Oklahoma Major Trauma Summary Report: 2009–2015

Oklahoma State Trauma Registry
Emergency Systems
Oklahoma State Department of Health

Creating a State of Health

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Acknowledgements

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Glossary

AIS—Abbreviated Injury Scale—a scale for scoring individual injuries; ranges from 1 (minor) to 6 (non-survivable).

All Reported Trauma—includes minor trauma transfers and 'duplicate' patients from the transferring and receiving facilities.

ED—Emergency Department.

EMS—Emergency Medical Service.

GCS—Glasgow Coma Scale—a quick assessment of neurologic status based upon eye, verbal and motor responses; ranges from 3 (worst) to 15 (best).

ICU—Intensive Care Unit.

Incident Case—patient only counted once even if reported by two or more facilities.

ISS—Injury Severity Score—a means for combining individual AIS scores into a summary score for a multiple-injured patient; score range from 1 (minor) to 75 (maximum score).

Major Trauma—cases that met the statutory major trauma criteria and are unduplicated (not counted more than once in the database).

MVC—Motor Vehicle Crashes.

OR—Operation Room.

OTR—Oklahoma Trauma Registry.

POV—Privately Owned Vehicle.

TRISS—Trauma Injury Severity Score—a survival probability score calculated from the age, primary injury type (blunt/penetrating), ISS and RTS scores. Score range is between 0 and 1: below 0.50 'expected' to die and above 0.50 'expected' to live.

RTS—Revised Trauma Score—a score indicator of physiologic status of a patient upon arrival at ED; based on initial systolic blood pressure, unassisted respiratory rate, and total Glasgow Coma Scale. Score range is 0 to 7.841 with higher values indicating better vital signs.

RR—Respiratory Rate.

SBP—Systolic Blood Pressure.

System Entry—relates to patient's means of arrival at the reporting facility—by EMS transport from the scene, privately owned vehicle, or transfer from another acute care hospital.

Oklahoma Trauma System and Registry

Senate Bill (SB) 1554—the Oklahoma Trauma System Improvement and Development Act—was passed during the 2004 legislative session. To fulfill this legislative mandate and facilitate the development of a statewide trauma system, several tools and resources have been developed and put into operation for the past decade. One of them is the Oklahoma Trauma Registry (OTR) which is used to collect and gather trauma data and information for the development and improvement of Oklahoma trauma system.

The OTR collects data regarding injured patients from all state-licensed acute care hospitals. Acute care hospitals are required to submit data on all injured patients that meet Oklahoma's Major Trauma Criteria (see Criteria). In addition, all injured patients that require transfer to another acute care facility must be reported regardless of severity. Patients meeting any of the exclusion criteria listed in the case definition are not required to be reported.

The focus of this report is on the definitive care record of patients who met Oklahoma's Major Trauma Criteria during the period January 1st, 2009 through December 31st, 2015 (N = 43,890).

Trauma Case Inclusion and Exclusion Criteria

Oklahoma Administrative Code (OAC) 310: 667-59-1(b) requires all hospitals to submit trauma registry data to the OSDH State Trauma Registry.

The following Case Inclusion and Exclusion criteria apply to those cases that **MUST** be included in the Oklahoma State Trauma Registry. Hospitals **may** elect to include additional cases in the database and to transmit/download those cases to the State Registry if desired.

Case Inclusion Criteria

All patients must have at least one of ICD-9 of 800.00-959.9 ***AND*** *at least one of the following:*

- length of hospital stay ≥ 48 hours; or
- patient dead on arrival or died while in hospital; or
- patient transferred with ***major or minor†*** trauma; or
- patient admitted to ICU; or
- patient transferred directly to OR for surgery to the head, chest, abdomen, or vascular system

Each reportable major trauma case must also meet at least one of the following criteria as computed by the trauma registry software:

1. an Abbreviated Injury Scale severity value of 3 or higher; or
2. an Injury Severity Score of 9 or higher; or
3. a TRISS or Burn Survival Probability less than .90; or
4. death

Case Exclusion Criteria

- isolated orthopedic injury to the extremities due to same level falls* (E885.9)
- overexertion injuries
- injury caused by pre-existing condition, e.g. osteoporosis (fracture); esophageal stricture (choking)
- injuries greater than 30 days old
- poisonings and toxic events (960-989.9)
- submersion injuries (994.1)
- foreign body (leading to choking or otherwise) (non-codable)
- strangulation/asphyxiation/anoxic brain death (994.7)
- electrocution (994.8)

*** The Exclusion criteria were modified effective July 1, 2003. Previously, the exclusion was for isolated orthopedic injuries to extremities regardless of cause/mechanism of injury. Now isolated orthopedic injuries to extremities that meet severity criteria will be included if they are due to causes other than same level falls.**
† Minor trauma transfer patients required to be reported (minimal database) effective July 1, 2004.

Hospital Reporting and Participation

There were 110 hospitals classified as trauma centers and submitted data to the OTR over 2009–2015, including:

- Level I: 1 classified trauma center
- Level II: 2 classified trauma centers
- Level III: 26 classified trauma centers
- Level IV: 80 classified trauma centers

These hospitals are located in eight trauma regions in Oklahoma, where Region 7 and 8 are the metropolitan areas of Tulsa and Oklahoma City, respectively.

- Region 1: NW (20)
- Region 2: NE (15)
- Region 3: SE (20)
- Region 4: East Central (13)
- Region 5: SW (13)
- Region 6: Central (9)
- Region 7: Tulsa County (9)
- Region 8: Oklahoma County (11)

Region	Name	Level
Region 1—NW	AllianceHealth Clinton	IV
	AllianceHealth Woodward	IV
	Beaver County Memorial Hospital	IV
	Cimarron Memorial Hospital	IV
	Cordell Memorial Hospital	IV
	Fairview Hospital	IV
	Great Plains Regional Medical Center	IV
	Harper County Community Hospital	IV
	INTEGRIS Bass Baptist Health Center	III
	Memorial Hospital of Texas County	IV
	Mercy Hospital Kingfisher	IV
	Mercy Hospital Watonga	IV
	Newman Memorial Hospital	IV
	Okeene Municipal Hospital	IV
	Roger Mills Memorial Hospital	IV

	Sayre Memorial Hospital*	IV
	Seiling Municipal Hospital	IV
	Share Medical Center	IV
	St. Mary's Regional Medical Center	III
	Weatherford Regional Hospital	IV
Region 2—NE	Blackwell Regional Hospital	IV
	AllianceHealth Ponca City	IV
	AllianceHealth Pryor	IV
	Cleveland Area Hospital	IV
	Saint Francis Hospital Vinita	IV
	Fairfax Memorial Hospital	IV
	Hillcrest Hospital Claremore	IV
	Hillcrest Hospital Cushing	IV
	INTEGRIS Miami Hospital	IV
	INTEGRIS Grove Hospital	IV
	Jane Phillips Medical Center	III
	Jane Phillips Nowata Health Center	IV
	Pawhuska Hospital	IV
	Perry Memorial Hospital	IV
	Stillwater Medical Center	III
Region 3—SE	Arbuckle Memorial Hospital	IV
	Carnegie Tri-County Municipal Hospital	IV
	Comanche County Memorial Hospital	III
	Duncan Regional Hospital	III
	Elkview General Hospital	IV
	Grady Memorial Hospital	III
	Harmon Memorial Hospital	IV
	Jackson County Memorial Hospital	IV
	Jefferson County Hospital	IV
	Lindsay Municipal Hospital	IV
	Memorial Hospital & Physician Group*	IV
	Mercy Health Love County	IV
	Mercy Hospital Ada	III

	Mercy Hospital Ardmore	III
	Mercy Hospital Healdton	IV
	Mercy Hospital Tishomingo	IV
	Pauls Valley General Hospital	IV
	Quartz Mountain Medical Center	IV
	Southwestern Medical Center	IV
	The Physicians' Hospital in Anadarko	IV
Region 4— East Central	Bristow Memorial Hospital	IV
	Drumright Regional Hospital	IV
	EASTAR Health System	III
	Haskell County Community Hospital	IV
	Hillcrest Hospital Henryetta	IV
	Epic Medical Center	IV
	Memorial Hospital of Stilwell	IV
	Muscogee (Creek) Nation Medical Center	IV
	Muskogee Community Hospital*	IV
	Northeastern Health System	III
	Sequoyah County-City of Sallisaw Hospital	IV
	St. John Sapulpa	IV
	Wagoner Community Hospital	IV
Region 5—SW	AllianceHealth Durant	III
	AllianceHealth Madill	IV
	AllianceHealth Seminole	IV
	Atoka County Medical Center	IV
	Choctaw Memorial Hospital	IV
	Creek Nation Community Hospital	IV
	Eastern Oklahoma Medical Center	IV
	Holdenville General Hospital	IV
	Latimer County General Hospital	IV
	Mary Hurley Hospital	IV
	McAlester Regional Health Center	III
	McCurtain Memorial Hospital	IV
	Pushmataha County-Town of Antlers Hospital Authority	IV

Region 6—Central	INTEGRIS Canadian Valley Hospital	III
	Mercy Hospital El Reno	IV
	Mercy Hospital Logan County	IV
	Norman Regional Health System	III
	Prague Community Hospital	IV
	Purcell Municipal Hospital	IV
	St. Anthony Shawnee Hospital	IV
	Stroud Municipal Hospital	IV
Region 7—Tulsa County	Bailey Medical Center	IV
	Hillcrest Hospital South	III
	Hillcrest Medical Center	III
	Oklahoma State University Medical Center	III
	Saint Francis Hospital Tulsa	II
	Saint Francis Hospital South	III
	St. John Broken Arrow	IV
	St. John Medical Center	II
	St. John Owasso	IV
Region 8—Oklahoma County	AllianceHealth Deaconess	III
	AllianceHealth Midwest	III
	Community Hospital	IV
	INTEGRIS Baptist Medical Center	III
	INTEGRIS Health Edmond	III
	INTEGRIS Southwest Medical Center	III
	McBride Clinic Othopedic Hospital	IV
	Mercy Hospital Oklahoma City	III
	Oklahoma Heart Hospital	IV
	OU Medical Center	I
	OU Medical Center Edmond †	I
	St. Anthony Hospital	III

Note:

* indicates that hospitals were closed but submitted substantial data to OTR over 2009–2015.

† indicates that it is a facility of another hospital under the same license.

Executive Summary

Demographics

- Major trauma incidents increased an average of 1.4% per year from 2009 to 2015.
- Quarter 3 (July–September) consistently had the highest number of reported patients.
- By month, August had the highest frequency of trauma patients while February had the fewest reported trauma patients.
- Saturday had the most trauma incidents by day of the week.
- The trauma incidents generally peaked around 19:00.
- 83.8% of trauma incidents occurred in the urban areas (Region 7 and 8).
- 29.9% of major trauma patients received definitive care at a Level I trauma center.
- 33.4% of major trauma patients received definitive care at a Level II trauma center.
- 82.0% of major trauma patients were reported as white.
- Proportions of male and female patients were 60.5% and 39.5% respectively.
- Among age groups, the age 65+ group had the highest proportion of trauma patients (34.7%), followed by the age 15–24 group (12.8%).

System Entry

- 57.3% of major trauma patients arrived at definitive care directly and 38.5% of patients were transferred to definitive care.
- For patients arriving direct from the scene, 74.0% patients arrived by land ambulance, 13.4% by helicopter ambulance, and 12.5% by private vehicle or walk-in.
- For transferred trauma patients, 74.3% patients arrived by land ambulance, 23.6% by helicopter ambulance, and 2.1% by private vehicle or walk-in.

Mechanism of Injury

- Falls and MVC were the two leading mechanisms of injury, accounting for 42.4% and 25.9%, respectively.
- Falls had an increasing trend while the number injured in an MVC decreased slightly over this 6 year period.
- 90.2% of trauma was classified as blunt trauma.
- Burn-related trauma was the least frequent mechanism (1.6%) but had the highest case-fatality rate of 26.6%.
- Falls consistently accounted for the greatest proportion of deaths, followed by MVC, 'other' injury etiology, Motorcycle, and gunshot.
- Gunshot injuries had the highest case-fatality rate of 32.8%, followed by pedestrian injuries with a rate of 16.3%. Much of the fatality rate for gunshot wounds was attributable to suicides.

ED and ED Disposition

- Patients with an ISS 16–24 spent an average of 4.2 hours in the ED before disposition.
- 91.1% of major trauma patients went to floor, ICU, and OR from the ED.

Hospital and ICU Days

- Fall-related trauma patients accounted for the greatest number of hospital days (114,043 days).
- The average length of stay (LOS) was longest for pedestrian-related trauma patients with an average LOS of 9.3 days.
- Patients with an ISS 9–14 accounted for the greatest number of total hospital days (155,224 days).
- Patients in the ISS 25+ group had the longest average LOS of 12.7 days.
- Average length of stay in Regions 7 and 8 were 7.5 and 7.7 days respectively, while LOS in other regions varied from 5 to 6 days.
- Patients injured by motorcycle, pedestrian, MVC, gunshot, and 'other' incidents had average ICU stays of more than four days, whereas fall-related patients averaged two days in ICU.
- The most severely injured patients (ISS 25+) had the longest average ICU stay (8.4 days) and accounted for the greatest number of total of ICU days (50,770 days).
- Average ICU days for patients treated at a Level I hospital was 5.4 days and for patients treated at a Level II hospital the average ICU days was 3.7 days.

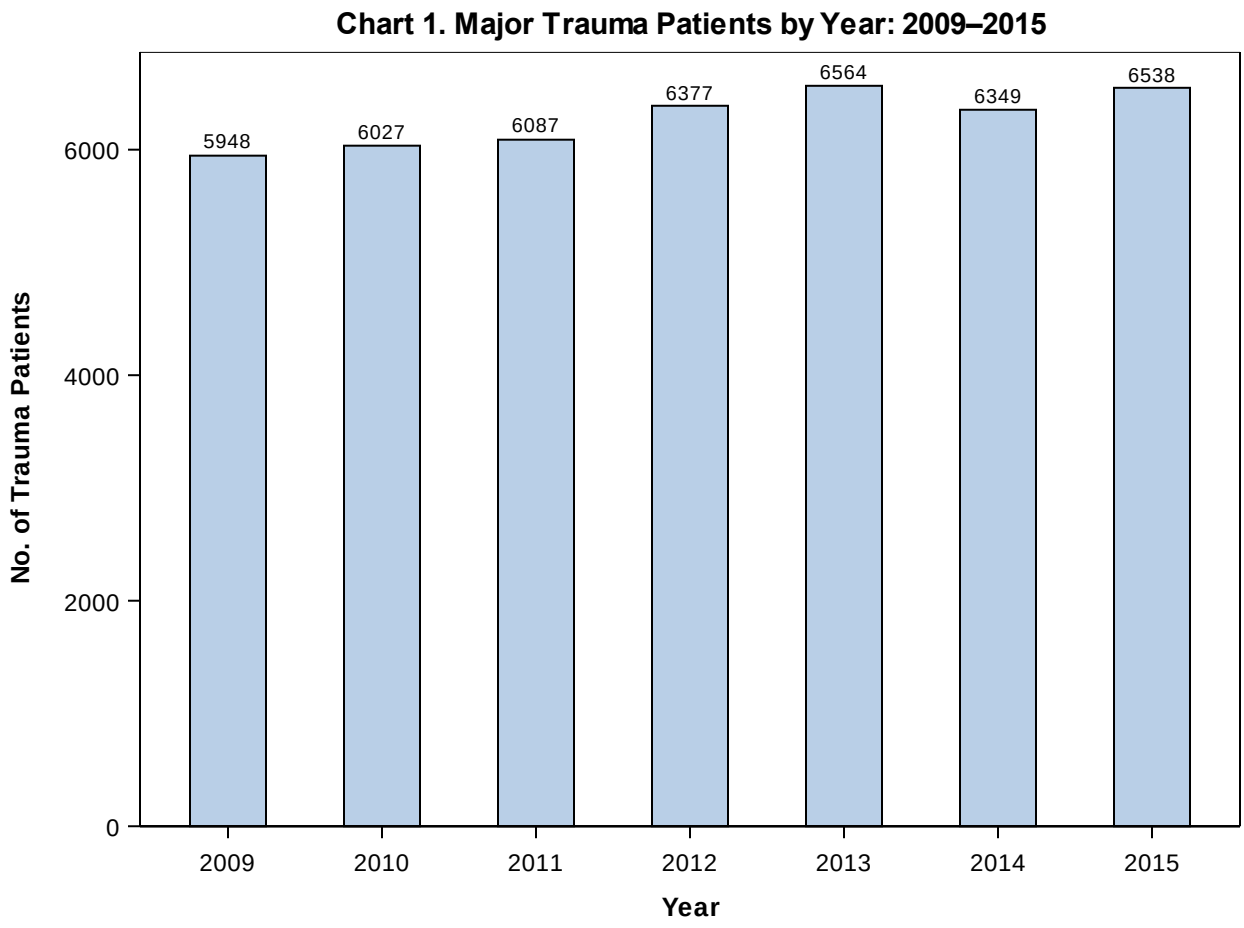
Outcomes

- 62.8% of Oklahoma major trauma patients had an ISS of 9–14.
- Crude mortality rate for major trauma patients was 9.7% over the 6-year period, ranging from a high of 10.1% in 2011 to a low of 9.4% in 2013.
- The crude mortality rate among the most severely injured patients (ISS 25+) was 36.9%.
- The mortality rate was highest among the age 65+ group at 43.7%, and lowest among the age 0–14 group at 4.3%.
- The mortality rate for males was consistently higher than that of females across all age groups.
- Average revised trauma score (RTS) values decreased with increasing injury severity for both patients that lived and among those that died.
- 60.1% of major trauma patients were discharged to home.
- 19.4% and 14.0% of trauma patients were discharged to rehabilitation facilities or skilled nursing facilities (SNF) respectively.

