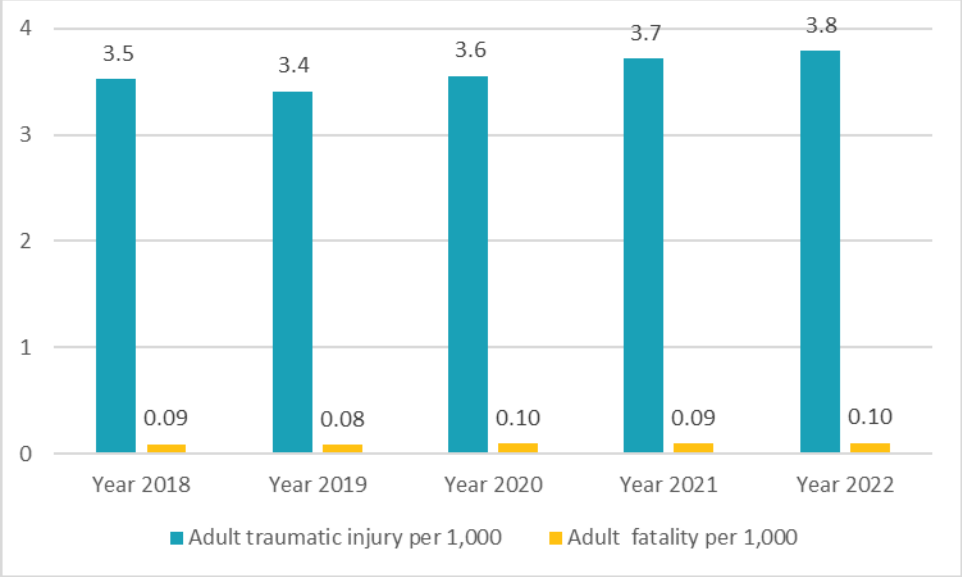
Figure 33. 2018–2022 Adult injury severity and fatality rate



Between 2018–2022, 92.4% of adults had minor (55.2%) and moderate (37.2%) injuries. Severe (15.6%) and critical injuries (13%) had the highest fatality rates.

F. 2018–2022 Adult per capita traumatic injury incidents and fatality

Figure 34. 2018–2022 Adult per capita traumatic injury incidents and fatality



The per capita injury rate slightly increased between 2018 and 2022 (from 3.5 per 1,000 to 3.8 per 1,000). On average, adult per capita fatality was about 3 times higher than pediatric patients (adult 0.09 per 1,000 vs. pediatric 0.03 per 1,000).

G. 2018–2022 Top 10 lethal injuries for adult patients

Table 15. 2018–2022 Top 10* lethal injuries for adult patients

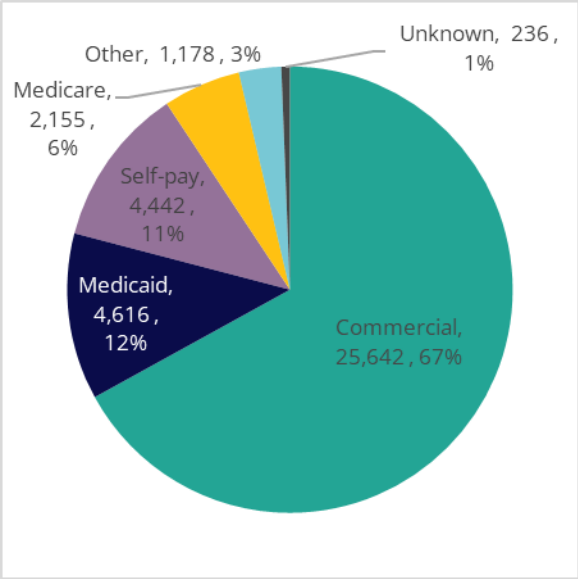
Ranking	Cause	Outcom	Count	%	Total
1	Hang	Alive	50	74.6%	67
		Dead	17	25.4%	
2	GSW	Alive	985	79.2%	1,243
		Dead	258	20.8%	
3	Exp	Alive	87	91.6%	95
		Dead	8	8.4%	
4	Ped	Alive	1,012	92.8%	1,090
		Dead	78	7.2%	
5	Burn	Alive	181	95.3%	190
		Dead	9	4.7%	
6	MV	Alive	5,840	96.4%	6,057
		Dead	217	3.6%	
7	MC	Alive	2,950	97.1%	3,038
		Dead	88	2.9%	
8	Assault	Alive	1,201	98.3%	1,222
		Dead	21	1.7%	
9	Stab	Alive	1,331	98.4%	1,352
		Dead	21	1.6%	
10	Fall	Alive	12,153	98.5%	12,333
		Dead	180	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 fatality rate of 25.4% and 20.8% respectively.

H. 2018–2022 Payers for adult trauma patients

Figure 35. 2018–2022 Payers for adult trauma patients

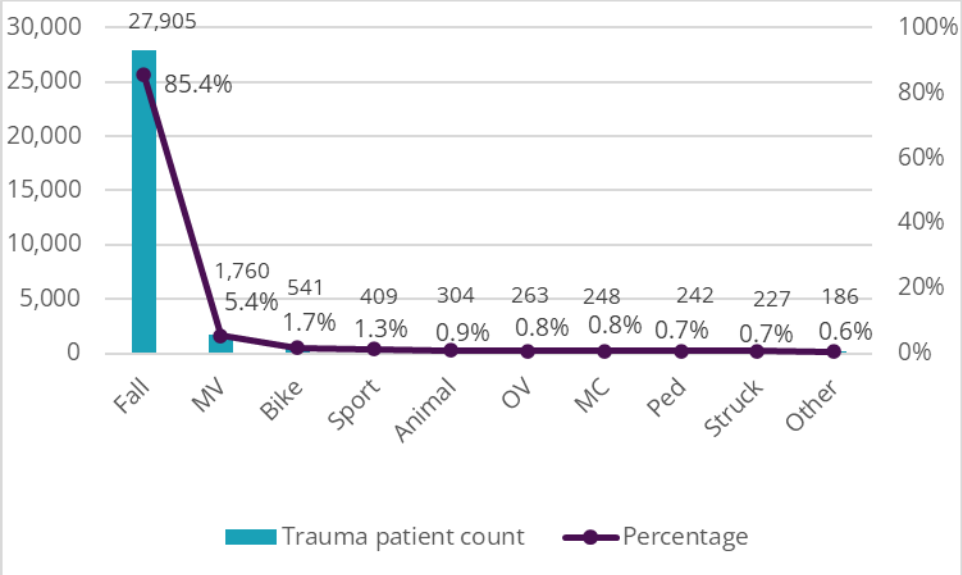


Commercial insurance (67%), Medicaid (12%), and self-pay (11%) paid for 90% of adult trauma care.