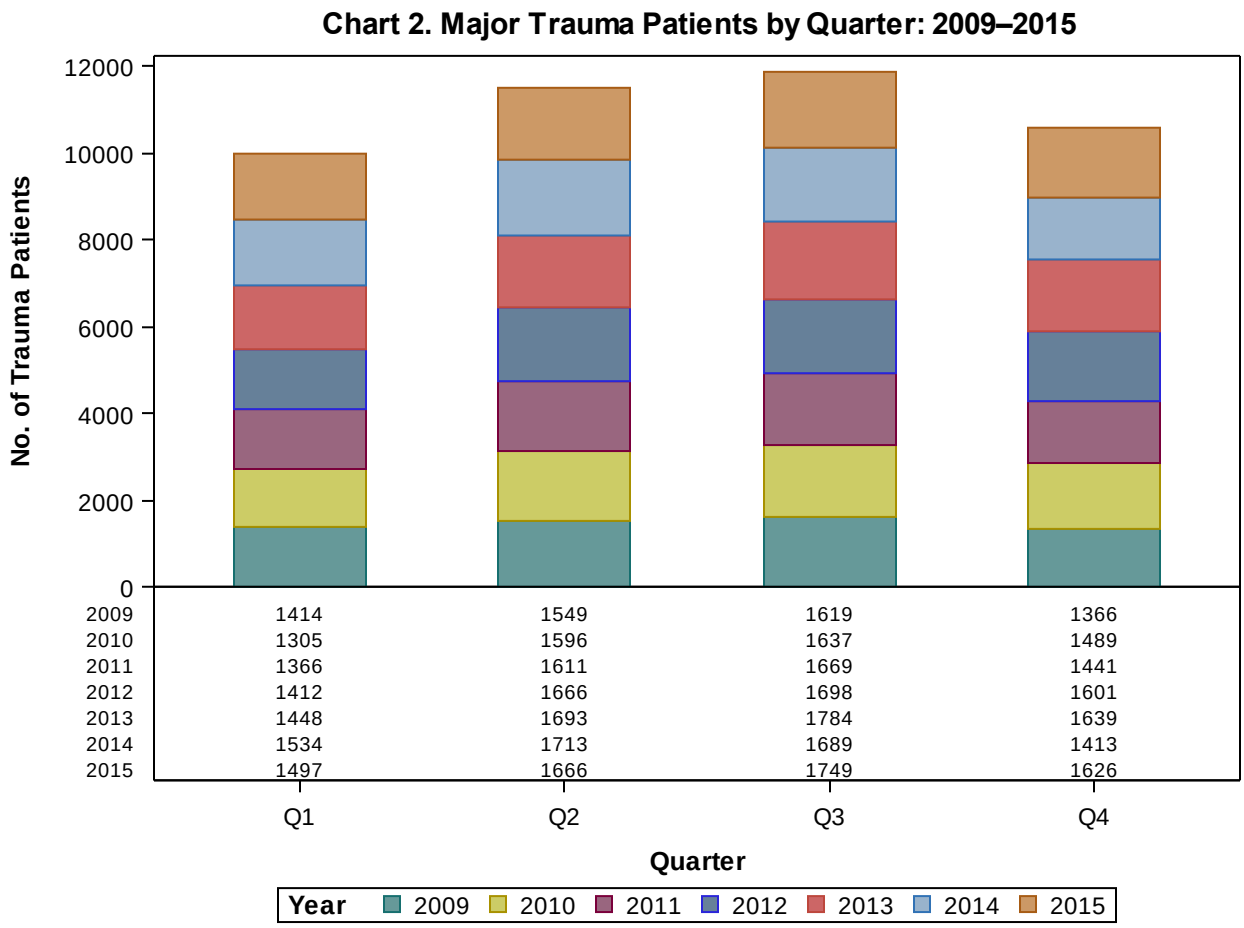
Injuries by Body Region

- It was common for a major trauma patient to have significant injuries (AIS 2+) to more than one body region (40.0%).
- The most frequently injured single body region was extremity (27.7%), followed by head (20.2%), thorax (6.8%), and abdomen (3.2%).

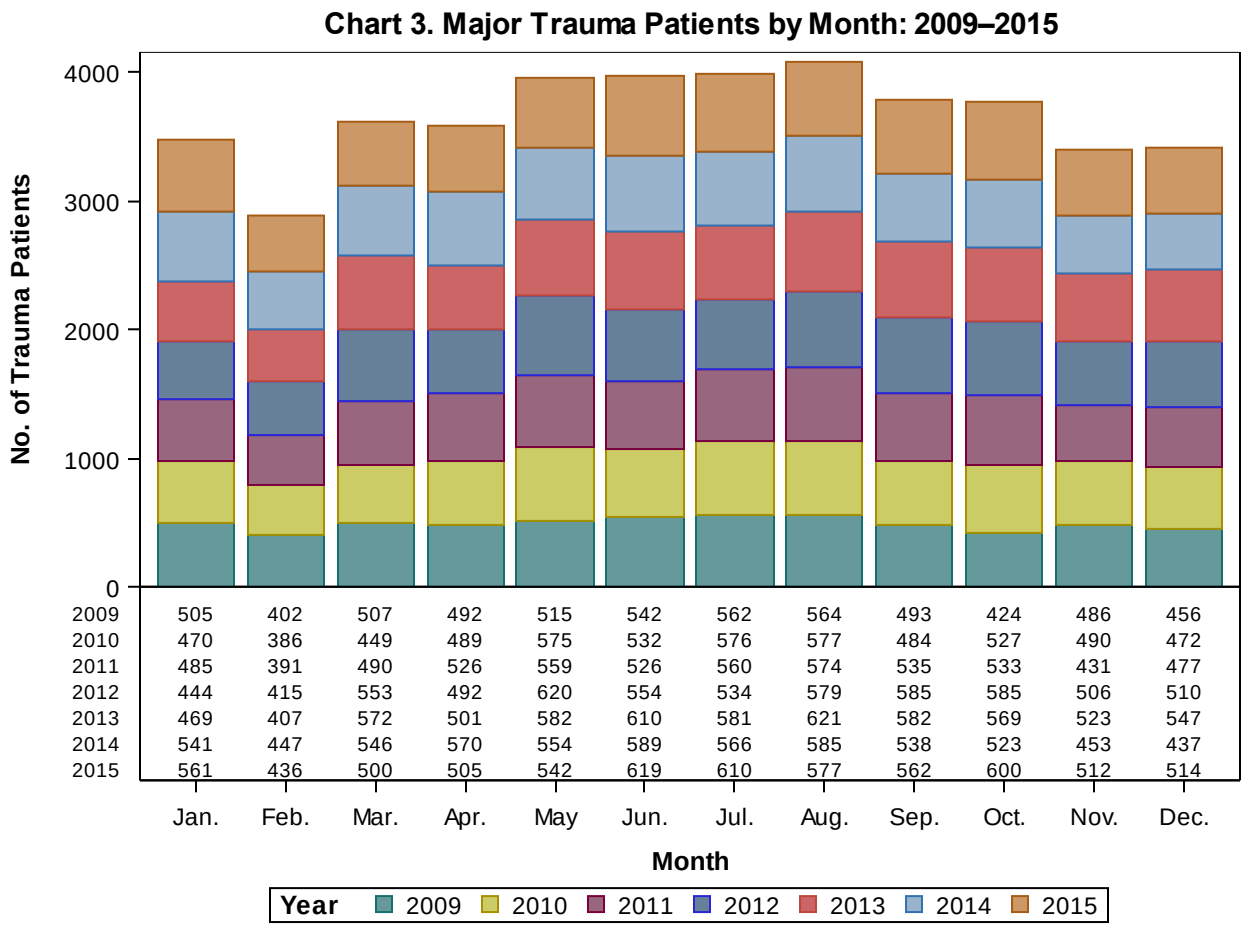
- Internal organ injury was the most common injury type in the Head and Neck region, accounting for 42.5% of injuries.
- Fractures were the most common injuries in the Spine and Back region comprising 94.5% of diagnoses.
- Internal organ injury and fractures made up almost 51.9% of the diagnoses in the Torso region.
- Fracture was the most common injury type in the Extremities, accounting for 67.8% of the diagnoses.



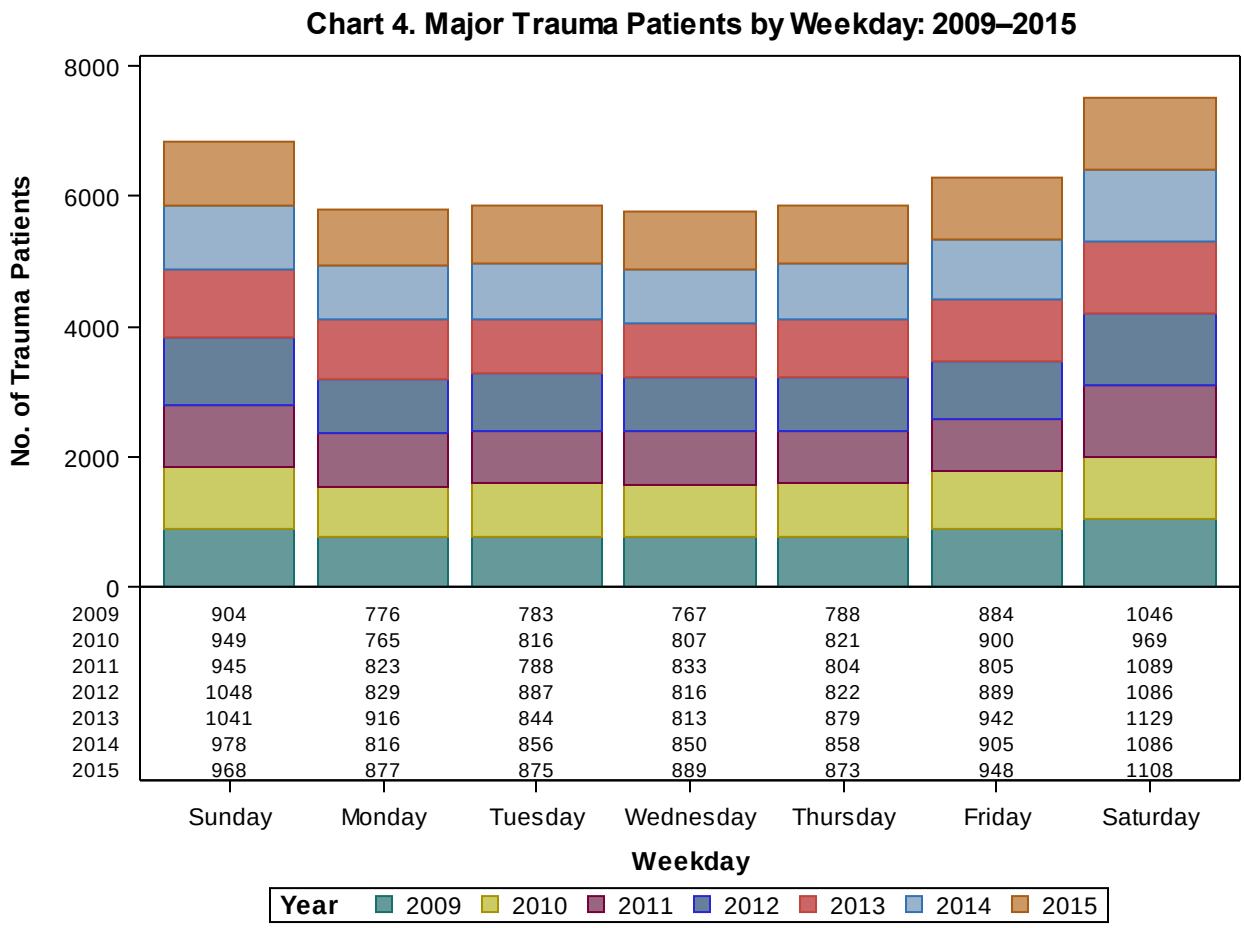
In Oklahoma, major trauma incidents, with the exception of 2014, slowly increased from 2009 to 2015. On average, the number of trauma patients reported has increased 1.4% every year over this period of time, which was slower than that from 2005 to 2008. Oklahoma's estimated population grew 5.2% from 2009 to 2015, whereas the reported major trauma incidents increased 9.9% over this same 7-year period.



This chart illustrates the number of trauma patients by quarter over 2009–2015. Quarter 3 consistently had the most trauma patients, whereas Quarter 1 consistently had the fewest.

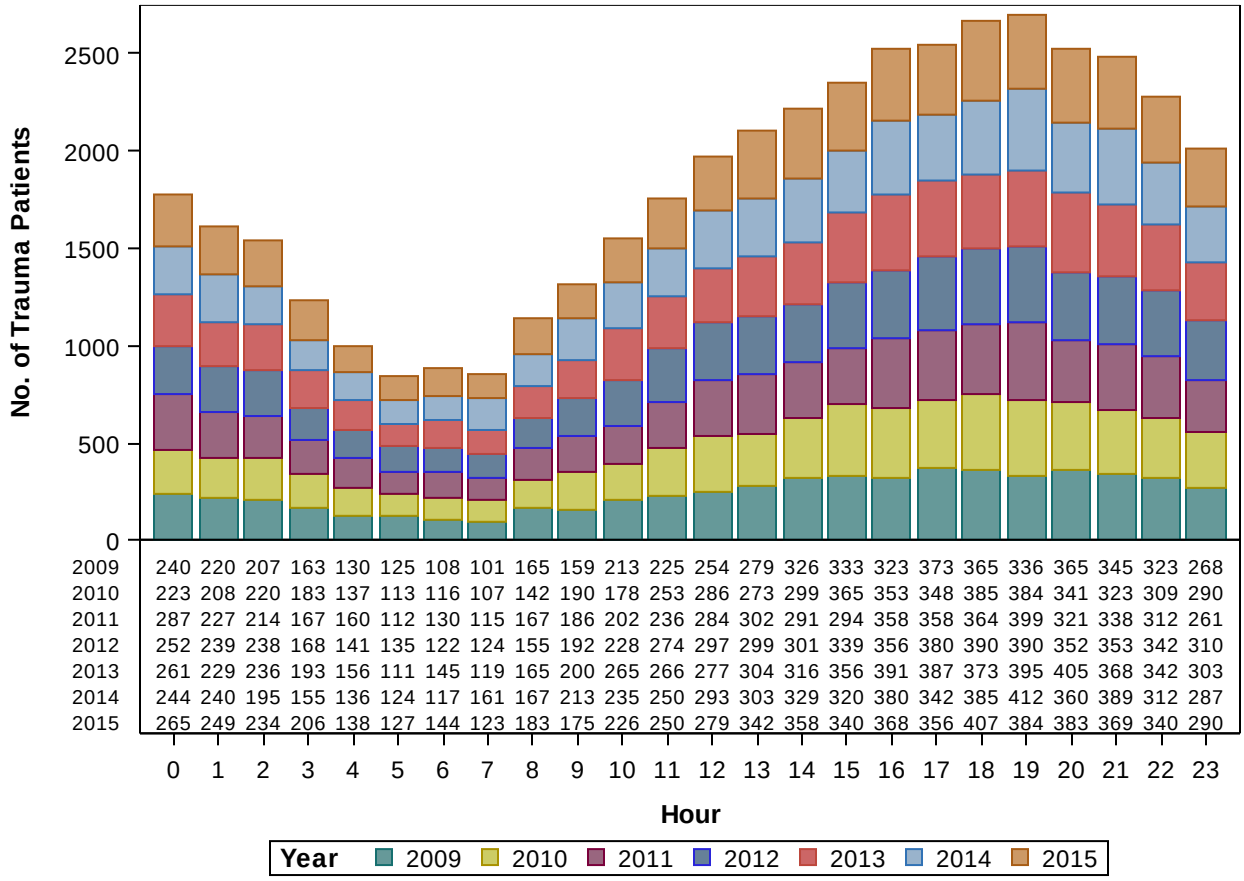


The number of trauma patients peaked in August, while February had the fewest reported trauma patients.



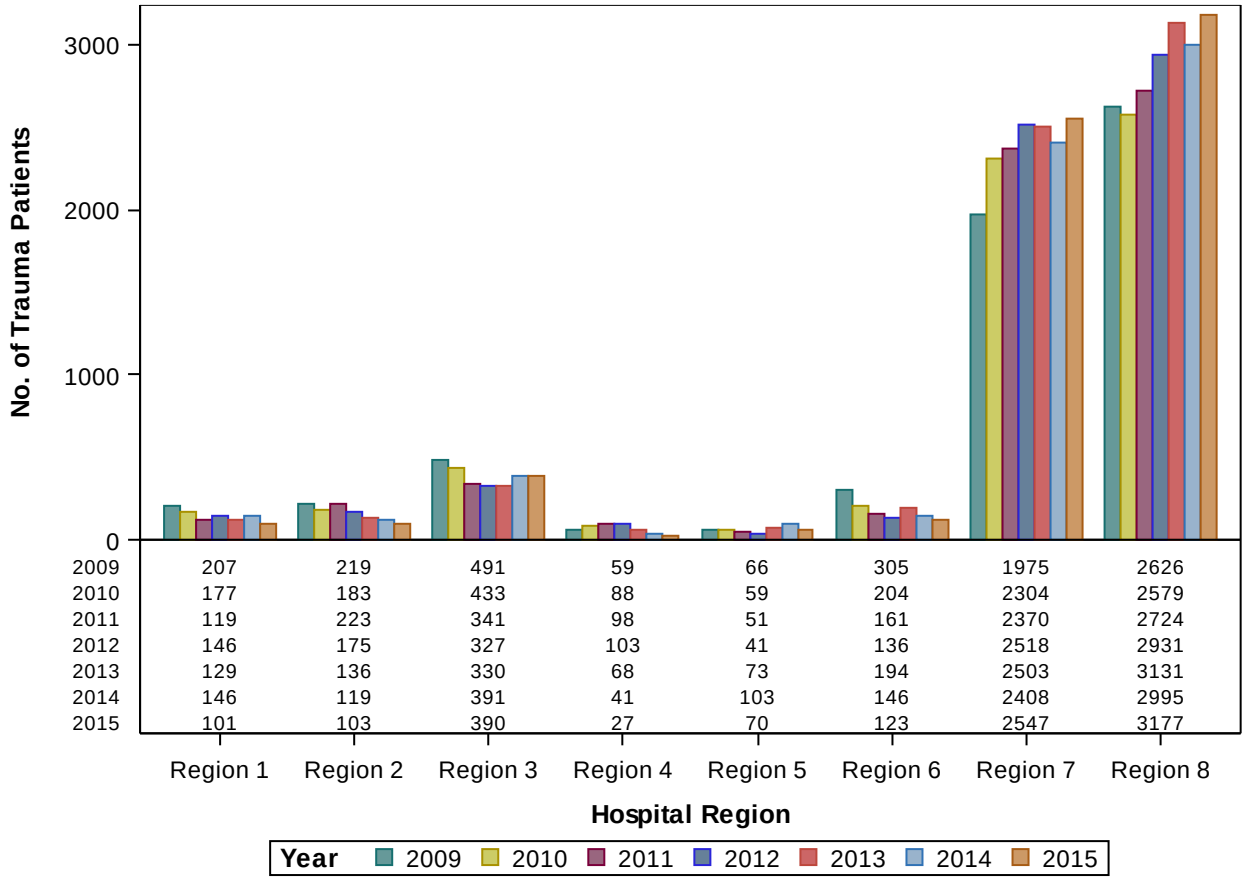
The highest number of trauma patients was consistently on Saturday, followed by Sunday and Friday. In comparison, the number of trauma incidents was stable from Monday to Thursday.

Chart 5. Major Trauma Patients by Hour: 2009–2015



Early morning hours (5:00–7:00) had the fewest trauma incidents. The number of trauma patients thereafter increased until it peaked between 17:00–19:00). This pattern was consistent over 2009–2015.

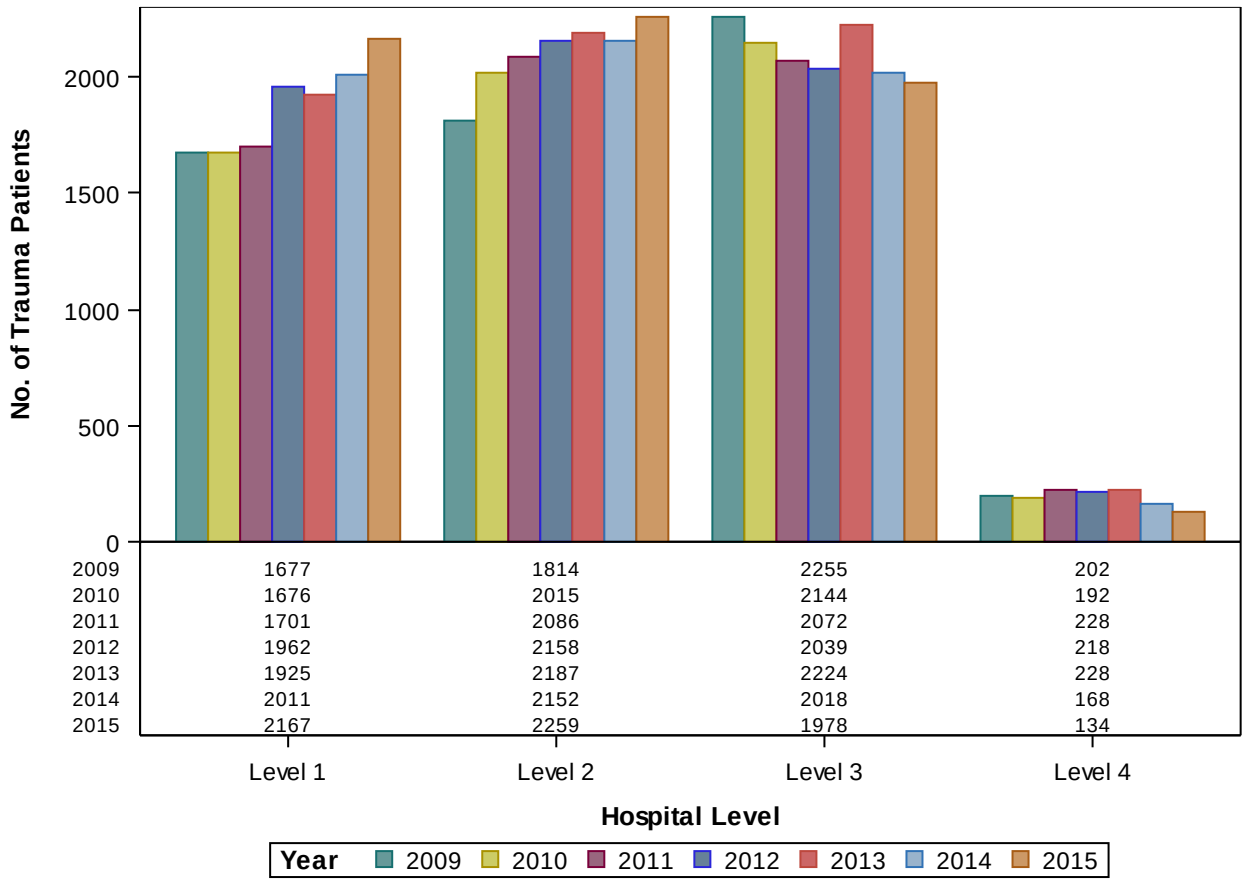
Chart 6. Major Trauma Patients by Hospital Region: 2009–2015



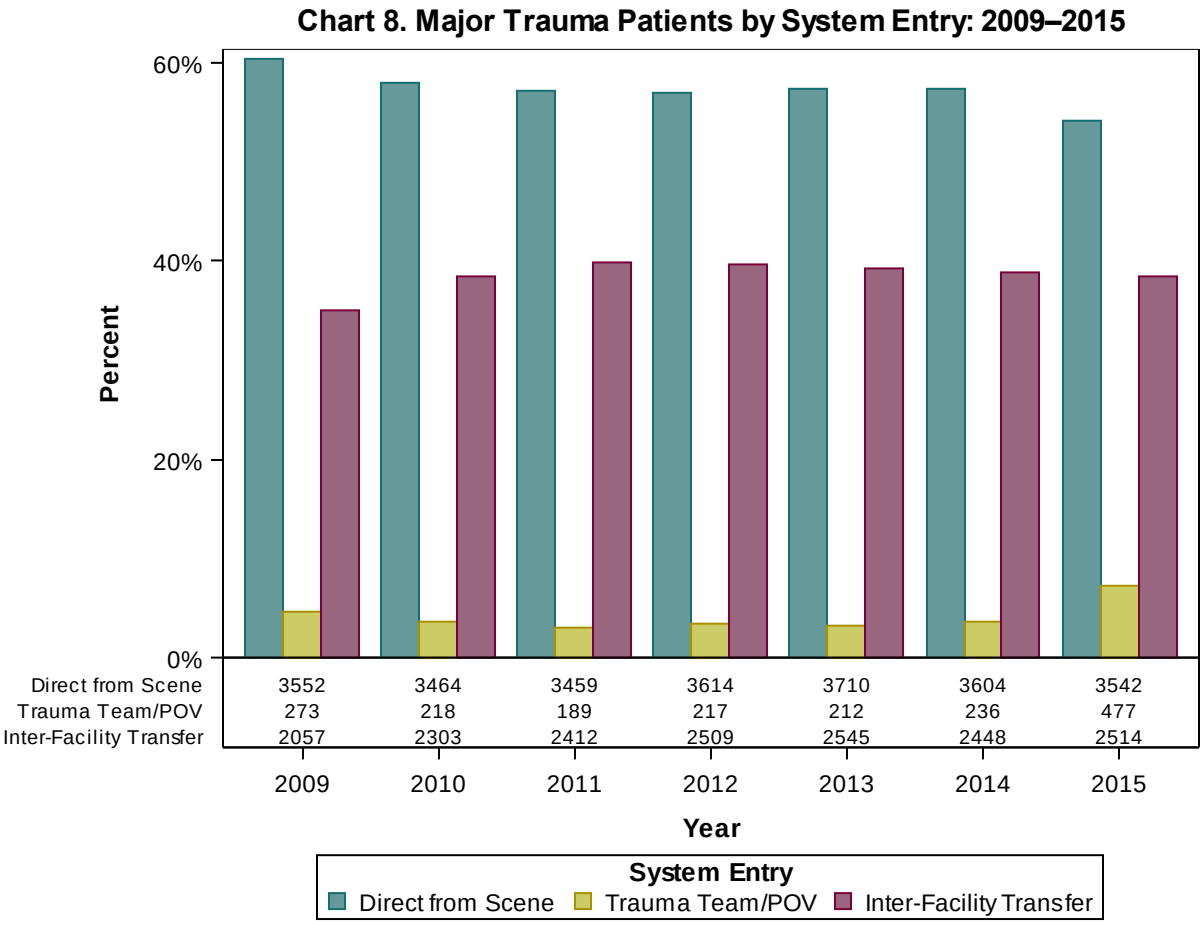
	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8
2009	207	219	491	59	66	305	1975	2626
2010	177	183	433	88	59	204	2304	2579
2011	119	223	341	98	51	161	2370	2724
2012	146	175	327	103	41	136	2518	2931
2013	129	136	330	68	73	194	2503	3131
2014	146	119	391	41	103	146	2408	2995
2015	101	103	390	27	70	123	2547	3177

This chart shows the number major trauma patients seen in each of Oklahoma's eight Trauma Regions. Region 8 (Oklahoma County) consistently had the most reported trauma patients, followed by Region 7 (Tulsa County). The trauma incidents gradually increased over 2009–2015 in Region 7 and 8, while many of the other regions saw a decrease.

Chart 7. Major Trauma Patients by Hospital Level: 2009–2015

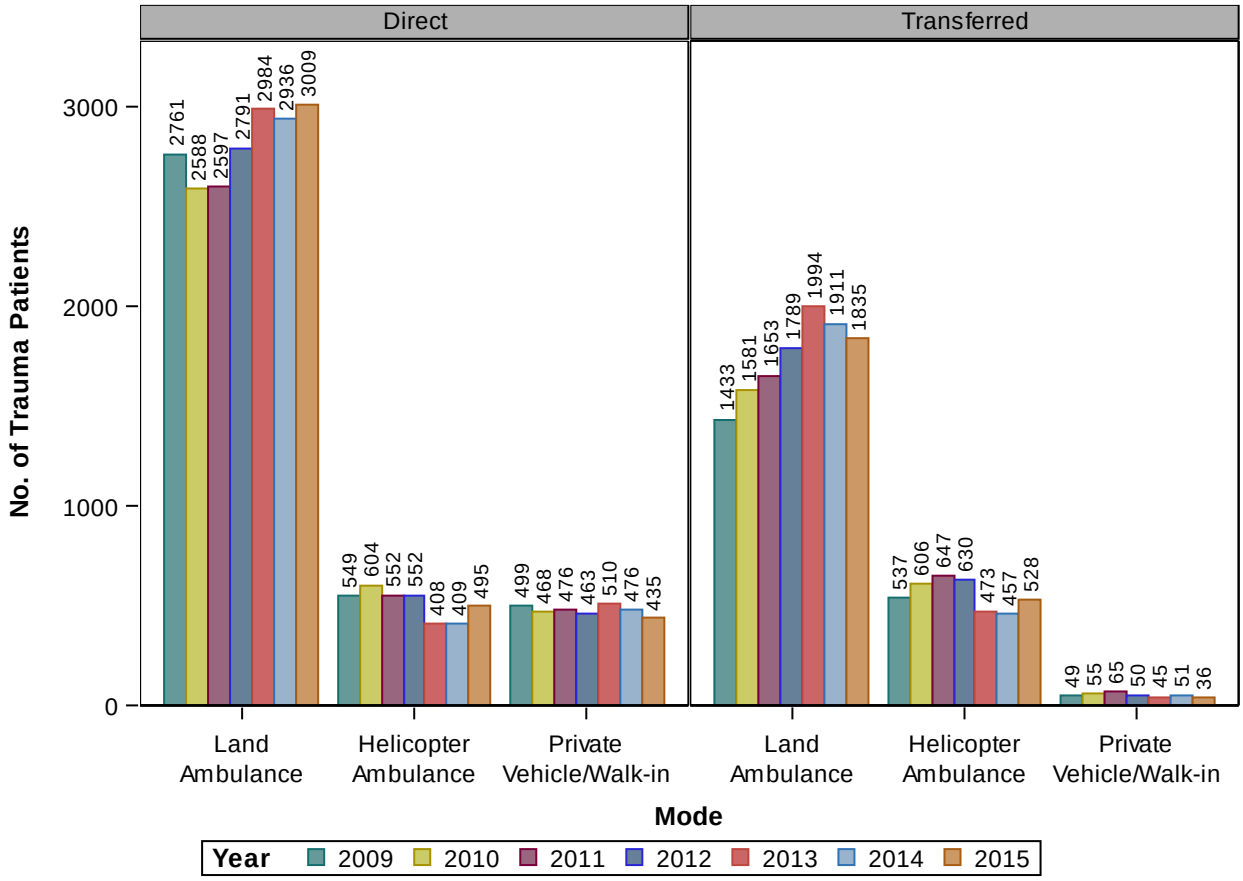


The number of trauma patients cared for in a Level I hospital was steady over 2009–2011 but increased thereafter. The number of trauma patients in Level II hospitals has gradually increased over 2009–2015 but decreased in 2014, with a growth rate of 3.5%. In contrast, the number of trauma patients has been decreasing in Level III hospitals with the exception of 2013 and has remained stable in Level IV hospitals.



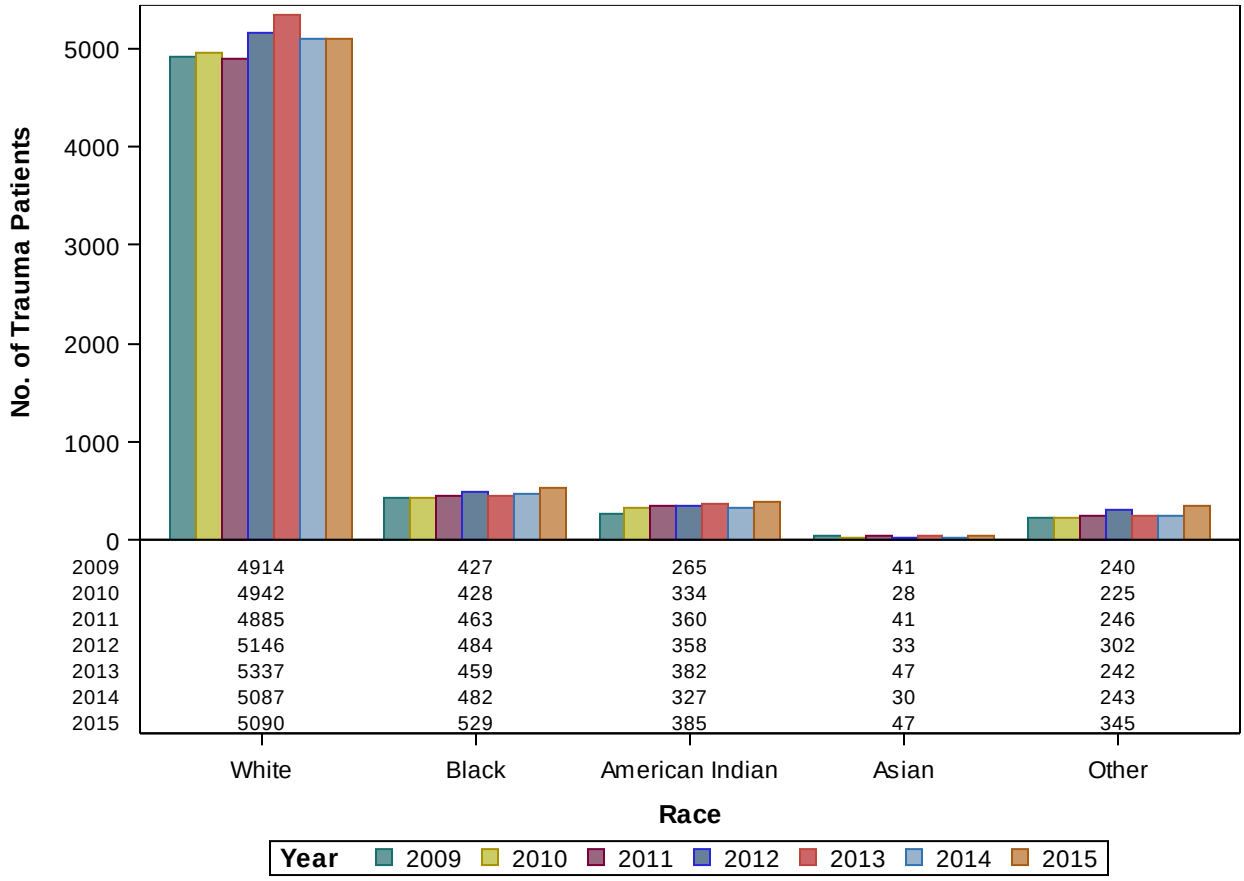
This chart indicates how major trauma patients arrived at definitive care: 1) Direct from scene by ambulance; 2) Direct from scene by privately owned vehicle (POV); and 3) Transfer from another acute care hospital. Overall, 57.3% of major trauma patients arrived at definitive care directly from scene by ambulance each year, however the proportion showed a decreasing trend over the six year period 2009–2015.