IV. 2018–2022 Geriatric trauma patients

A. 2018–2022 Top 10 causes for geriatric trauma patients

Figure 36. 2018–2022 Top 10* causes for geriatric trauma patients

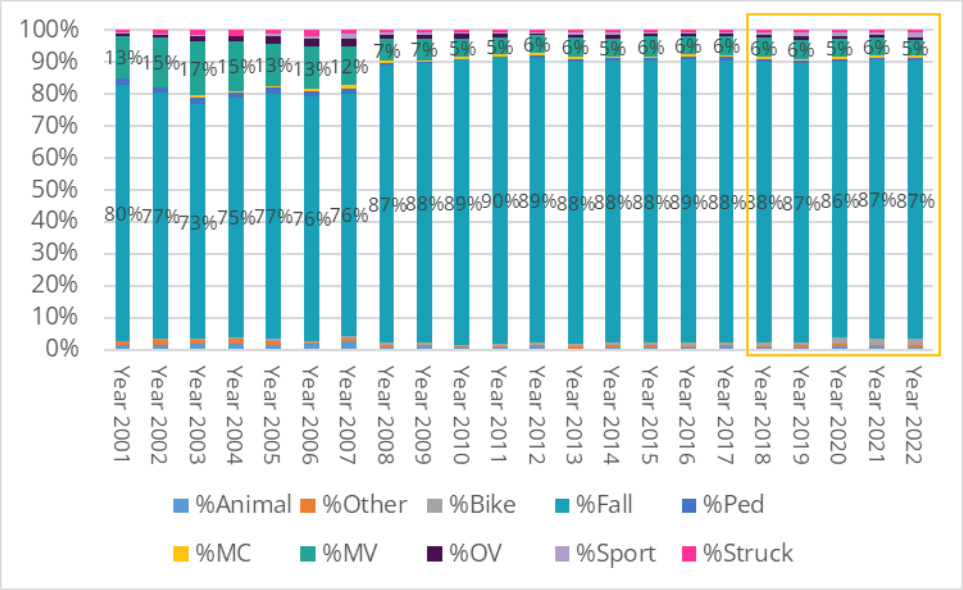


*Top 10 causes included about 98% (32,085) of all geriatric trauma patients (n=32,671).

Falls, including ground-level falls, accounted for 85% of geriatric trauma. Motor vehicle incidents were the second most common cause but to a much lesser degree (5.4%).

B. 2001-2022 Trend for top 10 causes for geriatric trauma patients

Figure 37. 2018–2022 Trend for top 10 causes for geriatric trauma patients



Falls have been 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 2018 and 2022. Motor vehicle incidents declined by more than half since 2001 (13% to 5%). Other injury causes remained relatively stable.

C. 2018–2022 Most commonly injured body regions by top 2 causes for geriatric trauma patients

Table 16. 2018–2022 Most commonly injured body regions by top 2 causes for geriatric trauma patients

Ranking	Fall	Total	%	MV	Total	%
1	Extremity	22,003	34.5%	External	2,495	29.3%
2	External	16,628	26.1%	Chest	2,356	27.7%
3	Head	11,959	18.7%	Extremity	1,613	19.0%
4	Chest	8,348	13.1%	Head	1,187	14.0%
5	ABD	2,591	4.1%	ABD	631	7.4%
6	Face	2,290	3.6%	Face	222	2.6%

Extremities were the most commonly injured body regions (34.5%) in falls, often representing geriatric ground-level falls which result in a hip fracture, followed by external (26.1%) and head (18.7%) regions. External (29.3%), chest (27.7%), and extremities (19%) comprised 76% of injured body regions in motor vehicle incidents.

D. 2018–2022 Geriatric fatality, average age, ISS, and LOS for top 10 causes

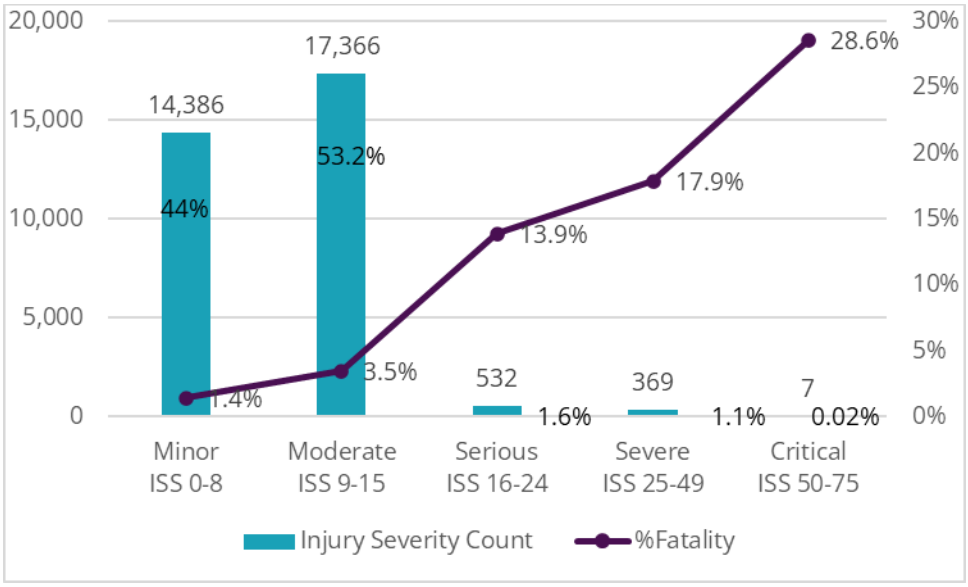
Table 17. 2018–2022 Geriatric fatality, average age, ISS, and LOS for top 10 causes

Cause	Count	Percentage	Fatality	Fatality rate	Avg age	Avg ISS	Avg LOS
Fall	27,905	87.0%	737	2.6%	79.9	7.5	3.4
MV	1,760	5.5%	108	6.1%	76.2	8.9	4.1
Bike	541	1.7%	14	2.6%	71.5	8.7	2.8
Sport	409	1.3%	2	0.5%	71.8	7.1	2.5
Animal	304	0.9%	3	1.0%	72.1	8.7	2.7
OV	263	0.8%	7	2.7%	72.7	9.3	3.6
MC	248	0.8%	14	5.6%	70.9	10.5	4.4
Ped	242	0.8%	25	10.3%	73.8	9.5	4.2
Struck	227	0.7%	2	0.9%	75.2	6.3	2.9
Other	186	0.6%	2	1.1%	76.8	5.8	3.0

Falls were the most common traumatic injury (87%) occurring in geriatric patients. Motorcycle incidents had the highest average ISS (10.5) and longest average hospital stay (4.4 days). Pedestrian incidents had the highest fatality rate (10.3%).

E. 2018–2022 Geriatric injury severity and fatality rate

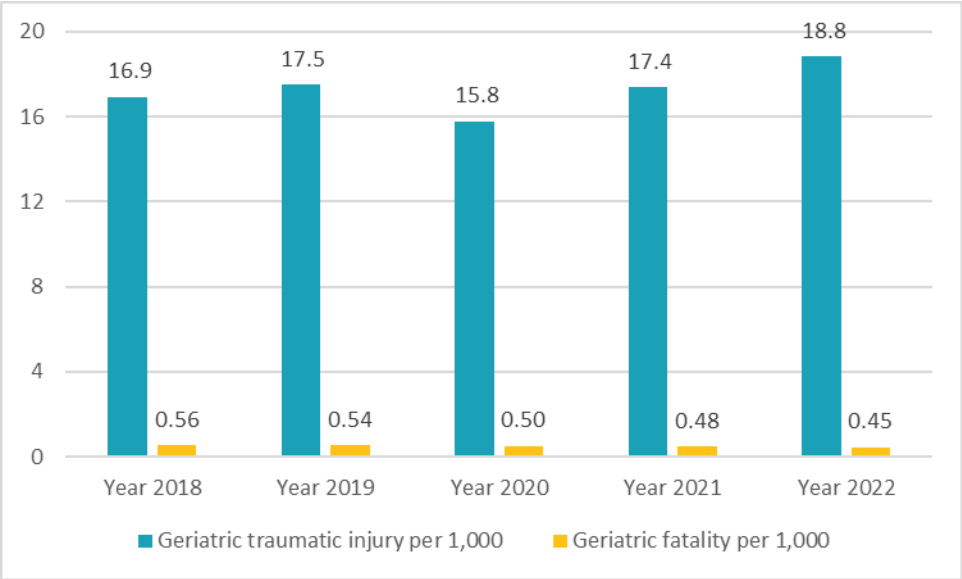
Figure 38. 2018–2022 Geriatric injury severity and fatality rate