Chart 9. Direct and Transferred Major Trauma Patients by Mode: 2009–2015

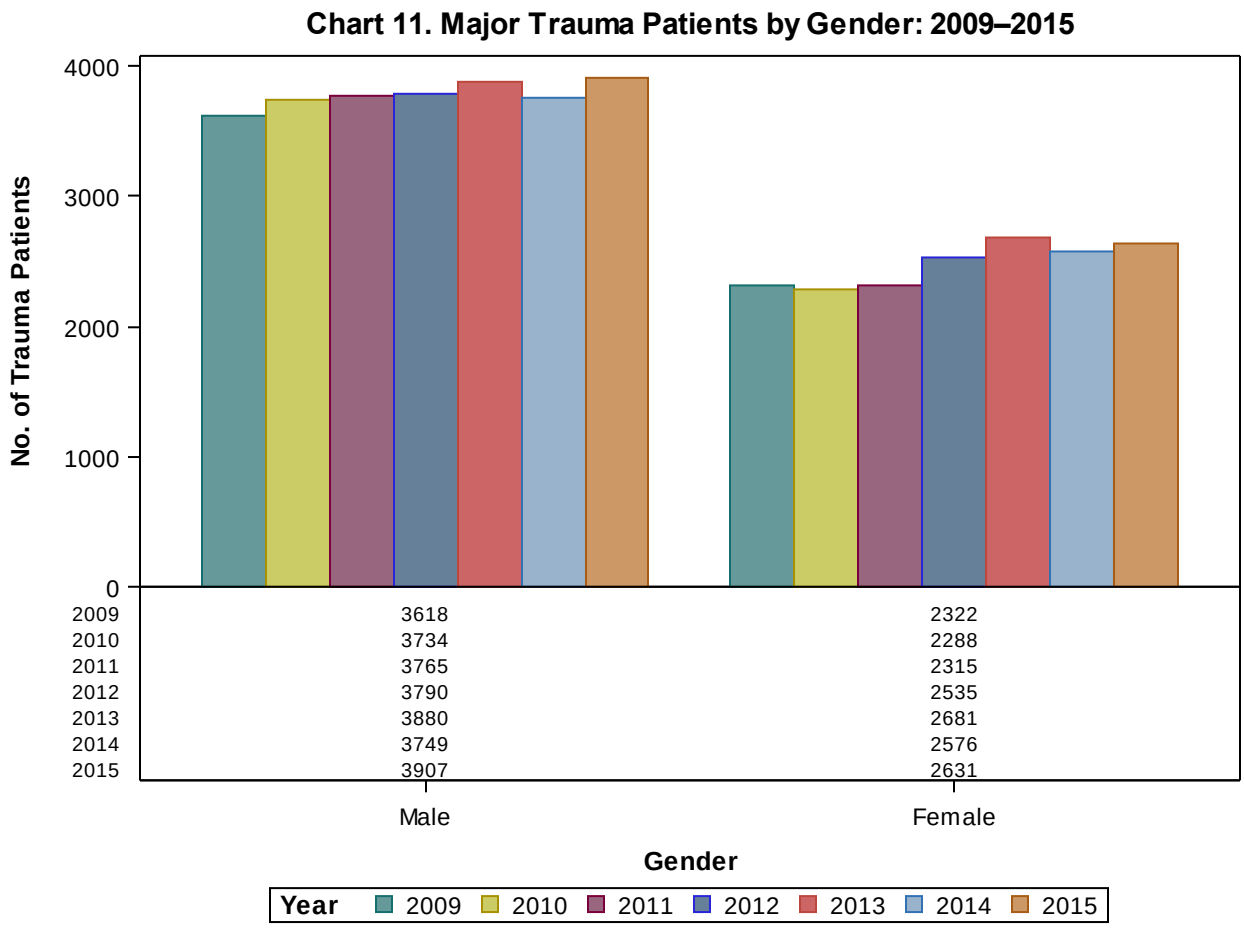


The majority of major trauma patients were transported by land ambulance. The direct patients had an increasing trend while the transferred patients increased in 2009–2013 but decreased in 2014–2015. Helicopter ambulance was the next most frequent mode which remained relatively stable but decreased in recent years. Private vehicle or walk-in was very common among direct patients.

Chart 10. Major Trauma Patients by Race: 2009–2015

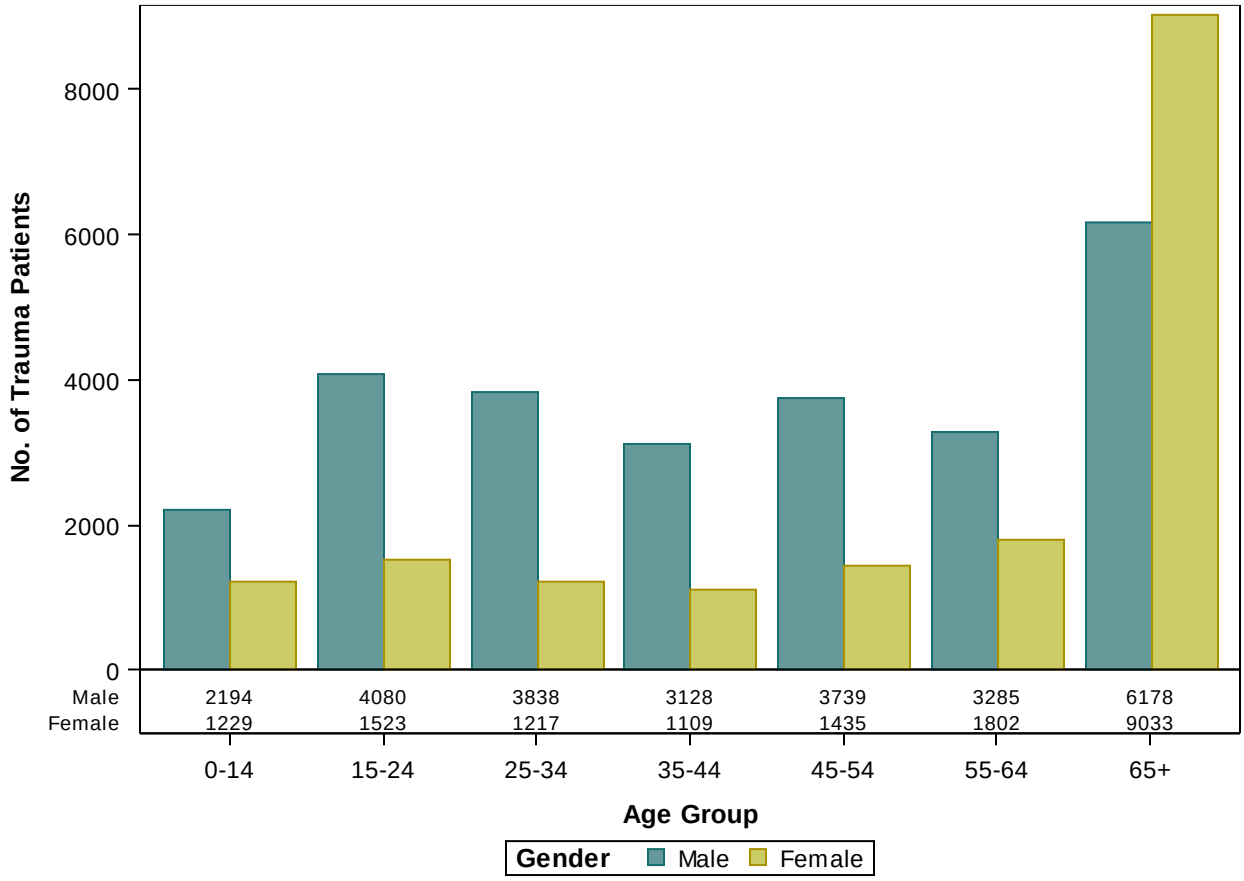


White was the reported race more than 80.0% of the time among major trauma patients. There was an increase in the number of white patients in 2012 and 2013, whereas the numbers for Black, American Indian, and other races remained steady over the same period of time.



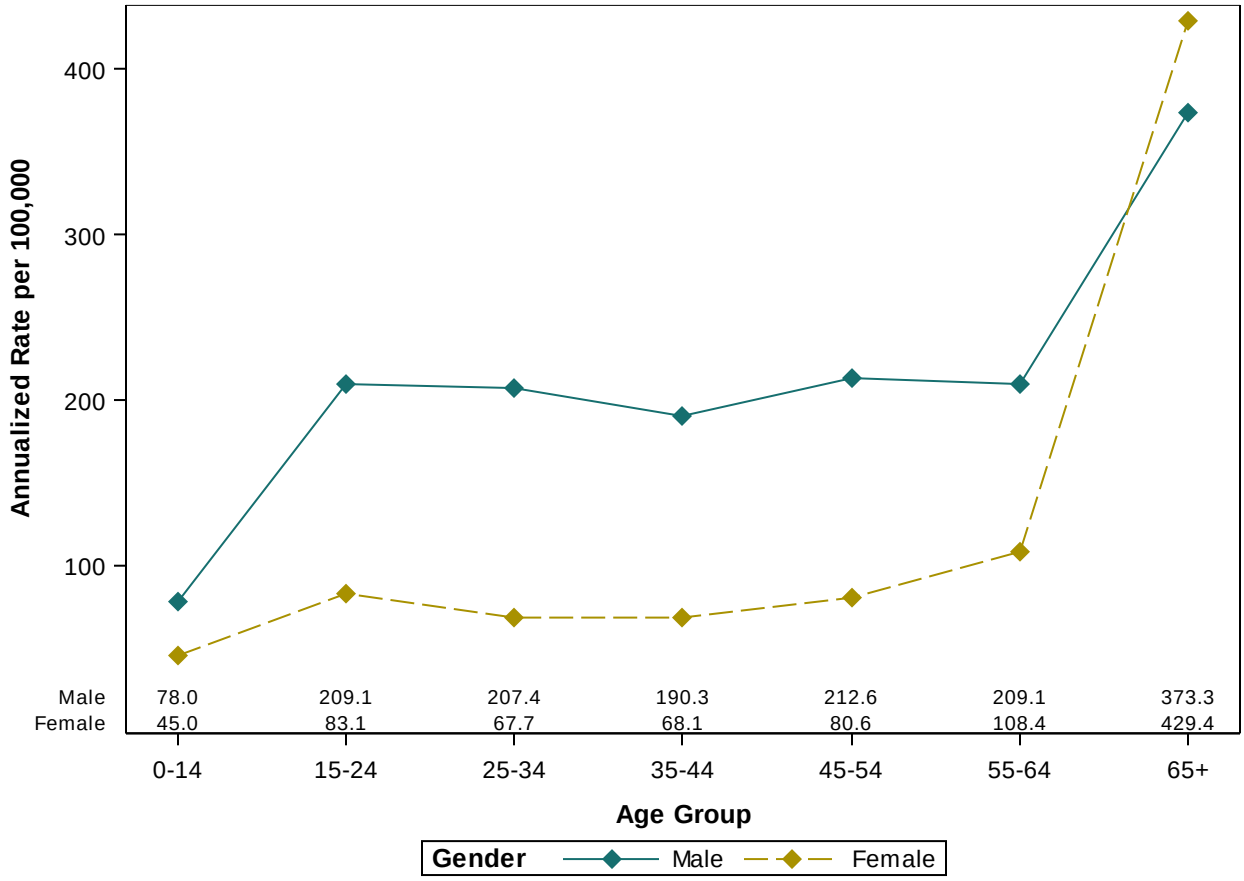
Males represented 60.4% of major trauma patients and females represented 39.6%. The numbers of male and female major trauma patients grew at a rate of 1.1% and 1.9%, respectively.

Chart 12. Major Trauma Patients by Gender and Age Group over 2009–2015



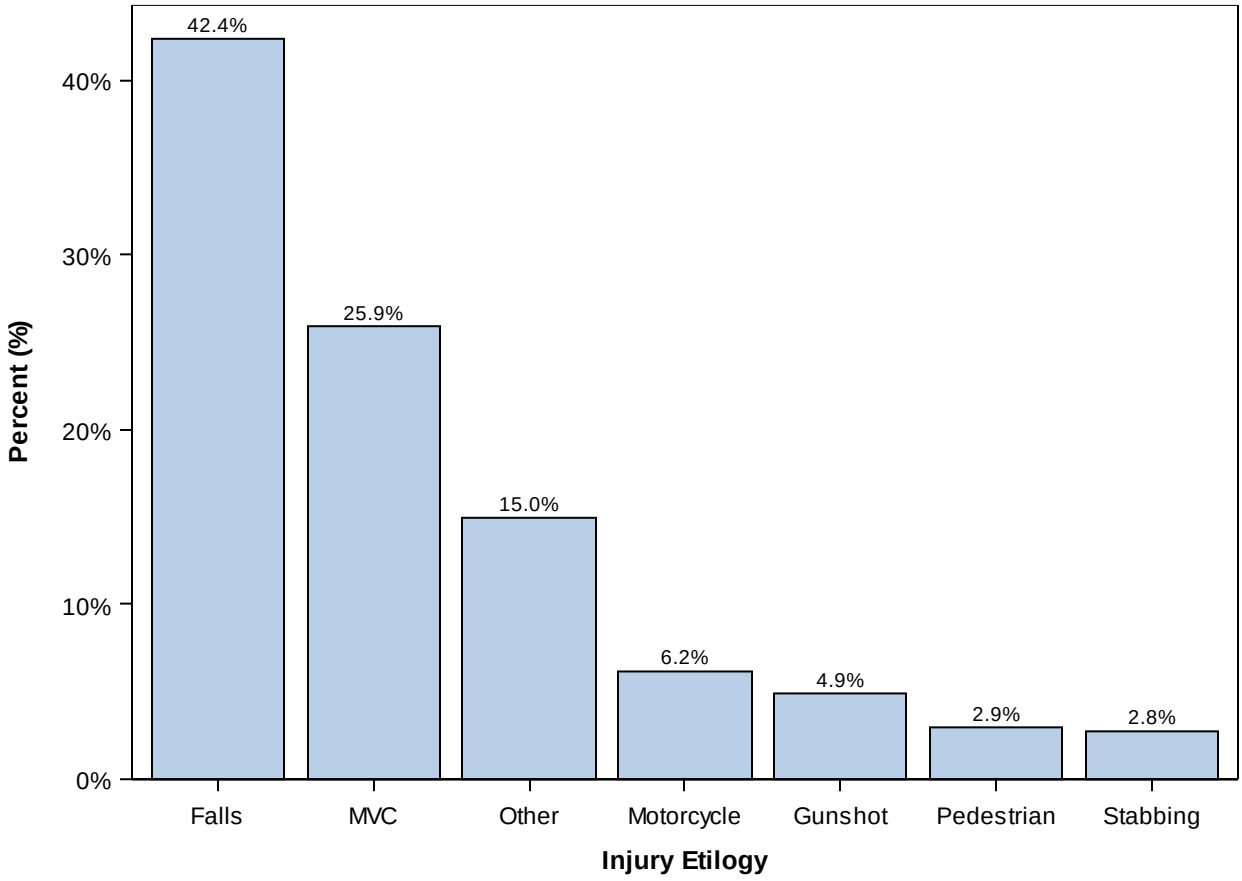
The ratio of males to females started at just below 2 for age 0–14 group. From age 15 to 44, the ratio increased to about 3 to 1. The ratio began to decrease in the age 45–54 group and finally reversed to 0.68 to 1 among those 65 or older.

Chart 13. Age Specific Rate by Gender over 2009–2015



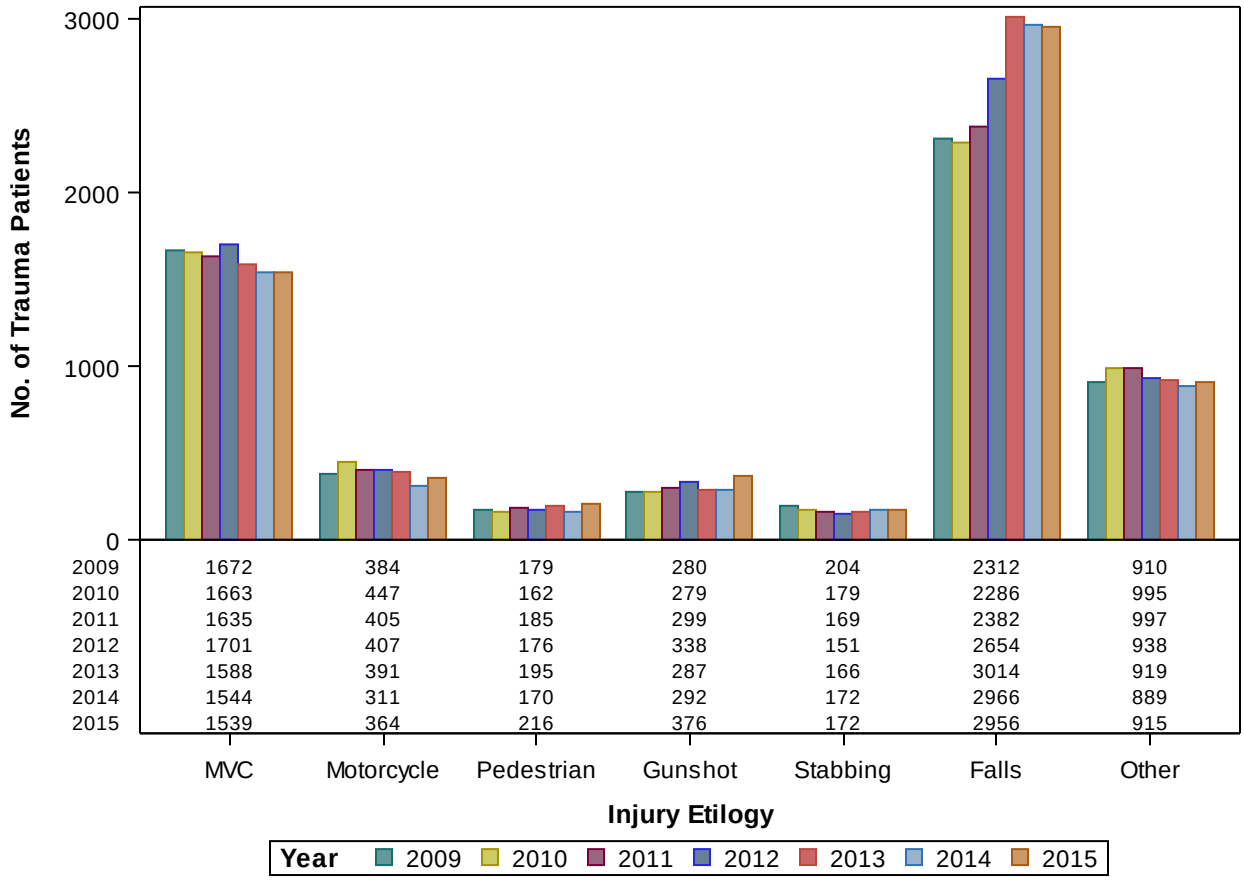
This graph exhibits the annualized, age-specific rate per 100,000 population by gender. The rates of age 0–14 group between males and females were lower than other age groups, especially among males. There was a large difference in rates by gender, with males having a higher rate until age 65+. The largest difference between males and females occurred in the age 25–34 group where the rate for males was 3.1 times than that for females. The rates of age 65+ group were the highest among all age groups; however, the rate for females was 1.2 times than that of males in this group.

Chart 14. Major Trauma Patients by Injury Etiology over 2009–2015



The injury categories used are based on the primary E-code (external cause of injury code). Falls and MVC were the two major causes of trauma, representing 42.4% and 25.9%, respectively. Within this seven category grouping there were 15.0% of trauma patients with an etiology of 'other', which includes things such as unarmed assault, animal-related injuries, and other specific injury etiologies that do not fit in the other categories.

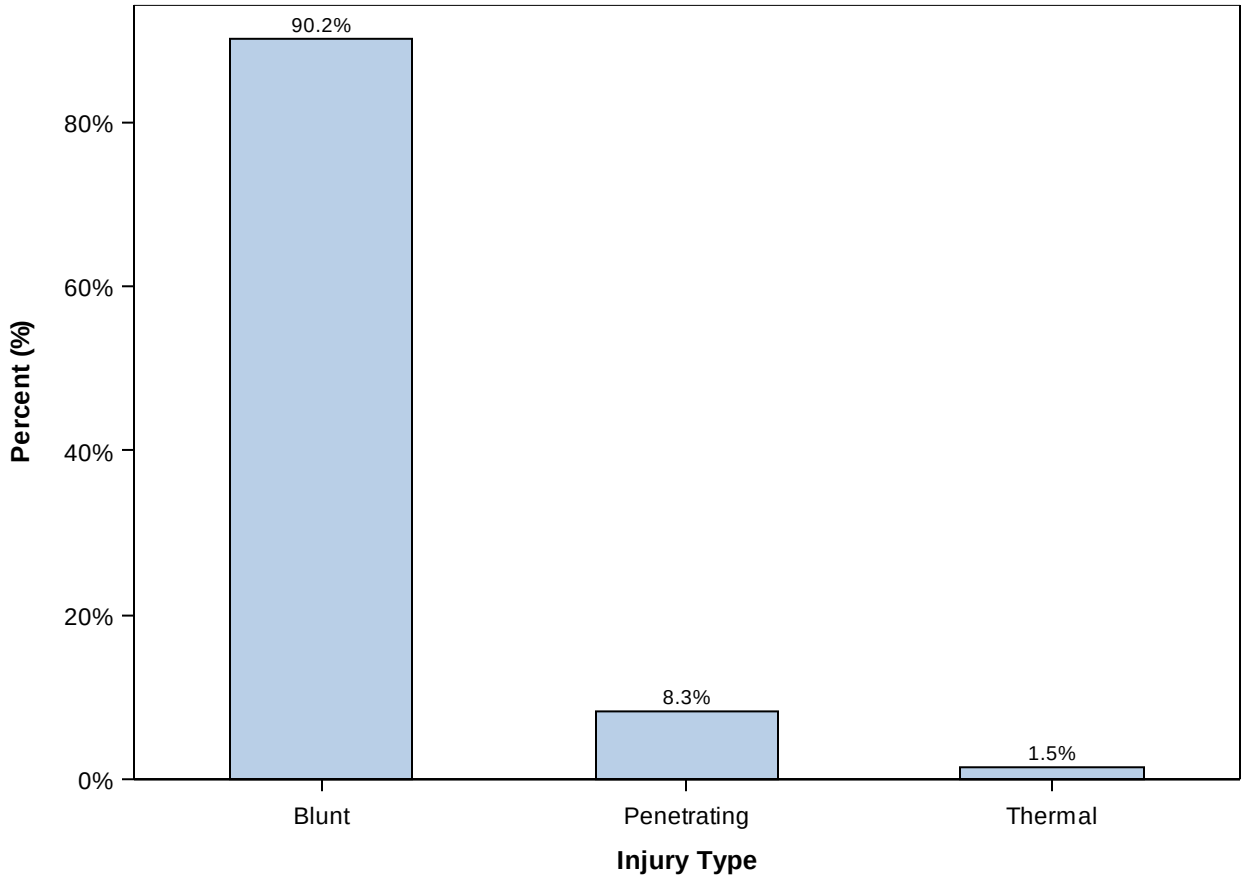
Chart 15. Major Trauma Patients by Injury Etiology: 2009–2015



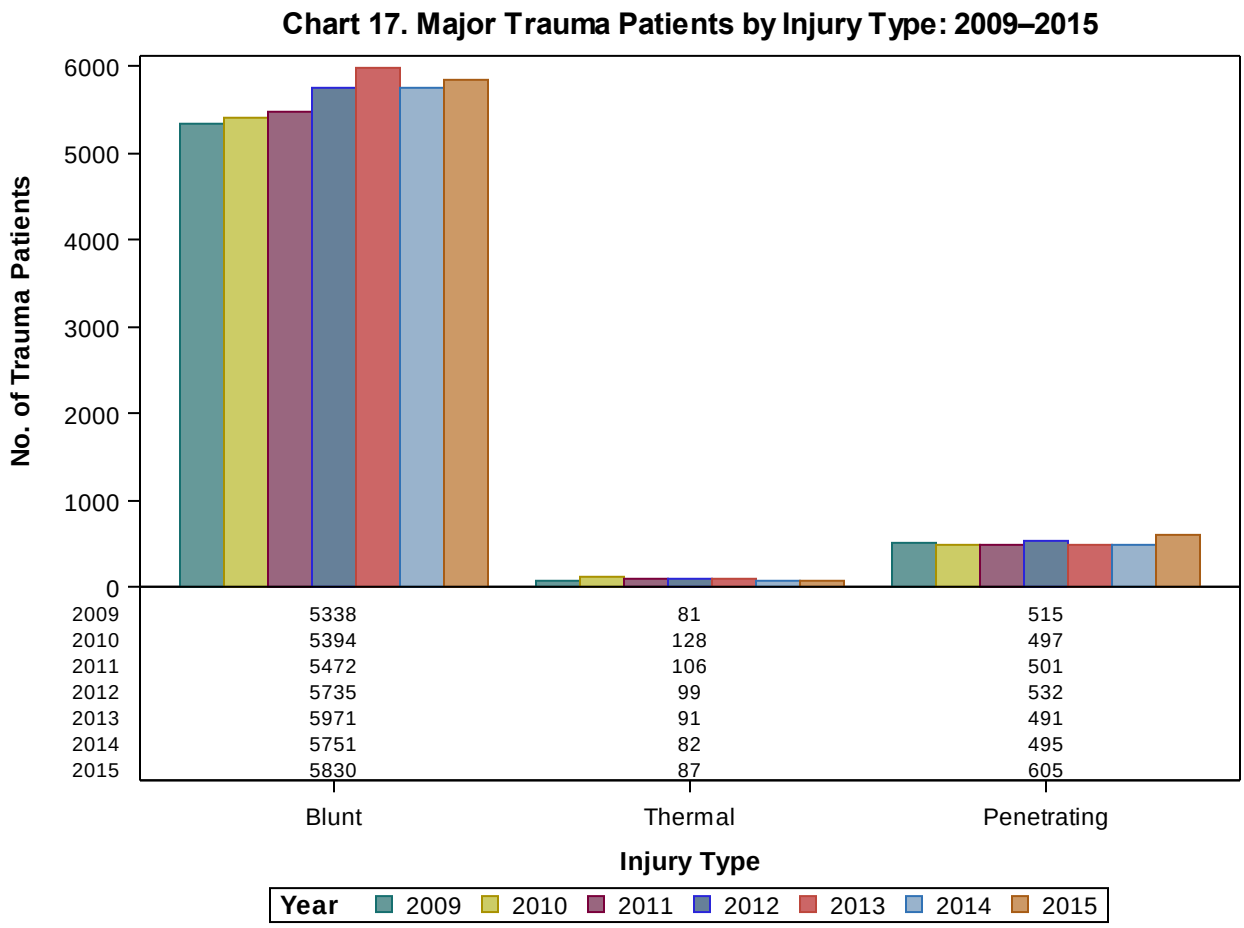
	MVC	Motorcycle	Pedestrian	Gunshot	Stabbing	Falls	Other
2009	1672	384	179	280	204	2312	910
2010	1663	447	162	279	179	2286	995
2011	1635	405	185	299	169	2382	997
2012	1701	407	176	338	151	2654	938
2013	1588	391	195	287	166	3014	919
2014	1544	311	170	292	172	2966	889
2015	1539	364	216	376	172	2956	915

This chart further examines injury etiology by year. Falls were the most common injury etiology. The major trauma patients due to falls increased 4.0% per year on average, while the patients due to MVC decreased 1.1% per year over 2009–2015. In contrast, the proportion of other injury etiologies such as motorcycle, pedestrian-related, and gunshot were relatively stable.

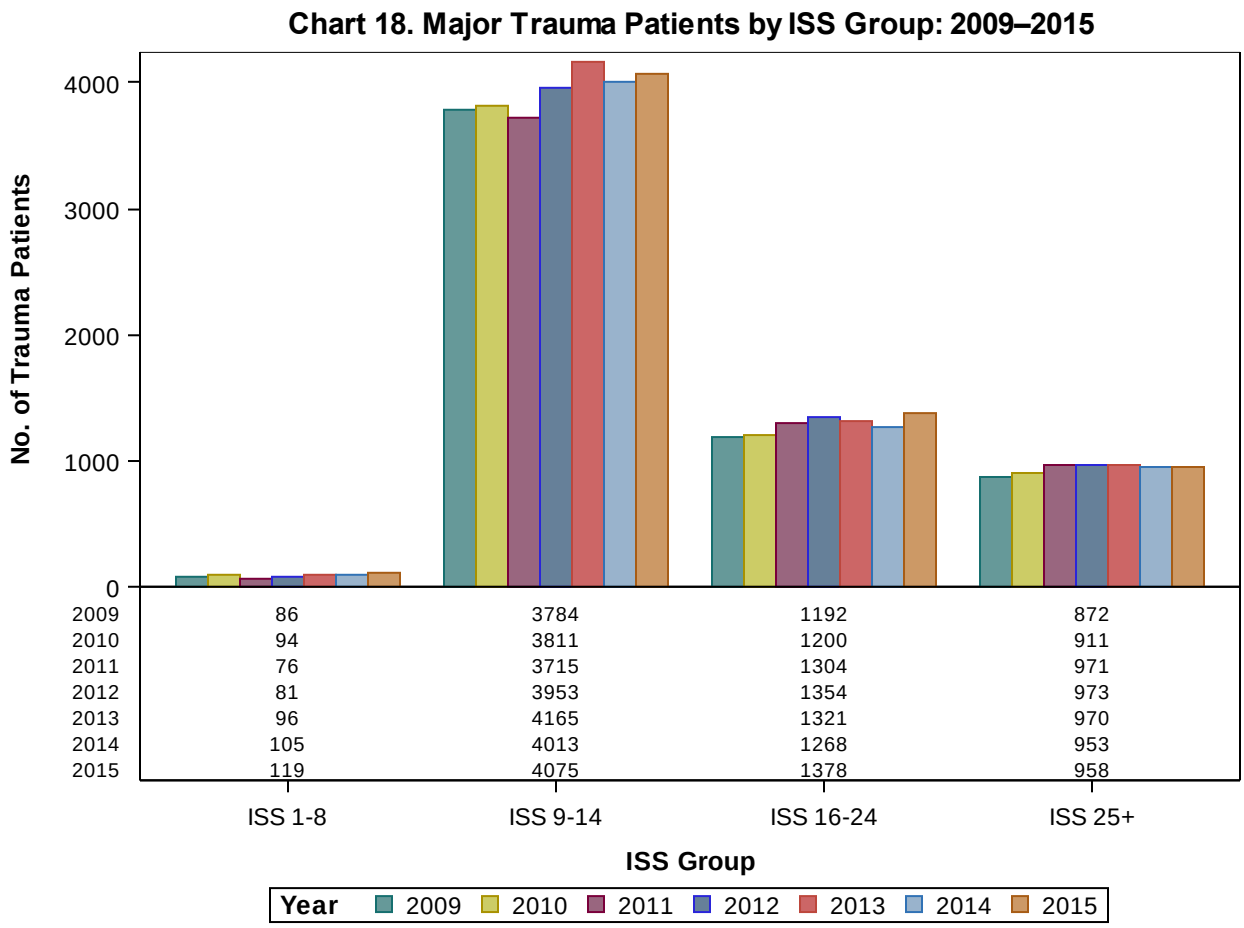
Chart 16. Major Trauma Patients by Injury Type over 2009–2015



Blunt trauma was by far the most common mechanism of injury accounting for just over 90% of the patients. However, the least frequent mechanism, burn patients, had the highest mortality rate of 26.6%. The mortality rate for penetrating trauma patients was 22.7%, whereas the mortality rate among blunt trauma patients was just 8.2%.

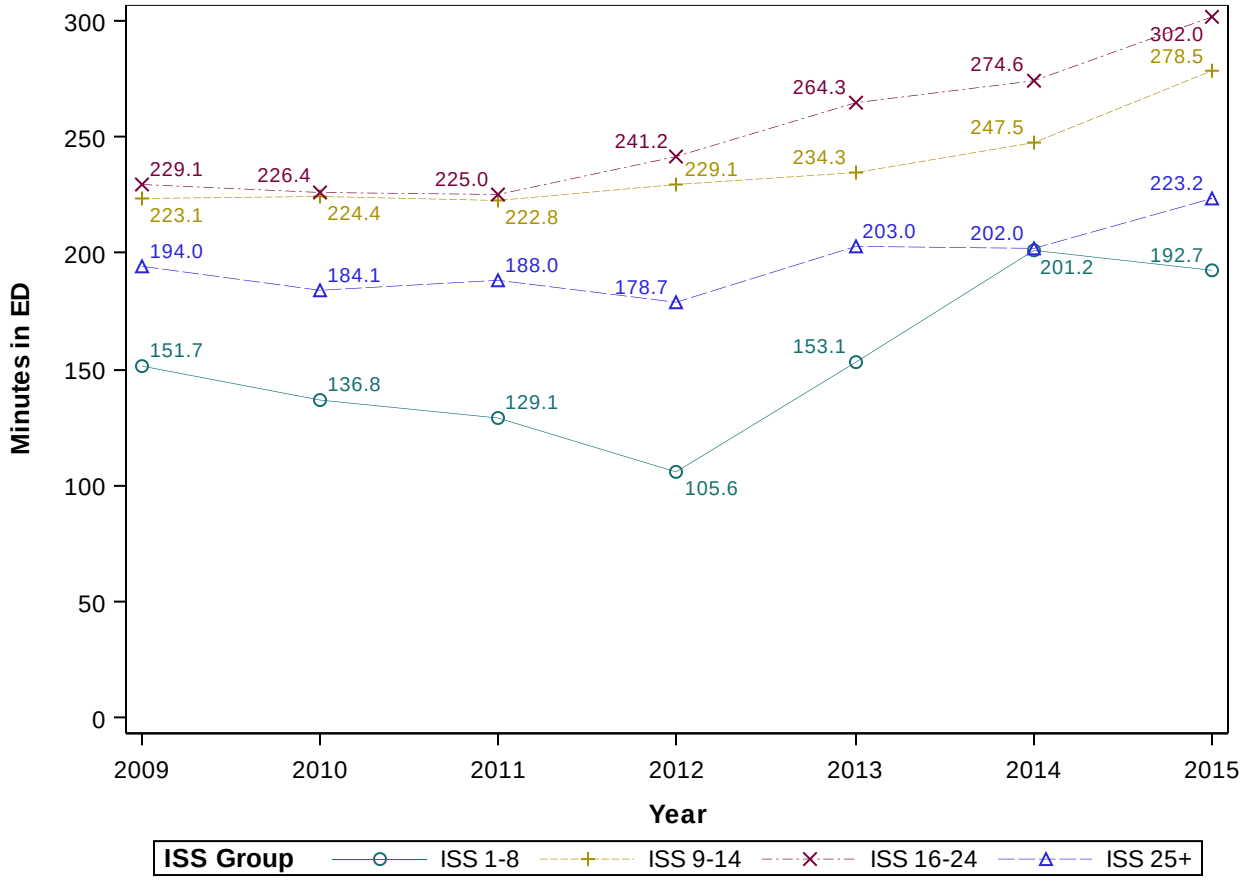


The number blunt trauma patients increased 1.3% per year from 2009 to 2015, whereas the penetrating and thermal trauma patients remained stable.



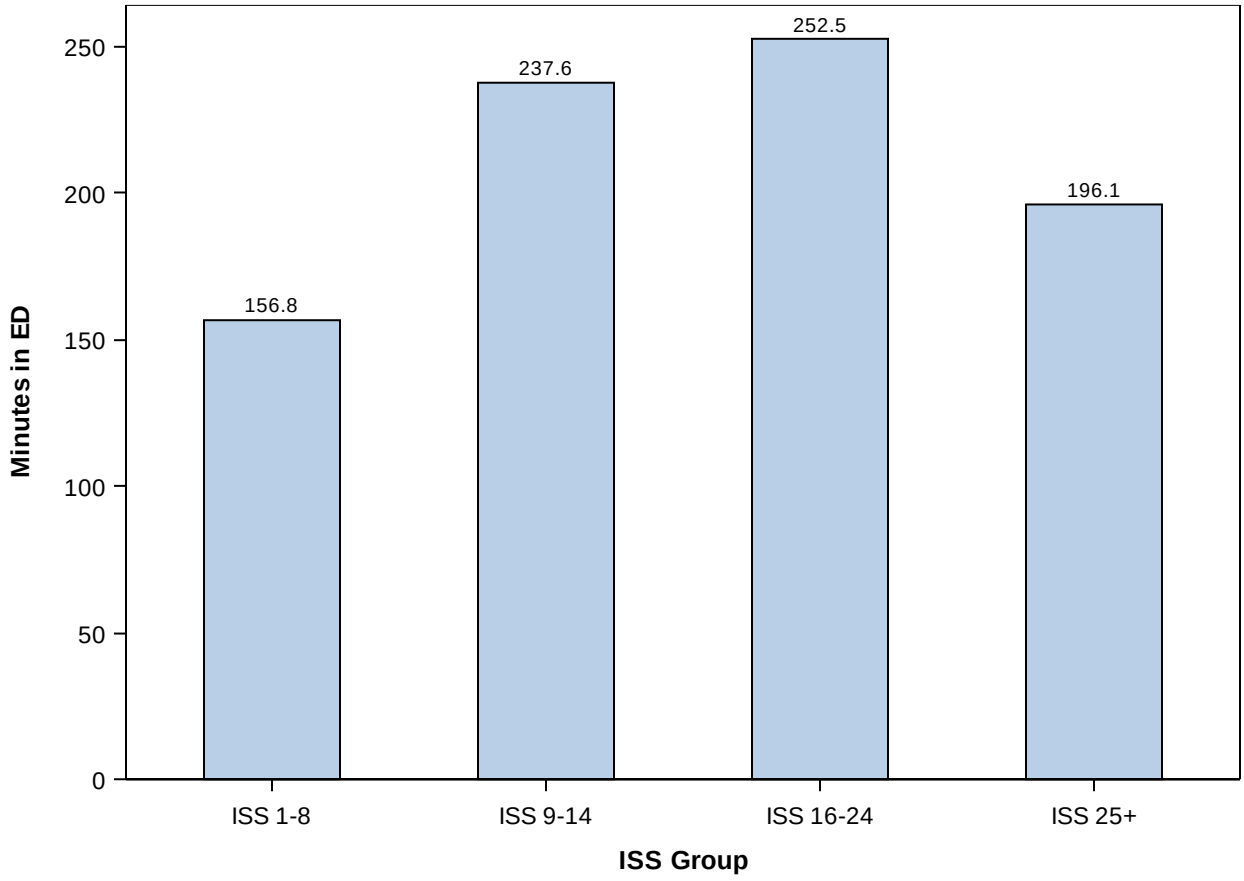
Injury Severity Score (ISS) groups for major trauma patients are shown here by year. The ISS 1–8 group was smaller as it consisted of patients that died or had a survival probability below 0.90, which were uncommonly seen in patients with an ISS below 9. The greatest increases occurred at the ISS threshold of 9 while the numbers of the most severely injured remained fairly stable.