Compared with pediatric (Figure 28) and adult patients (Figure 33), geriatric patients had more moderate injuries (pediatric 34.6%, adult 37.2%, and geriatric 53.2%) than minor injuries (pediatric 64.2%, adult 55.2%, and geriatric 44%). Also different from pediatric and adult patient groups, the fatality rates in geriatric patients increase as the ISS scores increase, having the highest fatality rate (28.6%) in the critical injury category.

F. 2018–2022 Geriatric per capita injury incidents and fatality

Figure 39. 2018–2022 Geriatric per capita injury incidents and fatality



The per capita incident of traumatic injury (5-year average of 17.3 per 1,000) in geriatric patients was about 4.8 times higher than adults (5-year average of 3.6 per 1,000 [Figure 34]) and 7.2 times higher than pediatric patients (5-year average of 2.4 per 1,000 [Figure 29]). The per capita fatality for geriatric trauma patients (5-year average of 0.5 per 1,000) was about 5.5 times higher than adults (5-year average of 0.09 per 1,000 [Figure 34]) and 25 times higher than pediatric patients (5-year average of 0.02 per 1,000 [Figure 29]). Although the number of injury incidents per capita increased (16.9 per 1,000 in 2018 to 18.8 per 1,000 in 2022), the number of fatalities per capita for geriatric patients decreased between 2018 and 2022 (0.56 per 1,000 in 2018 and 0.45 per 1,000 in 2022). This reduction in geriatric fatality rates may have contributed to the reduction in the overall fatality rate of Utah trauma patients between 2018 and 2022 (from 2.7% to 2.4% [Figure 2]).

G. 2018–2022 Top 10 lethal injuries for geriatric trauma patients

Table 18. 2018–2022 Top 10* lethal injuries for geriatric trauma patients

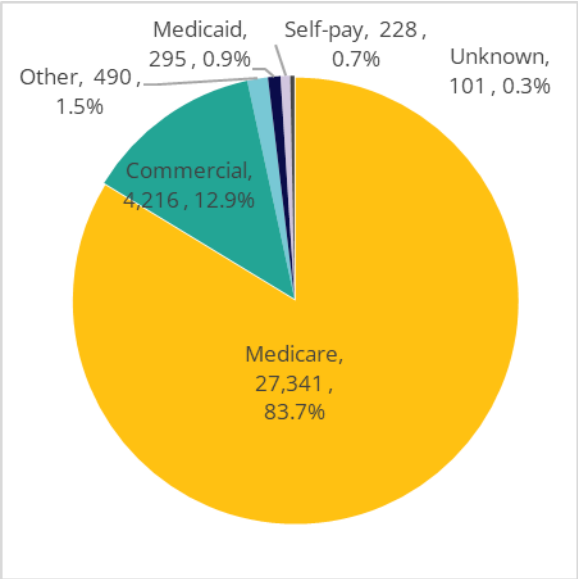
nking	Cause	Outcom	Count	%	Total
1	GSW	Alive	61	73.5%	83
		Dead	22	26.5%	
2	Burn	Alive	36	85.7%	42
		Dead	6	14.3%	
3	Ped	Alive	217	89.7%	242
		Dead	25	10.3%	
4	MV	Alive	1,652	93.9%	1,760
		Dead	108	6.1%	
5	MC	Alive	234	94.4%	248
		Dead	14	5.6%	
6	OV	Alive	256	97.3%	263
		Dead	7	2.7%	
7	Fall	Alive	27,161	97.4%	27,898
		Dead	737	2.6%	
8	Bike	Alive	527	97.4%	541
		Dead	14	2.6%	
9	Other	Alive	184	98.9%	186
		Dead	2	1.1%	
10	Assault	Alive	88	98.9%	89
		Dead	1	1.1%	

*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 (fatality rate 26.5%), followed by burns (14.3%) and pedestrian incidents (10.3%).

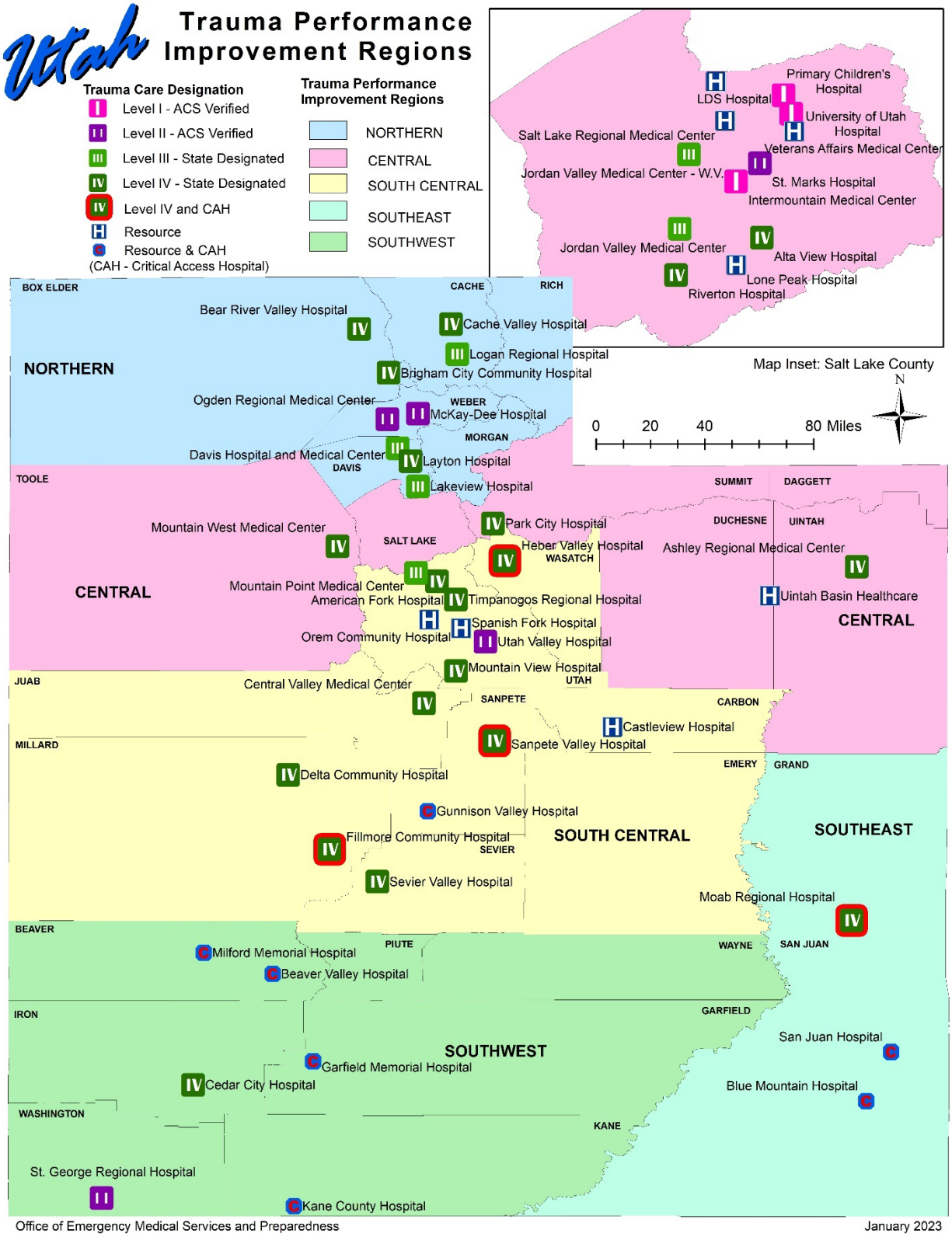
H. 2018–2022 Payers for geriatric trauma patients