Chart 19. Mean Minutes in the ED by ISS Group: 2009–2015



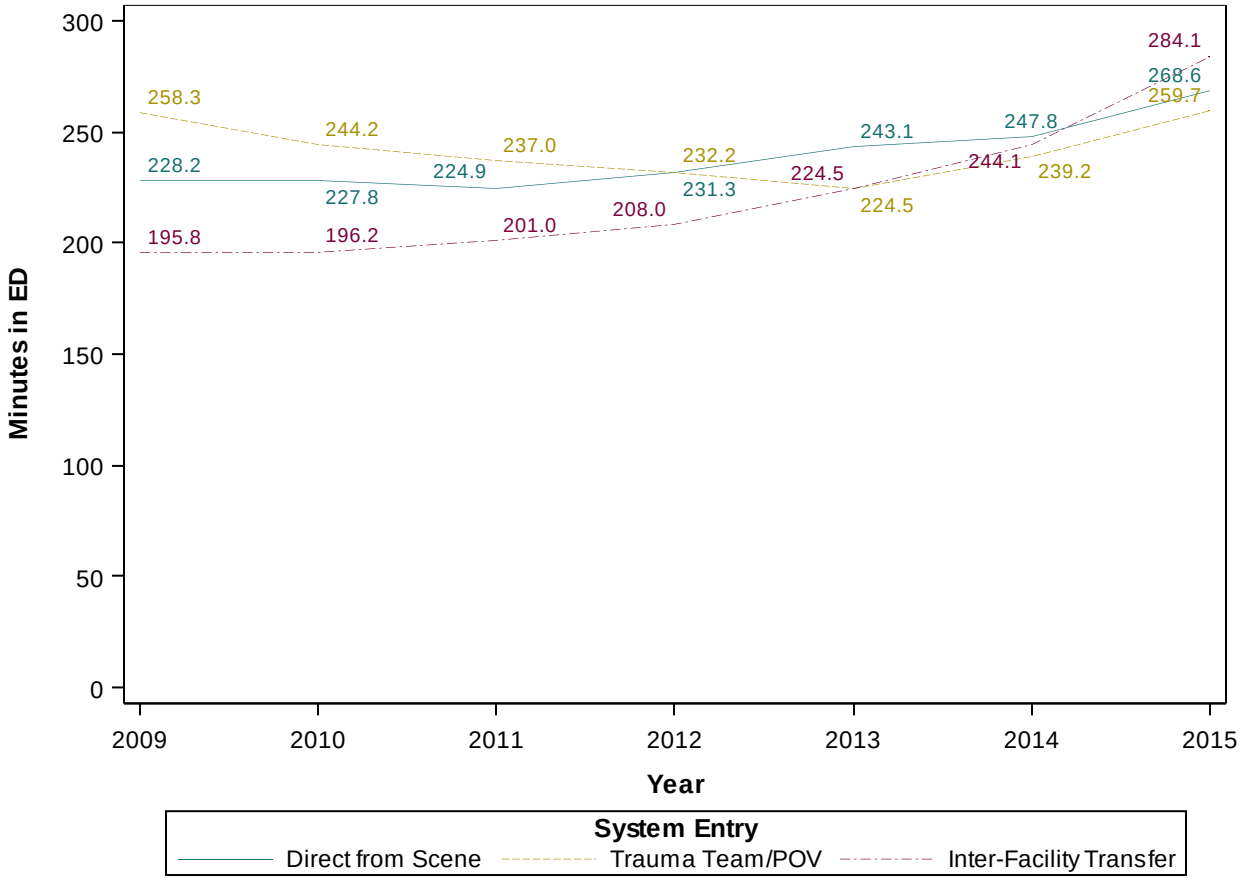
Each line above represents an ISS group and shows the mean minutes spent in the emergency department by year. Only patients at the definitive care facility are included, so the graph represents the time in the ED before being sent to the floor, ICU, OR, or morgue. Again, there were very few major trauma patients with an ISS 1-8 which made variability in that group much higher. Patients with an ISS of 16 to 24 consistently spent the most time in the ED.

Chart 20. Mean Minutes in the ED by ISS Group over 2009–2015



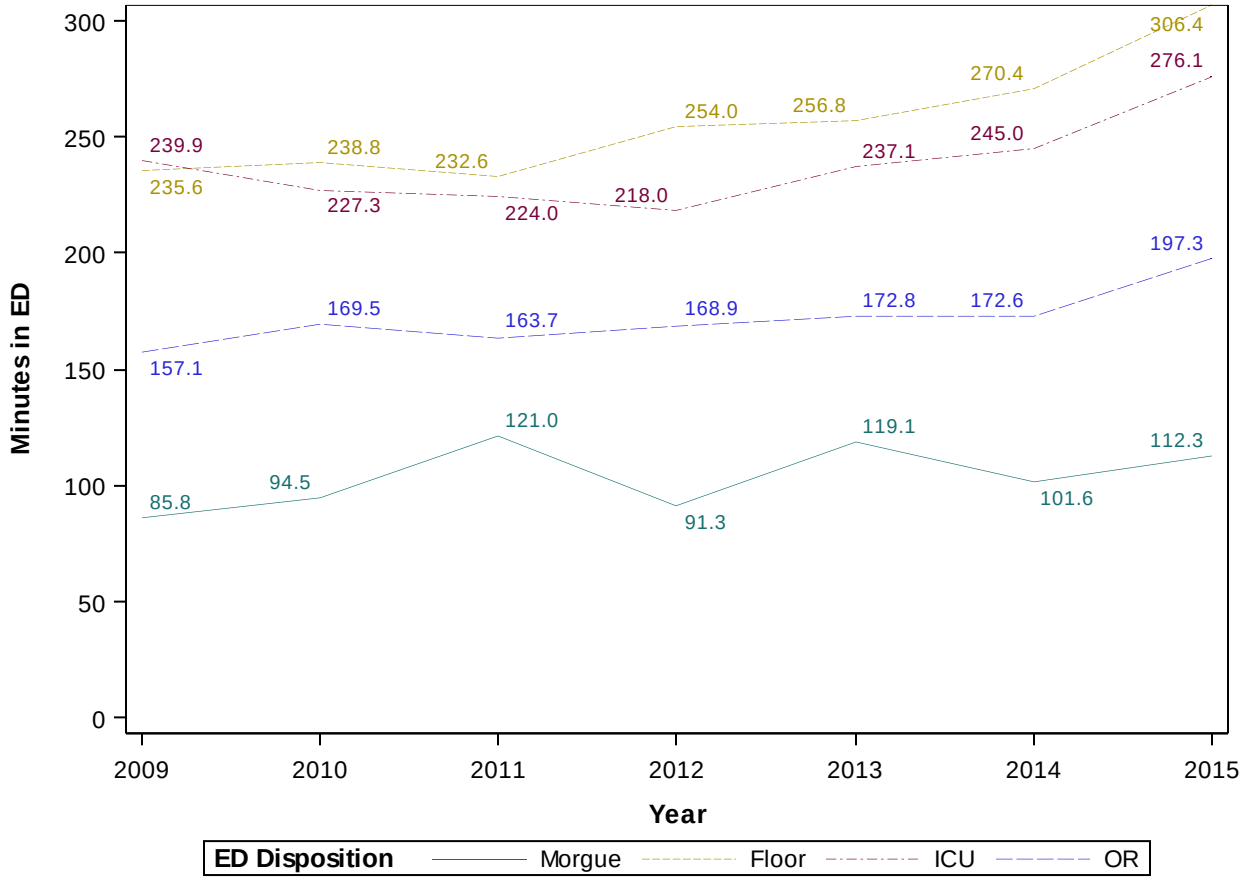
Patients across all seven years were aggregated according to their ISS value and the columns show the average number of minutes spent in the ED before disposition. Again, it can be seen that patients with an ISS of 16–24 spent the longest time in the ED, averaging more than four hours over this seven year period. The patients in the ISS 9–14 group spent about 15 minutes less than the ISS 16-24 group, while those in ISS 25+ group spent 41 minutes less.

Chart 21. Mean Minutes in the ED by System Entry at Definitive Care: 2009–2015

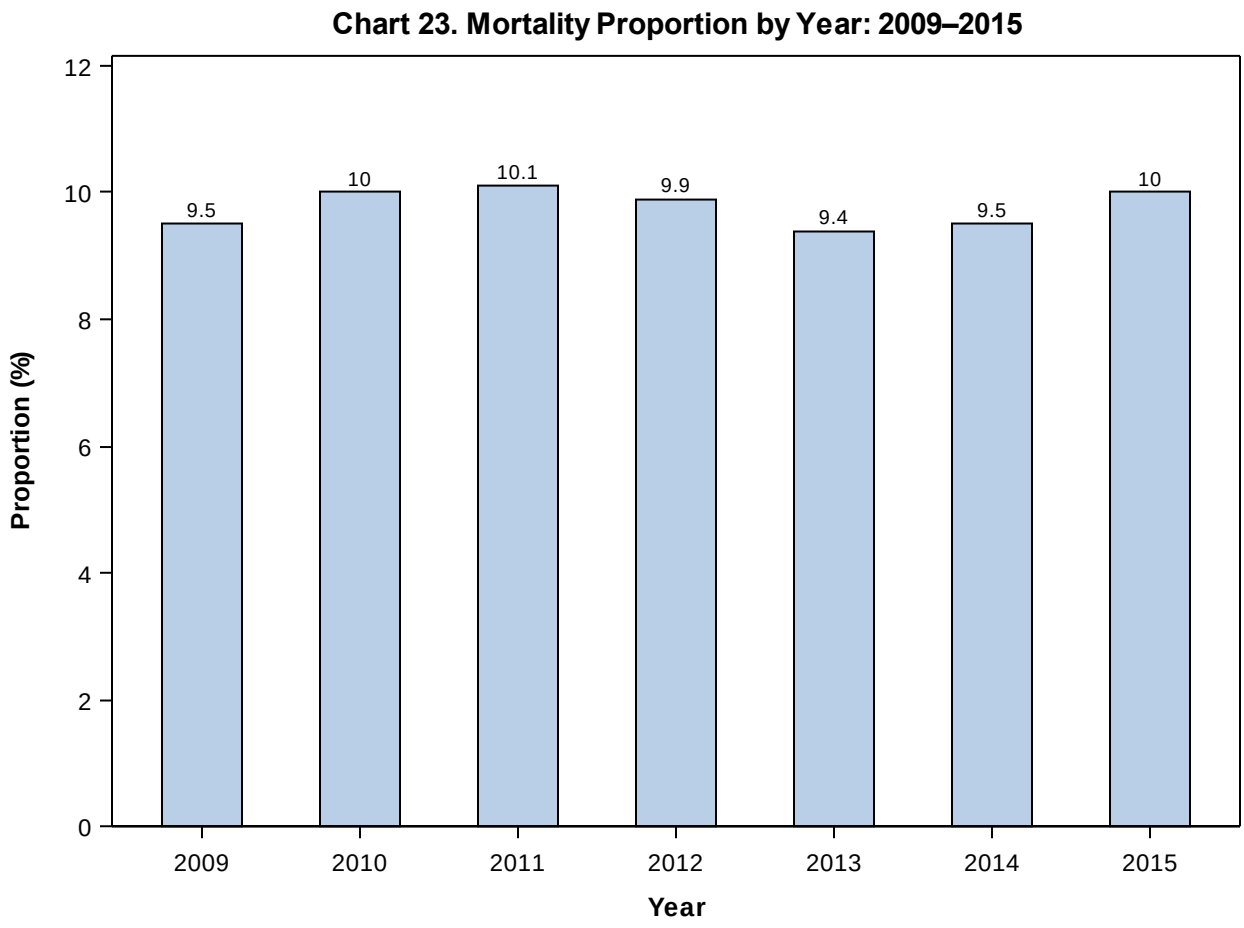


Each line above represents the mean minutes spent in the emergency department by system entry: 1) Direct from scene by ambulance; 2) Direct from scene by privately owned vehicle (POV); and 3) Transfer from another acute care hospital. Patients arriving directly from scene by ambulance spent 20–30 minutes longer in the ED than transferred patients over 2009–2012 but reversed over 2013–2015. Moreover, the average time in the ED for patients arriving by POV had a decreasing trend over 2009–2013 but increased over 2014–2015.

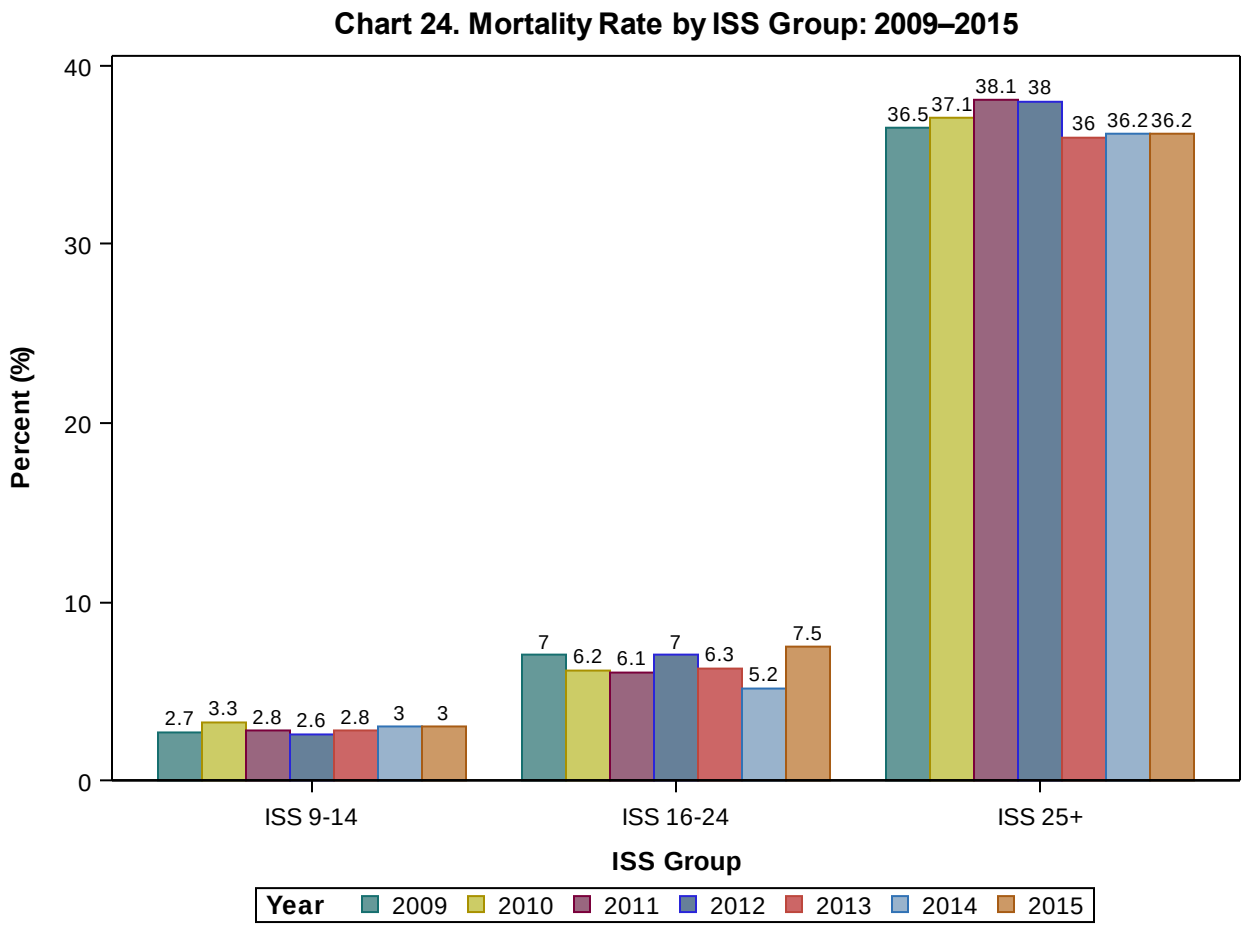
Chart 22. Mean Minutes in the ED by ED Disposition: 2009–2015



Mean minutes in the ED are shown by ED disposition and year. Four major ED dispositions—floor, ICU, OR, and morgue—were selected for this chart. Patients sent to ICU or to the Floor had nearly identical ED time in 2009; however, the gap between them has been increasing up to 30 minutes in recent years. Mean time to OR has remained fairly stable at just under 3 hours but increased in 2015. The mean time in the ED for patients that died varied from a low of 85.8 minutes in 2009 to a high of 121.0 minutes in 2011.



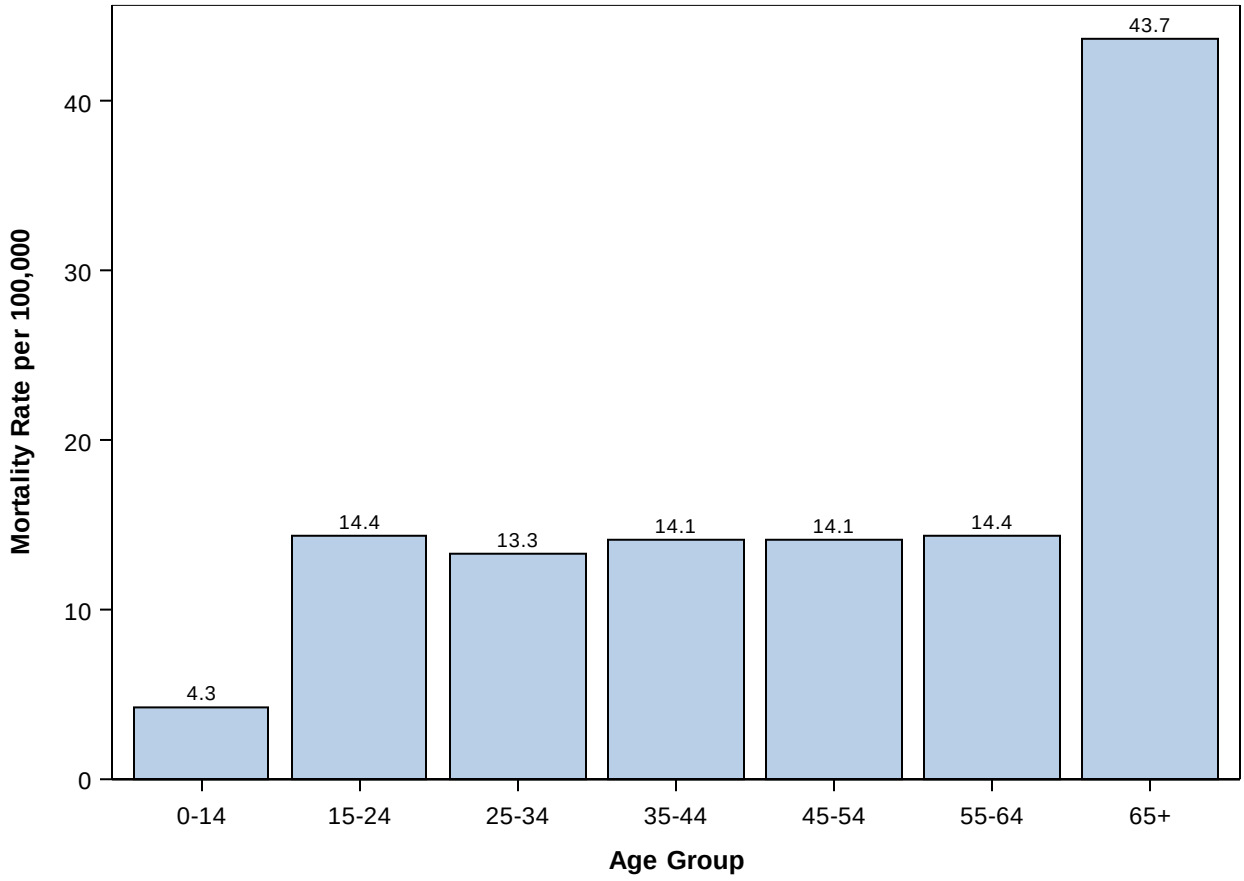
The columns above indicate the unadjusted mortality proportions for each year. The average mortality proportion over 7-year period was 9.4%; ranging from a high of 10.1% in 2011 to a low of 9.4% in 2013.



Note: ISS 1–8 group was excluded because many of these patients only met major trauma criteria because they died, which artificially inflated the mortality rate.

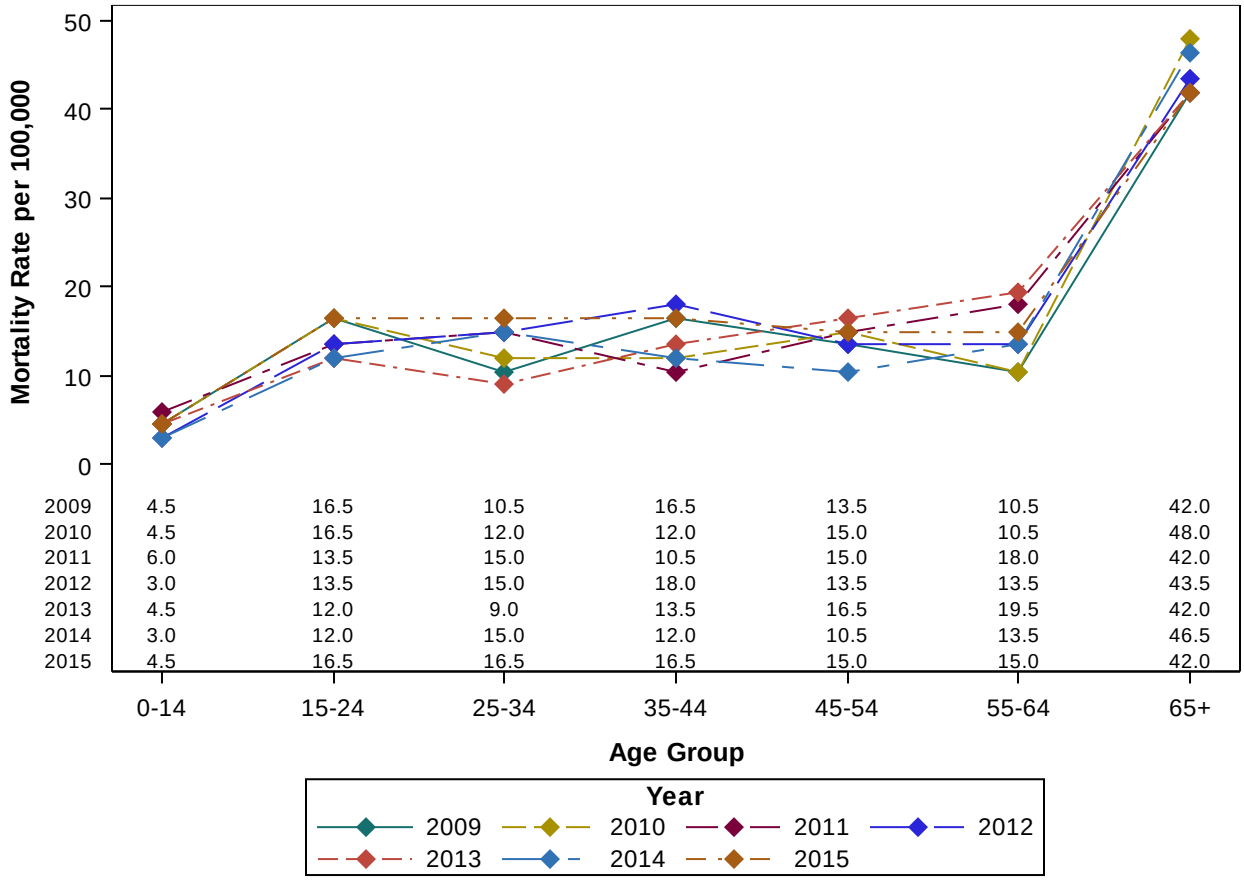
Mortality rates are shown for each ISS category by year. Mortality among patients with ISS of 9–14 was low and virtually unchanged over the seven year period. Mortality among patients with ISS of 16–24 also remained fairly stable across the years but jumped in 2015. The overall mortality rate among the most severely injured patients (ISS 25+) was 36.8% ranging from a high of 38.1% in 2011 to a low of 36.0% in 2013.

Chart 25. Age Specific Mortality Rates over 2009–2015



The columns above indicate the mortality rates per 100,000 population by age group for 2009–2014. The mortality rate for the age 0–14 group was the lowest at 4.3, whereas the highest mortality rate was seen in the age 65+ group at 43.7. In comparison, the other age groups had a similar mortality rate, with an average of 14.1.

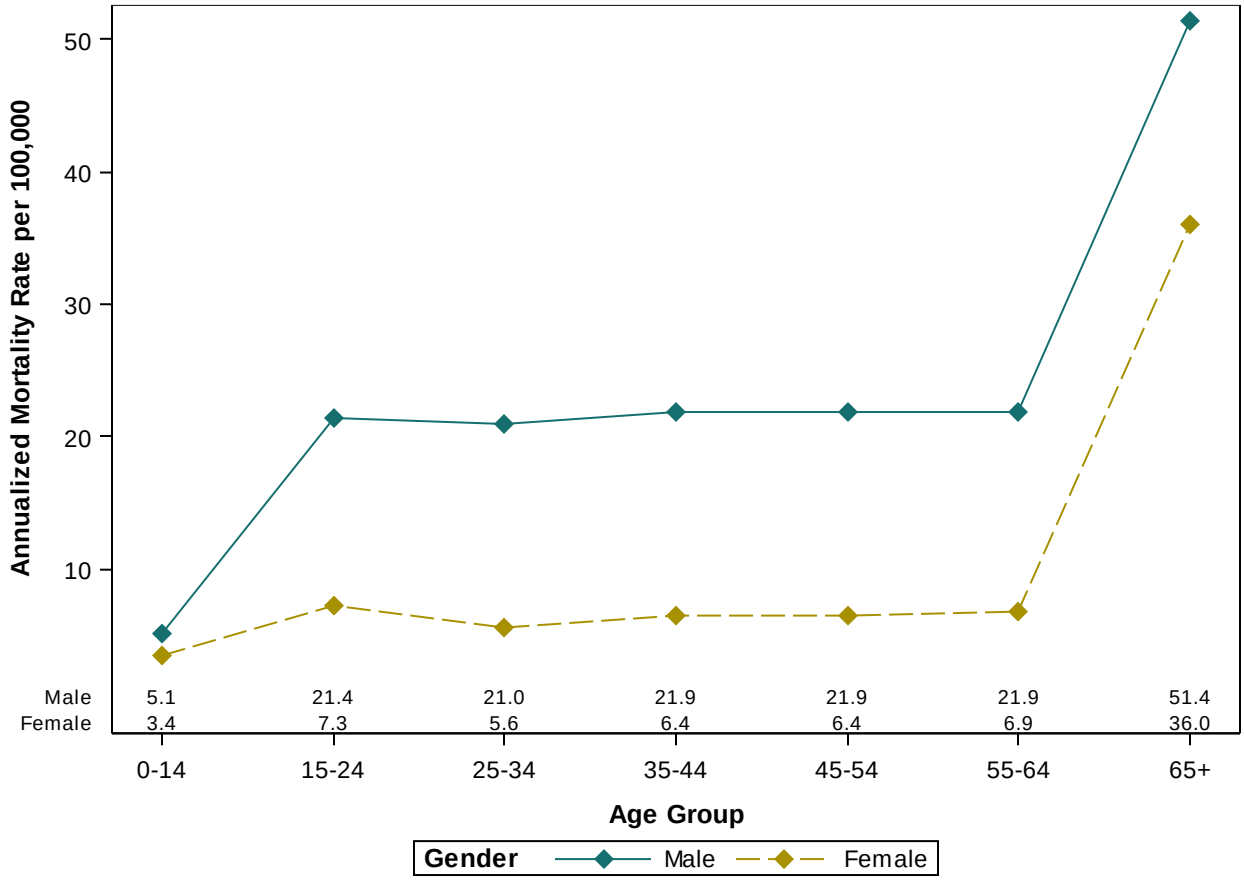
Chart 26. Age Specific Mortality Rates by Year: 2009–2015



	0-14	15-24	25-34	35-44	45-54	55-64	65+
2009	4.5	16.5	10.5	16.5	13.5	10.5	42.0
2010	4.5	16.5	12.0	12.0	15.0	10.5	48.0
2011	6.0	13.5	15.0	10.5	15.0	18.0	42.0
2012	3.0	13.5	15.0	18.0	13.5	13.5	43.5
2013	4.5	12.0	9.0	13.5	16.5	19.5	42.0
2014	3.0	12.0	15.0	12.0	10.5	13.5	46.5
2015	4.5	16.5	16.5	16.5	15.0	15.0	42.0

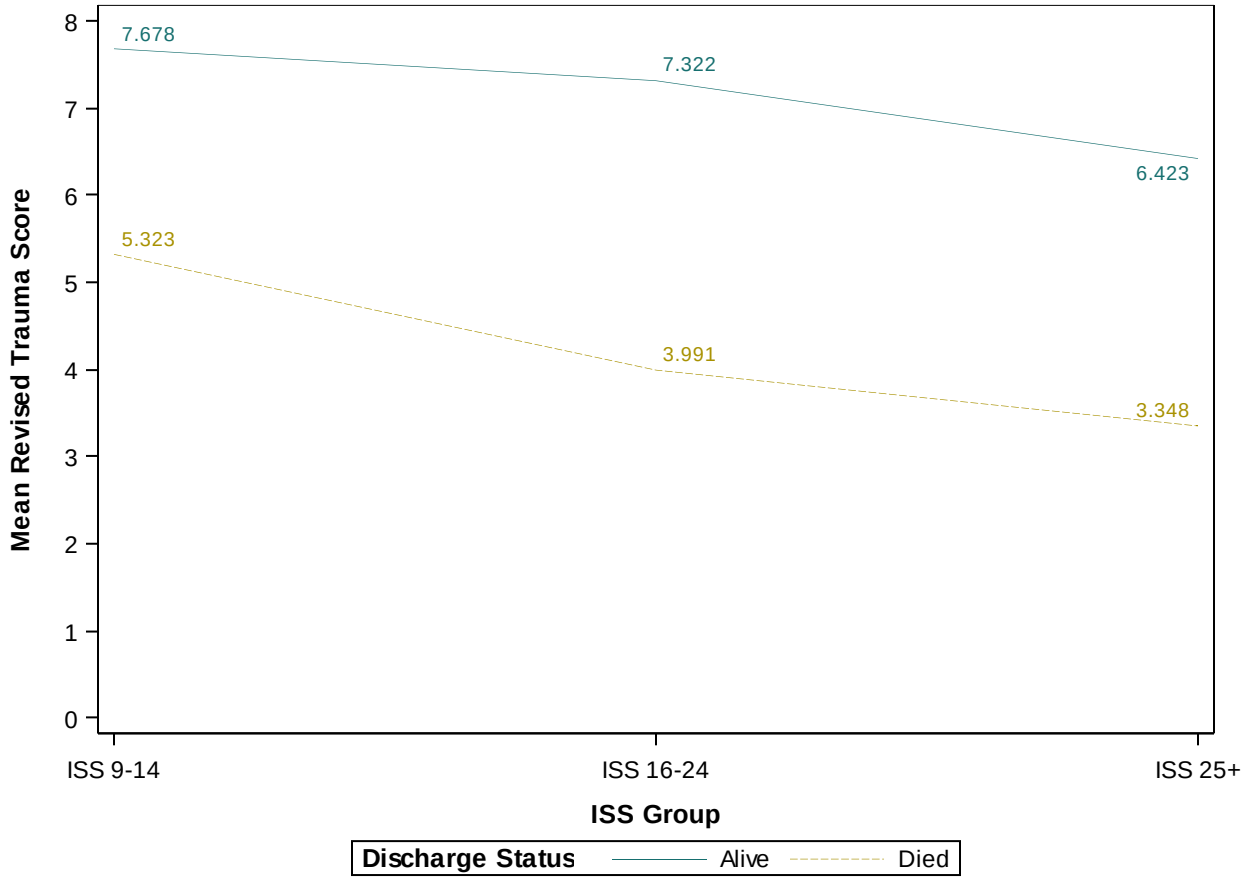
The mortality rates per 100,000 population above are shown for each age group and year. The greatest variation over time was seen among older age groups from age 25 to 64, whereas the least variation was among younger age groups from 0 to 24. The rates were dramatically higher among the 65+ age group and were primarily related to falls.

Chart 27. Age Specific Mortality by Gender: 2009–2015



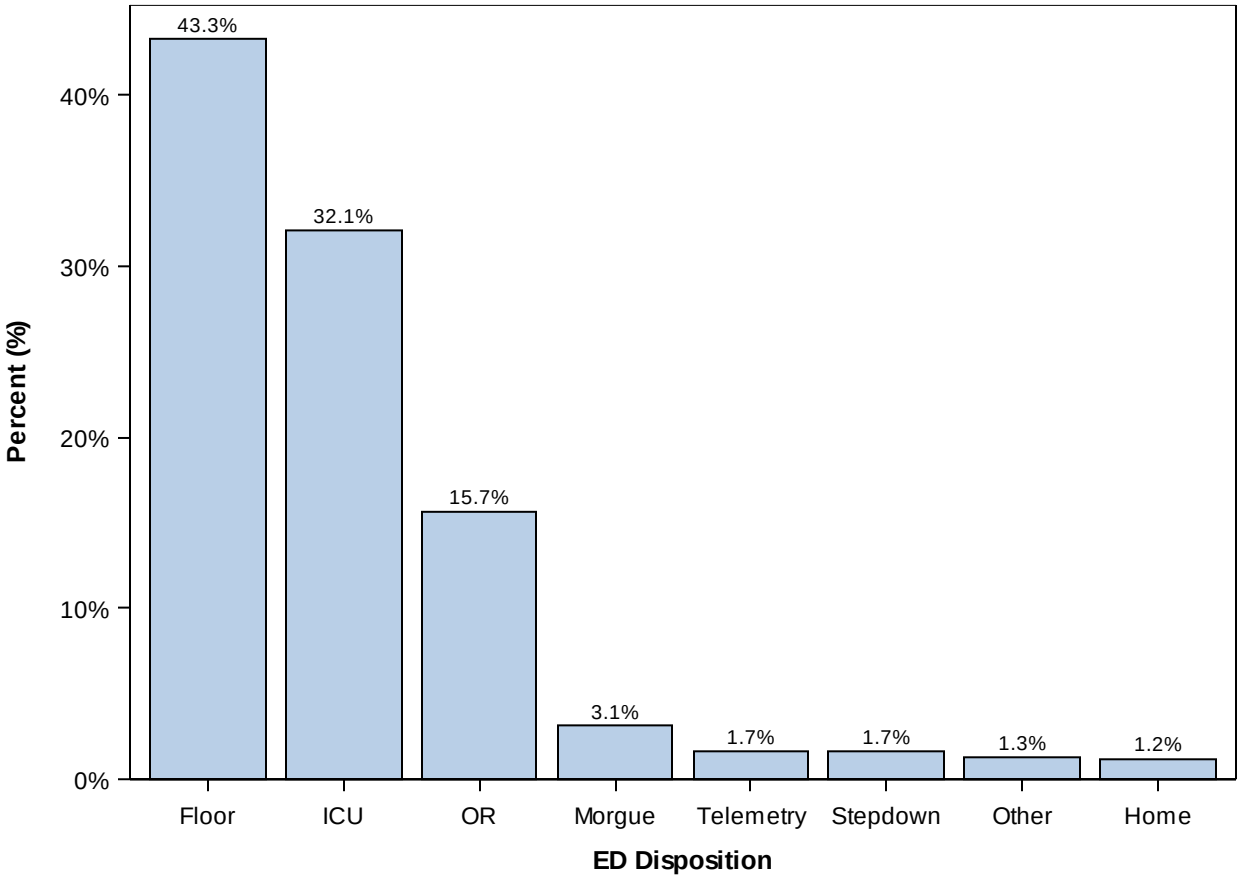
Mortality rates for females and males by age group are shown above. The mortality rate for males remained consistently higher than that of females across all the age groups. The mortality rate for males was just slightly higher than females in the 0–14 age group, whereas the rate for males was triple that of females from age 15 to 64. The mortality rates for both females and males were much higher in the 65+ age group.