Figure 40. 2018–2022 Payers for geriatric trauma patients



Medicare (83.7%) and commercial insurance (12.9%) paid for about 97% of geriatric trauma care between 2018 and 2022.

Appendix A–Utah trauma system



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	South Jordan Health Center	Other
Central	St. Mark's Hospital	Level II
Central	Taylorsville Emergency Center	Other
Central	St. Mark's Emergency Care West Valley	Other
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	Resource
Central	LDS Hospital	Resource
Central	Lone Peak Hospital	Resource
Central	Mountain West Medical Center	Level IV
Central	Riverton Hospital	Level IV
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	Pleasant View Emergency Department	Other
Northern	Davis Hospital and Medical Center	Level III
Northern	Davis Hospital Weber Campus	Other
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	Level III
Southcentral	Utah Valley Hospital	Level II
Southcentral	American Fork Hospital	Level IV
Southcentral	Mountain Point Medical Center	Level IV
Southcentral	Mountain View Hospital	Level IV
Southcentral	Timpanogos Regional Hospital	Level IV
Southcentral	Delta Community Hospital	Resource & CAH
Southcentral	Fillmore Community Hospital	Level IV & CAH
Southcentral	Heber Valley Hospital	Level IV & CAH
Southcentral	Sanpete Valley Hospital	Level IV & CAH
Southcentral	Castleview Hospital	Resource
Southcentral	Orem Community Hospital	Resource
Southcentral	Sevier Valley Hospital	Resource
Southcentral	Central Valley Medical Center	Resource & CAH
Southcentral	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	St. George Regional Hospital	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

Outlined below are common criteria for trauma centers verified by the ACS and also designated by states and municipalities. Facilities are designated/verified as adult and/or pediatric trauma center. It is not uncommon for facilities to have different designations for each group (a trauma center may be a Level I adult facility and also a Level II pediatric facility).

Level I

Level I trauma center is a comprehensive regional resource that is a tertiary care facility central to the trauma system. A Level I trauma center is capable of providing total care for every aspect of injury—from prevention through rehabilitation.

Elements of Level I Trauma Centers Include:

- 24-hour in-house coverage by general surgeons, and prompt availability of care in specialties such as orthopedic surgery, neurosurgery, anesthesiology, emergency medicine, radiology, internal medicine, plastic surgery, oral and maxillofacial, pediatric, and critical care
- Referral resource for communities in nearby regions
- Provides leadership in prevention and public education to surrounding communities
- Provides continuing education for the trauma team members
- Incorporates a comprehensive quality assessment program
- Operates an organized teaching and research effort to help direct new innovations in trauma care
- Program for substance abuse screening and patient intervention
- Meets minimum requirement for annual volume of severely injured patients

Level II

A Level II trauma center is able to initiate definitive care for all injured patients.

Elements of Level II trauma centers Include:

- 24-hour immediate coverage by general surgeons, as well as coverage by the specialties of orthopedic surgery, neurosurgery, anesthesiology, emergency medicine, radiology, and critical care
- Tertiary care needs such as cardiac surgery, hemodialysis and microvascular surgery may be referred to a Level I trauma center
- Provides trauma prevention and continuing education programs for staff
- Incorporates a comprehensive quality assessment program

Level III

A Level III trauma center has demonstrated an ability to provide prompt assessment, resuscitation, surgery, intensive care, and stabilization for injured patients and emergency operations.

Elements of Level III trauma centers Include:

- 24-hour immediate coverage by emergency medicine physicians and the prompt availability of general surgeons and anesthesiologists
- Incorporates a comprehensive quality assessment program
- Developed transfer agreements for patients who require more comprehensive care at a Level I or Level II trauma center
- Provides back-up care for rural and community hospitals
- Offers continuing education for the nursing staff and allied health personnel or the trauma team
- Involved with prevention efforts with an active outreach program for its referring communities

Level IV

A Level IV trauma center has the ability to provide advanced trauma life support (ATLS) prior to transfer of patients to a higher-level trauma center. It provides evaluation, stabilization, and diagnostic capabilities for injured patients.

Elements of Level IV Trauma Centers Include:

- Basic emergency department facilities to implement ATLS protocols and 24-hour laboratory coverage. Available trauma nurse(s) and physicians available upon patient arrival
- May provide surgery and critical-care services, if available
- Has developed transfer agreements for patients who require more comprehensive care at a Level I or Level II trauma center
- Incorporates a comprehensive quality assessment program
- Involved with prevention efforts with an active outreach program for referring communities

Source: American Trauma Society: Trauma Center Levels Explained. Retrieved from https://www.amtrauma.org/page/traumalevels

Critical access hospital (CAH) designations

CAH Designations

A Medicare-participating hospital can become, and remain, a certified CAH by meeting these regulatory requirements*:

- Located in a state that established a state rural health plan for MRHFPs. Connecticut, Delaware, Maryland, New Jersey, and Rhode Island haven't established MRHFP state rural health plans.
- Located in a rural area or treated as rural under a special provision that qualifies hospital providers in urban areas. CAHs have a 2-year transition period to reclassify as rural if the Office of Management and Budget changes their location designation to urban. See 42 CFR 412.103 for more information.
- Provides 24-hour emergency services, 7 days a week, using on-site or on-call staff, with specific on-site, on-call staff response times.
- Doesn't exceed 25 inpatient beds for inpatient or swing bed services.
    - It may operate a distinct part rehabilitation and a psychiatric unit, each with up to 10 beds
    - If it has distinct part units (DPUs), it must follow all hospital and CAH CoPs in the DPU
- Reports an annual average acute care inpatient length of stay (LOS) of 96 hours or less, excluding swing bed services and DPU beds. We don't assess this requirement on initial certification; it only applies after CAH certification.
- Is **more than** a 35-mile drive on primary roads from any other CAH or hospital or, in the case of mountainous terrain or in areas with only secondary roads available, a 15-mile drive if a state didn't designate a CAH as a necessary provider before January 1, 2006. A primary road of travel for determining the driving distance of a CAH and its proximity to other providers is a numbered federal highway, including interstates, intrastates, expressways, or any other numbered federal or state highway with 2 or more lanes each way.

* This list contains basic requirements. It isn't all inclusive.

The CAH must inform each patient, or their representative, of their rights before starting or ending patient care. This requires CAHs to establish a process for overseeing and promptly resolving patient grievances, including whom to contact to file a grievance.

If the CAH is part of a health system with more than 1 hospital or CAH, it must have a unified and integrated Quality Assessment and Performance Improvement Program to make sure each of its separately certified CAHs meets requirements.

Source: Centers for Medicare & Medicaid Services: Information for Critical Access Hospitals. Retrieved from https://www.cms.gov/outreach-and-education/medicare-learning-network-mln/mlnproducts/downloads/critaccesshospfctsht.pdf

Resource hospitals

Hospitals play a vital role in the Utah EMS system by receiving patients in emergency departments and providing definitive care. With the exception of designated trauma centers, the DHHS has designated all acute care hospitals and the VA hospital as resource hospitals. Utah Administrative Code R426-9-1000 Minimum Licensure Requirements outlines the availability of online medical direction for EMS agencies. The designated resource hospitals are committed to providing direct voice communication to EMS providers on the scene and as they transport patients to their facility. The hospitals are also responsible to integrate EMS 10 providers into quality assurance and educational activities. In 2019, 17 hospitals were designated as resource hospitals.

Source: Office of Emergency Medical Services and Preparedness, Strategic Plan, January 1, 2020–December 31, 2024. Retrieved from https://bemsp.utah.gov/wp-content/uploads/sites/34/2020/11/2020-BEMSP-strategic-plan-1.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

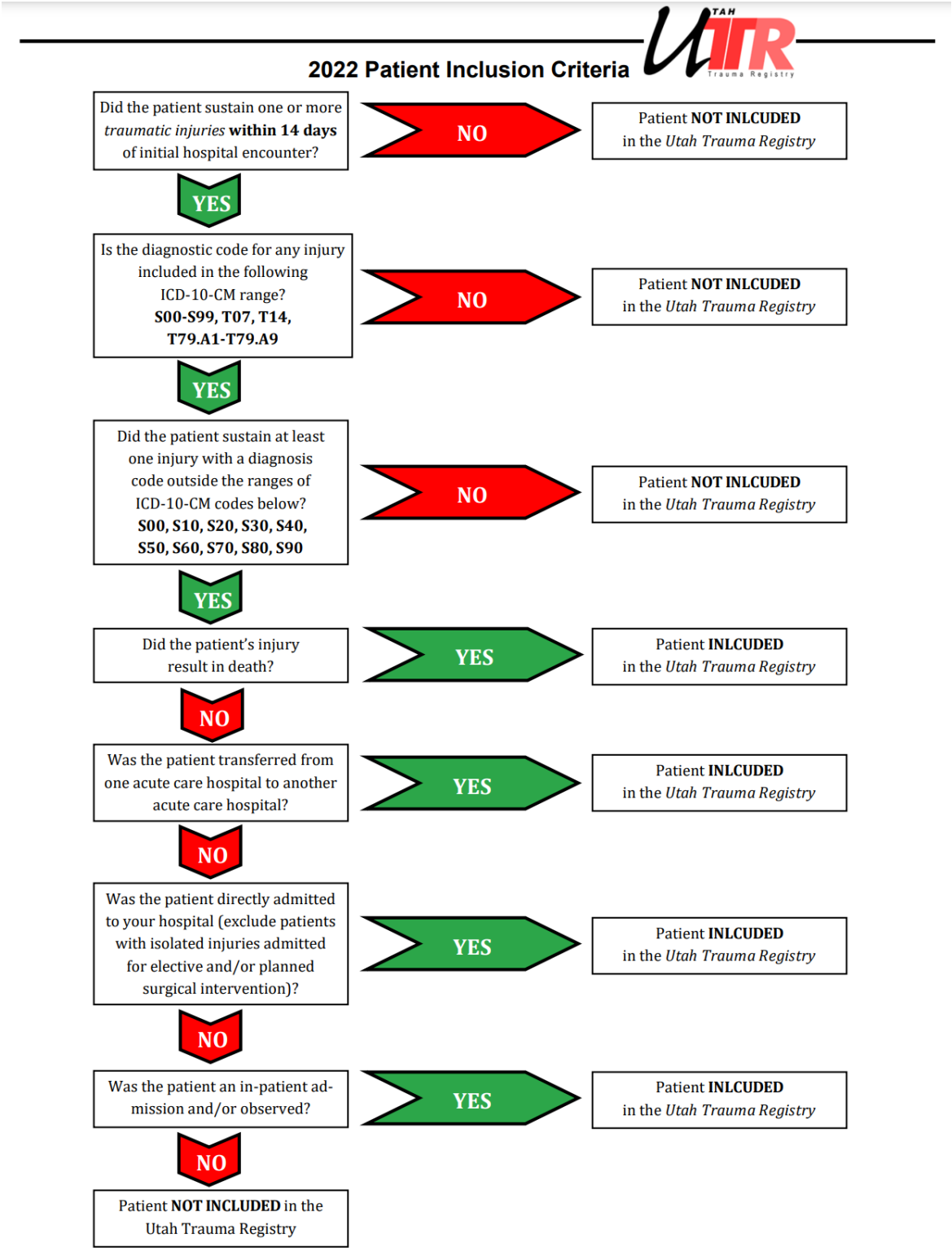
(13) Assist the Department in evaluating EMS system effectiveness by submitting to the Department, in an electronic format quarterly data specified by the Department.

(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



Source: Utah Trauma Registry: 2022 Utah trauma registry inclusion criteria. Retrieved from https://www.utahtrauma.org/publicResources/documents/2022PatientInclusionFlowChart.pdf

Appendix C–Injury severity score (ISS) and abbreviated injury scale (AIS)

Association for the Advancement of Automotive Medicine

AIS ABBREVIATED INJURY SCALE

ISS, NISS and MAIS Mapping with AAAM's ICD ISS Map
May 30, 2017

The ICD ISS Map enables an analyst/researcher to derive a single patient severity score for a patient case record based on either ICD9CM or ICD10CM "initial encounter" injury codes. The ICD ISS map is based on the AIS 2005 Revision 2008 Update dictionary.

The single numerical score created by the ICD ISS Map is used to grade the overall severity of a patient. While the map was developed to calculate the Injury Severity Score (ISS), at least two other scores can also be calculated – the New ISS (NISS), and the Maximum AIS (MAIS).

The ISS is frequently used within the clinical setting and has become an integral part of all trauma registry-based severity assessment tools. The ISS is the sum of the squares of the highest AIS scores in three different ISS body regions. These body regions differ from AIS regions and are unique to the ISS calculation. To calculate an ISS, take the highest AIS severity code in each of the three most severely injured ISS body regions, square each AIS code and add the three squared numbers for an ISS.

ISS scores range from 1 to 75. A score of 75 is derived from either three AIS 5 injuries or from one AIS 6 injury. Any AIS 6 (maximal) injury is an automatic maximal ISS of 75, regardless of any other injuries that may also be found.

NISS has been proposed in the last several years as a successor to the ISS. The NISS is the sum of the squares of the three highest AIS scores anywhere in the body. While the proponents of the NISS claim its superiority over the ISS, it is still not in widespread use to date.

The MAIS is the highest (i.e. most severe) AIS severity score in a patient with multiple injuries. It is widely used by researchers, particularly in the injury prevention field, to describe overall injury to the whole body.

EXAMPLE 1

Injury	AIS	ISS Region
Carotid artery laceration	4	Head/neck
Concussion	2	Head/neck
Femur, open fracture	3	Extremities
Humerus, open fracture	2	Extremities
Leg laceration	1	External

MAIS = 4; ISS = 26 (16 + 9 + 1); NISS = 29 (16 + 9 + 4)

Example of ICD10 CM Map to AIS 2005 Update 2008 Table

First 10 rows of Mapping Table:

CODE	DESCRIPTION	MAX AIS SEVERITY	ISS BODY REGION	AIS CHAPTER
S00	Superficial injury of head	1	6	1
S00.0	Superficial injury of scalp	1	6	1
S00.00	Unspecified superficial injury of scalp	1	6	1
S00.00XA	Unspecified superficial injury of scalp, initial encounter	1	6	1
S00.01	Abrasion of scalp	1	6	1
S00.01XA	Abrasion of scalp, initial encounter	1	6	1
S00.02	Blister (nonthermal) of scalp	0	0	-1
S00.02XA	Blister (nonthermal) of scalp, initial encounter	0	0	-1
S00.03	Contusion of scalp	1	6	1
S00.03XA	Contusion of scalp, initial encounter	1	6	1

AIS Chapter Names – Legend/Enumeration

AIS chapters	AIS Chapter Names
-1	No Map
0	Other Trauma
1	Head
2	Face
3	Neck
4	Thorax
5	Abdomen
6	Spine
7	Upper Extremity
8	Lower Extremity
9	External

ISS Body Region - Legend/Enumeration

ISS Body region (br)	ISS Body Region (br)
0	No Map
1	HeadNeck
2	Chest
3	Abdominal & Pelvic Content
4	Extremities & Pelvic Girdle
5	Face
6	External

* For the purposes of this map ISS Body Regions have been assigned numeric values to indicate precedence.

Source: ISS, NISS and MAIS mapping with AAAM's ICD ISS map. Retrieved from https://www.aaam.org/wp-content/uploads/2017/07/ICD-ISS-Map_Instructions_July192017.pdf

Appendix D–County classification

County Classifications in Utah

County Classification	Counties
Frontier (6 or fewer persons per square mile)	Beaver, Daggett, Emery, Garfield, Grand, Juab, Kane, Millard, Piute, Rich, San Juan, Wayne
Rural (6 to 100 persons per square mile)	Box Elder, Carbon, Duchesne, Iron, Morgan, Sanpete, Sevier, Summit, Tooele, Uintah, Washington, Wasatch
Urban (100 or more person per square mile)	Cache, Davis, Salt Lake, Utah, Weber

Source: County classifications in Utah Updated: 06/28/2021. Retrieved from https://ibis.health.utah.gov/ibisph-view/pdf/resource/CountyClassificationsInfo.pdf

Appendix E–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:

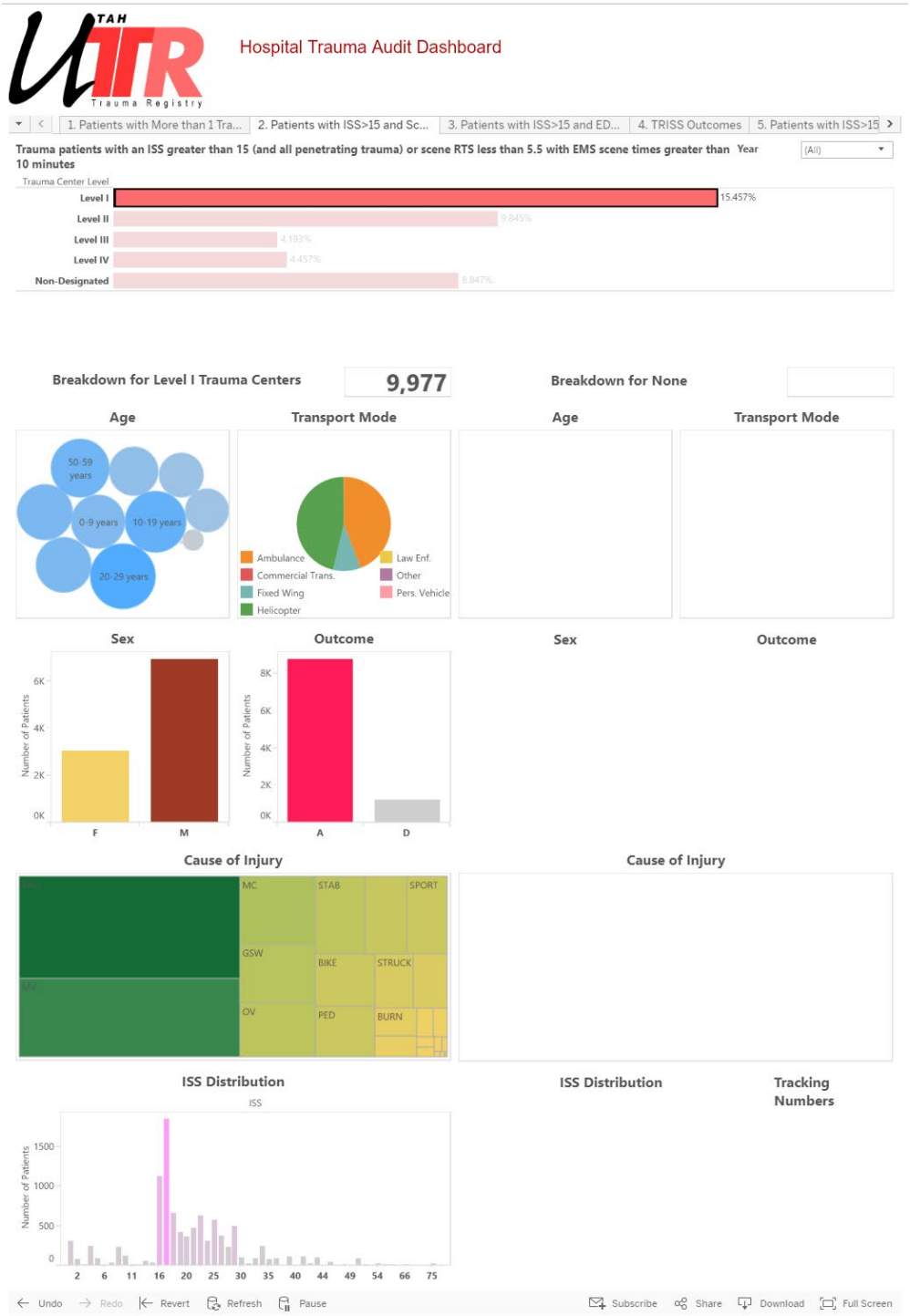
(1) develop programs to inform the public of the emergency medical service system; and

(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

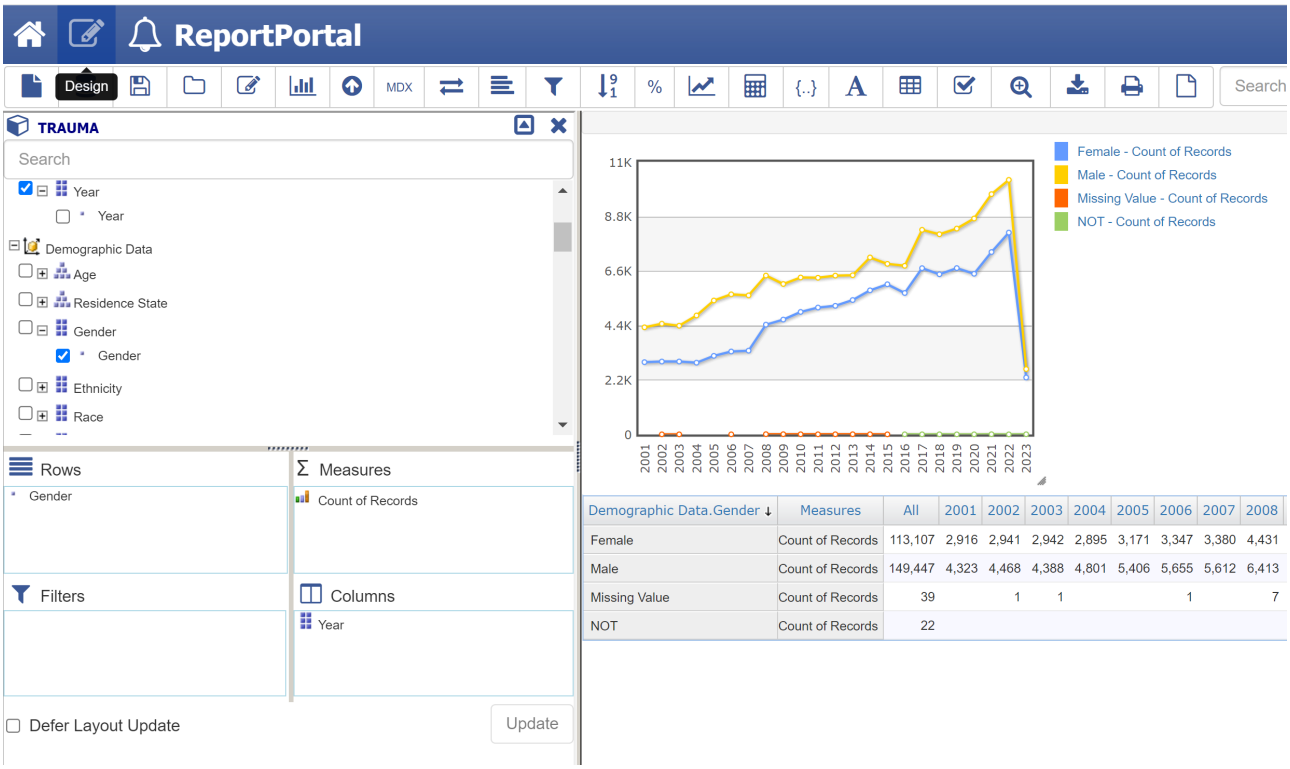
Appendix F–Utah trauma dashboard and trauma cube

Trauma dashboard



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

Trauma cube



Demographic Data.Gender ↓	Measures	All	2001	2002	2003	2004	2005	2006	2007	2008
Female	Count of Records	113,107	2,916	2,941	2,942	2,895	3,171	3,347	3,380	4,431
Male	Count of Records	149,447	4,323	4,468	4,388	4,801	5,406	5,655	5,612	6,413
Missing Value	Count of Records	39		1	1			1		7
NOT	Count of Records	22								

Source: Data Cubes. Retrieved from https://portal.utahdcc.org/sites/UTR

Appendix G–Trauma and injury severity score (TRISS), revised trauma score (RTS), and Glasgow Coma Scale (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:

$$b = b0 + b1(RTS) + b2(ISS) + b3(AgeIndex)$$

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

Source: Trauma Score - Injury Severity Score : TRISS. Retrieved from https://www.srisangworn.go.th/home/triss/TRAUMA_ORG.htm

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.

Source: Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME (May 1989). "A revision of the Trauma Score". The Journal of Trauma. 29 (5): 623–9.

Glasgow Coma Scale

The Glasgow Coma Scale (GCS) is used to objectively describe the extent of impaired consciousness in all types of acute medical and trauma patients. The scale assesses patients according to 3 aspects of responsiveness: eye-opening, motor, and verbal responses. Reporting each of these separately provides a clear, communicable picture of a patient. The findings in each component of the scale can aggregate into a total Glasgow Coma Score which gives a less detailed description but can provide a useful summary of the overall severity. The Glasgow Coma Scale and its total score have since been incorporated into a number of clinical guidelines and scoring systems for victims of trauma or critical illness. This activity describes the use of the Glasgow Coma Scale and reviews the role of using the scale for the interprofessional team to successfully communicate a patient's condition.

Scoring and parameters

The Glasgow Coma Scale divides into 3 parameters: best eye response (E), best verbal response (V) and best motor response (M). The levels of response in the components of the Glasgow Coma Scale are 'scored' from 1, for no response, up to normal values of 4 (eye-opening response) 5 (verbal response), and 6 (motor response)

As a result, the total coma score has values between 3 and 15. Three is the worst and 15 is the highest.

The score is the sum of the scores as well as the individual elements. For example, a score of 10 might be expressed as GCS10 = E3V4M3.

Best eye response (4)

1. No eye opening
2. Eye opening to pain
3. Eye opening to sound
4. Eyes open spontaneously

Best verbal response (5)

1. No verbal response
2. Incomprehensible sounds
3. Inappropriate words
4. Confused
5. Oriented

Best motor response (6)

1. No motor response
2. Abnormal extension to pain

3. Abnormal flexion to pain
4. Withdrawal from pain
5. Localized pain
6. Obeys commands

Application of the Glasgow Coma Scale in pediatrics

The Glasgow Coma Scale can be used in children older than 5 years of age with no modification. Younger children and infants are unable to provide the necessary verbal responses for the practitioner to use the scale to assess their orientation or obey the commands to evaluate their motor response. Since a Pediatric Glasgow Coma Scale was initially described in Adelaide, there have been several modifications without any particular one becoming universally accepted.[7] The versions below derive from those of James and the Pediatric Emergency Care Applied Research Network[8][6]

Children younger than 2 years old (pre-verbal)/Children older than 2 years old (verbal)

Best eye response

1. No eye opening/1 No eye opening
2. Eye opening to pain/2 Eye opening to pain
3. Eye opening to sound/3 Eye opening to sound
4. Eyes open spontaneously/4 Eyes open spontaneously

Best verbal response

1. None/1 None
2. Moans in response to pain/2 Incomprehensible sounds
3. Cries in response to pain/3 Incomprehensible words
4. Irritable/cries/4 Confused
5. Coos and babbles/5 Oriented—appropriate

Best motor response

1. No motor response/1 No motor response.
2. Abnormal extension to pain/2 Abnormal extension to pain
3. Abnormal flexion to pain/3 Abnormal flexion to pain
4. Withdrawal to pain/4 Withdrawal to pain
5. Withdraws to touch/5 Localizes to pain
6. Moves spontaneously and purposefully/6 Obeys commands

Clinical significance

Assessment of responsiveness with the Glasgow Coma Scale is widely used to guide early management of patients who have a head injury or other kind of acute brain injury. Decisions in more severely impaired patients include emergent management such as securing the airway and triage to determine patient transfer. Decisions in less severely impaired patients include the need for neuroimaging, admission for observation, or discharge. Serial Glasgow Coma Scale assessments are also critical to monitor the clinical course of a patient and guided changes in management.

The information gained from the 3 components of the scale varies across the spectrum of responsiveness [9]. Changes in motor response are the predominant factor in more severely impaired patients, whereas eye and verbal are more useful in lesser degrees. In individual patients, the clinical findings in 3 components should, therefore, be reported separately. The total score communicates a useful summary overall index but with some loss of information.

In both pre-verbal and verbal pediatric patients, the Glasgow Coma Scale is an accurate marker for clinically important traumatic brain injury (injury requiring neurosurgical intervention, intubation for more than 24 hours, hospitalization for more than 2 nights, or causing death).[6]

The Glasgow Coma Scale has been taken into numerous guidelines and assessment scores. These include trauma guidelines (such as Advanced Trauma Life Support), Brain Trauma Foundation (severe TBI guidelines), intensive care scoring systems (APACHE II, SOFA) and Advanced Cardiac Life Support.

Relation to outcome

A relationship between assessments of the GCS (typically reported as the total GCS Score) and the outcome was shown clearly by Gennarelli et al.,[10] who demonstrated the existence of a continuous, progressive association between increasing mortality after a head injury and decreases in GCS score from 15 to 3. This association has been seen in many other subsequent studies. The findings for the eye, verbal. and motor responses also relate to the outcome but in distinctive ways so that assessment of each separately yields more information than the aggregate total score.[9]

However, although it is one of the most powerful clinical prognostic features, neither the GCS score nor any single feature alone should be used to predict the outcome of an individual patient. This is because the prognostic implications of the score are influenced by several factors. These include the diagnosis, and in trauma, the cause and if there are extracranial injuries,[11] patient-related factors such as age and other clinical indices (such as pupillary dysfunction and imaging findings), the GCS score is a key component of multifactorial models for prediction of outcomes such as in the IMPACT and CRASH trials.[11][12]

Classification of severity of TBI

The relationship between the GCS score and outcome is the basis for a common classification of acute traumatic brain injury:

- Severe, GCS 3 to 8
- Moderate, GCS 9 to 12
- Mild, GCS 13 to 15

References

1. Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale. Lancet. 1974 Jul 13;2(7872):81-4. [PubMed]

2. Teasdale G, Murray G, Parker L, Jennett B. Adding up the Glasgow Coma Score. Acta Neurochir Suppl (Wien). 1979;28(1):13-6. [PubMed]

3. Teasdale GM, Drake CG, Hunt W, Kassell N, Sano K, Pertuiset B, De Villiers JC. A universal subarachnoid hemorrhage scale: report of a committee of the World Federation of Neurosurgical Societies. J Neurol Neurosurg Psychiatry. 1988 Nov;51(11):1457. [PMC free article] [PubMed]

4. Teasdale G, Maas A, Lecky F, Manley G, Stocchetti N, Murray G. The Glasgow Coma Scale at 40 years: standing the test of time. Lancet Neurol. 2014 Aug;13(8):844-54. [PubMed]

5. Grinnon ST, Miller K, Marler JR, Lu Y, Stout A, Odenkirchen J, Kunitz S. National Institute of Neurological Disorders and Stroke Common Data Element Project - approach and methods. Clin Trials. 2012 Jun;9(3):322-9. [PMC free article] [PubMed]

6. Borgialli DA, Mahajan P, Hoyle JD, Powell EC, Nadel FM, Tunik MG, Foerster A, Dong L, Miskin M, Dayan PS, Holmes JF, Kuppermann N., Pediatric Emergency Care Applied Research Network (PECARN). Performance of the Pediatric Glasgow Coma Scale Score in the Evaluation of Children With Blunt Head Trauma. Acad Emerg Med. 2016 Aug;23(8):878-84. [PubMed]

7. Reilly PL, Simpson DA, Sprod R, Thomas L. Assessing the conscious level in infants and young children: a paediatric version of the Glasgow Coma Scale. Childs Nerv Syst. 1988 Feb;4(1):30-3. [PubMed]

8. James HE. Neurologic evaluation and support in the child with an acute brain insult. Pediatr Ann. 1986 Jan;15(1):16-22. [PubMed]

9. Reith FCM, Lingsma HF, Gabbe BJ, Lecky FE, Roberts I, Maas AIR. Differential effects of the Glasgow Coma Scale Score and its Components: An analysis of 54,069 patients with traumatic brain injury. Injury. 2017 Sep;48(9):1932-1943. [PubMed]

10. Gennarelli TA, Champion HR, Copes WS, Sacco WJ. Comparison of mortality, morbidity, and severity of 59,713 head injured patients with 114,447 patients with extracranial injuries. J Trauma. 1994 Dec;37(6):962-8. [PubMed]

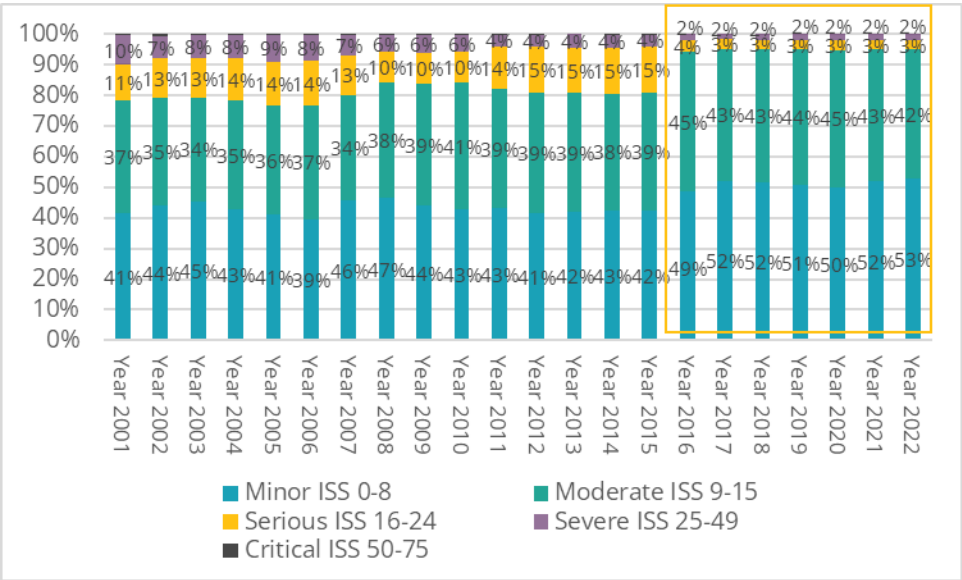
11. Steyerberg EW, Mushkudiani N, Perel P, Butcher I, Lu J, McHugh GS, Murray GD, Marmarou A, Roberts I, Habbema JD, Maas AI. Predicting outcome after traumatic brain injury: development and international validation of prognostic scores based on admission characteristics. PLoS Med. 2008 Aug 05;5(8):e165; discussion e165. [PMC free article] [PubMed]

12. MRC CRASH Trial Collaborators. Perel P, Arango M, Clayton T, Edwards P, Komolafe E, Poccock S, Roberts I, Shakur H, Steyerberg E, Yutthakasemsunt S. Predicting outcome after traumatic brain injury: practical prognostic models based on large cohort of international patients. BMJ. 2008 Feb 23;336(7641):425-9. [PMC free article] [PubMed]

Source: Jain S, Iverson LM. Glasgow Coma Scale. [Updated 2023 Jun 12]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK513298/

Appendix H–Injury severity score (ISS) distribution and mean changes after transferring from ICD-9 to ICD-10 coding system

2016–2022 ISS distributions



2016–2022 ISS means