Chart 28. Mean Revised Trauma Score by ISS Group and Discharge Status: 2009–2015



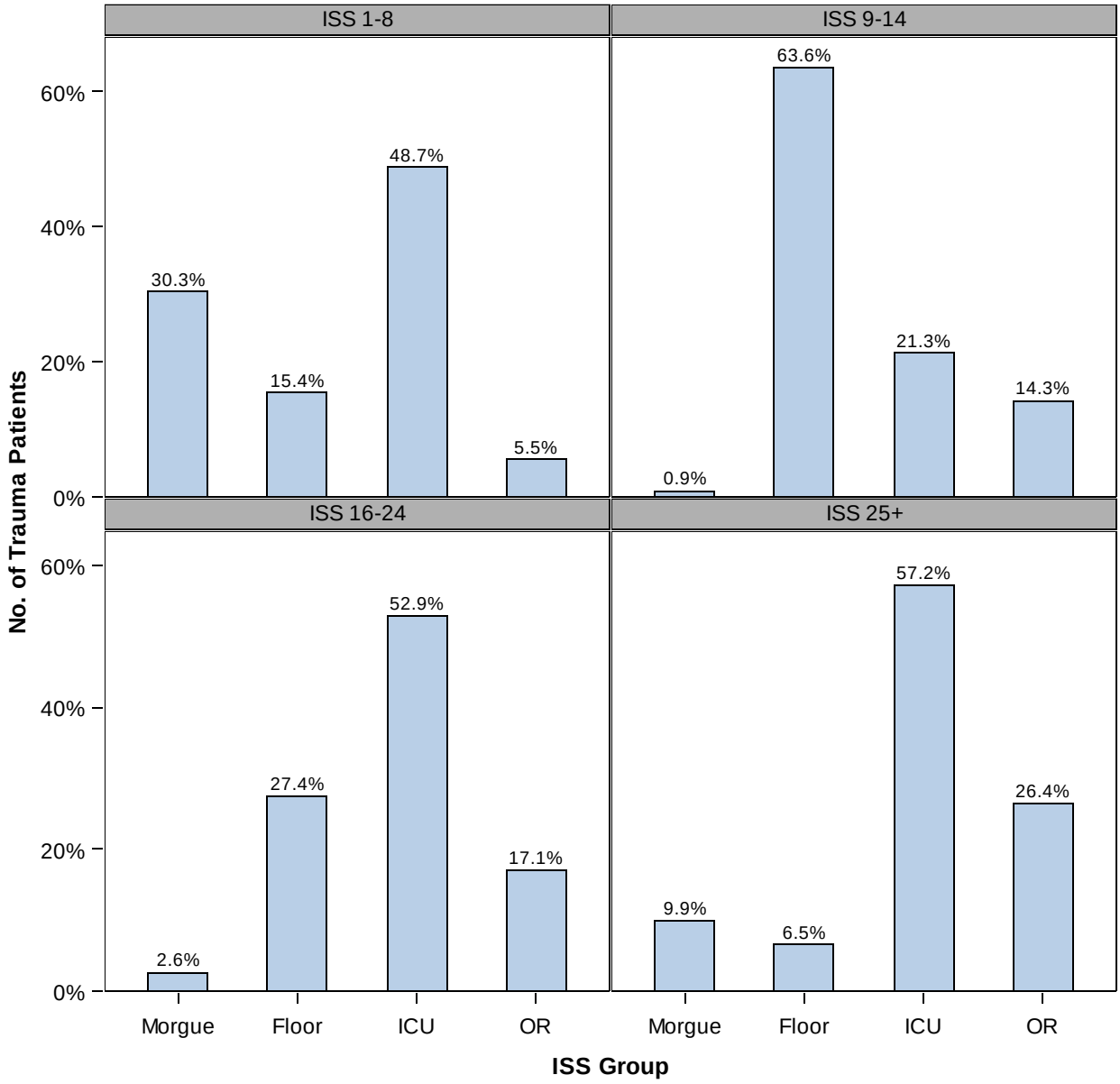
The relationship between the revised trauma score (RTS) and ISS is illustrated above. The RTS is a composite measure based on the initial hospital vital signs of a trauma patient. It ranges from 7.841 to 0, with higher values indicating better vital signs. It includes the Glasgow Coma Scale score, systolic blood pressure, and unassisted respiratory rate. In this chart, the RTS was based on the initial vital signs measured in the definitive care ED. As expected RTS values decreased with increasing injury severity for both survivors and patients that died. However, the differences in RTS scores of survivors and patients that died were large even within the same ISS group.

Chart 29. Major Trauma Patients by ED Disposition: 2009–2015



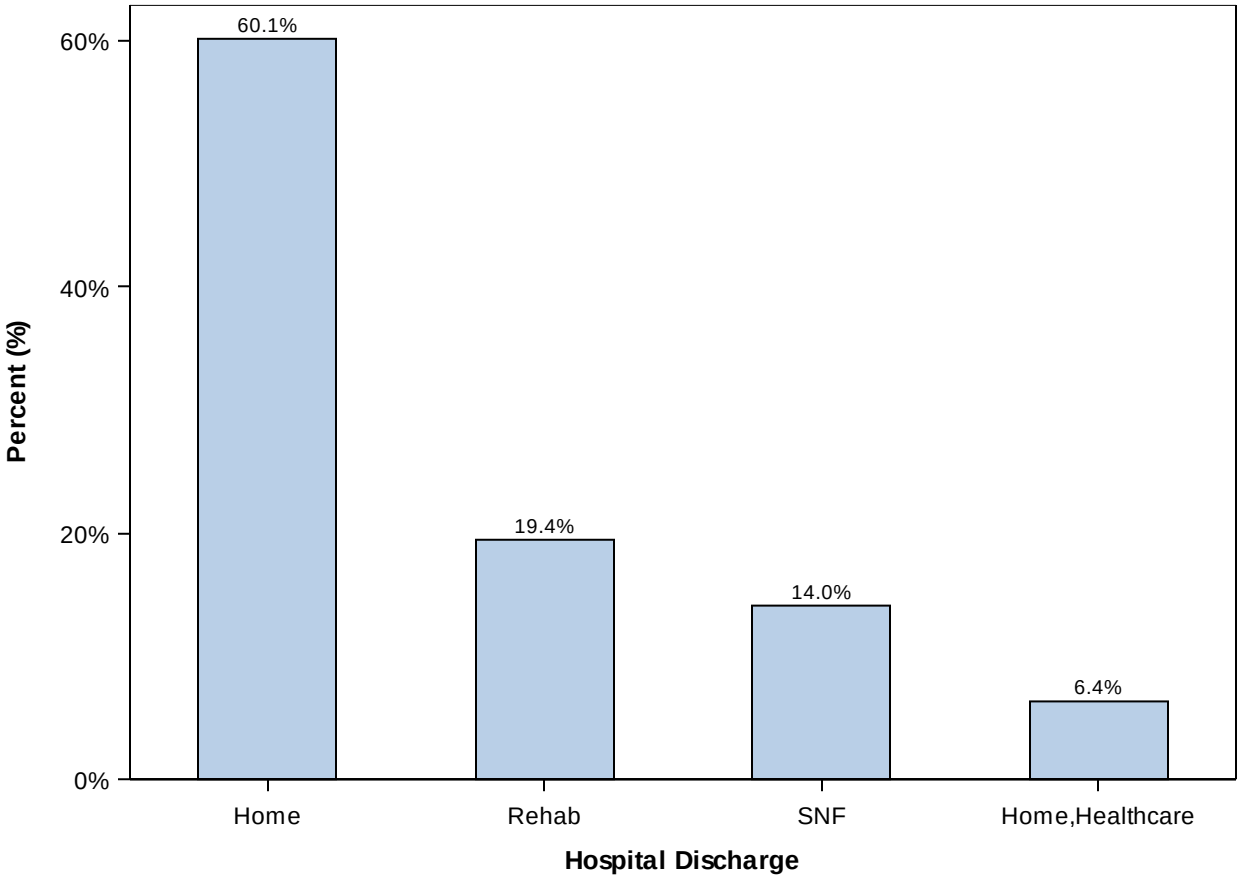
The proportional distribution of ED disposition locations are shown above. More than ninety percent of the patients were sent to floor, ICU, and OR. There were 3.1% of major trauma patients sent directly to morgue from ED.

Chart 30. Major Trauma Patients by ED Disposition and ISS Group: 2009–2015



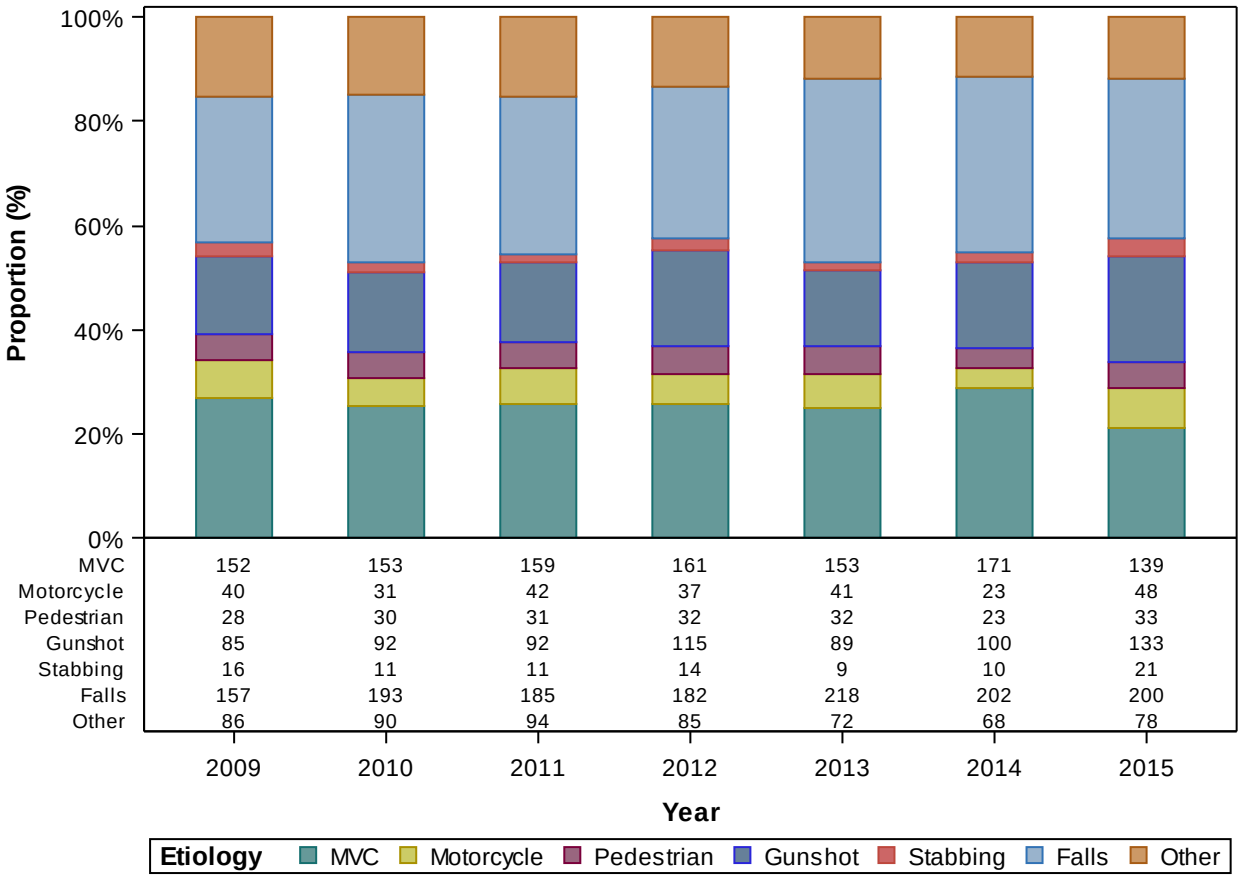
Each window shows ED disposition location according to the patient's ISS group. Patients within the ISS 1–8 group represent a very small group because they typically only meet Oklahoma's Major Trauma Criteria by either dying or because of very poor vital signs at system entry. Because of the aforementioned reasons among those in the ISS 1-8 group 48.7% were sent to ICU and 30.3% were sent directly to the morgue. Just 63.6% of trauma patients with an ISS of 9–14 were sent to floor, whereas more than 50.0% of trauma patients with an ISS of 16 or higher were disposed to the ICU. About 93.5% of patients with an ISS of 25+ were sent to either the ICU, OR, or Morgue.

Chart 31. Major Trauma Patients by Hospital Discharge: 2009–2015



Each column shows hospital discharge destination proportions for patients that survived to discharge. There were 60.1% of major trauma patients sent to home without mention of home healthcare. Slightly over 33% of the patients were discharged to a rehabilitation (Rehab) or skilled nursing facility (SNF).

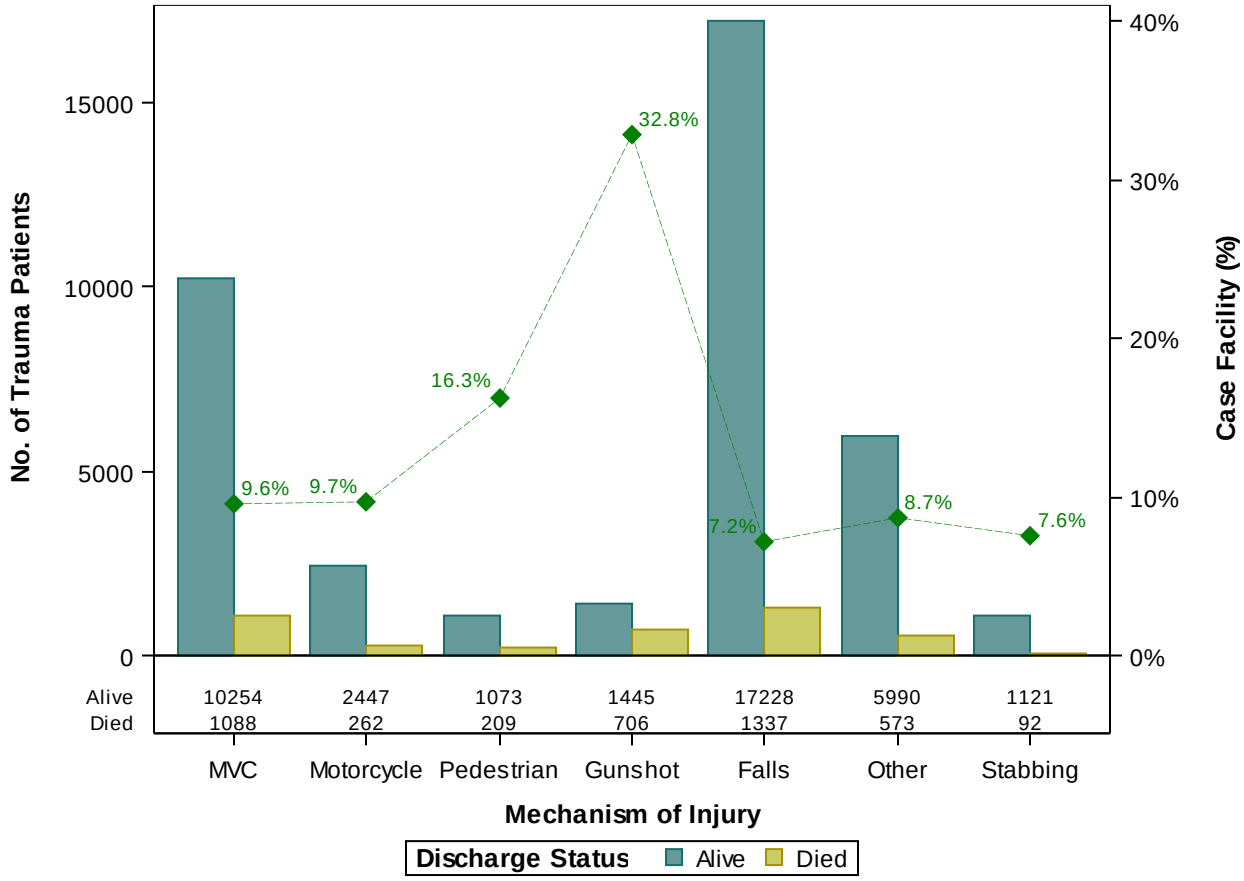
Chart 32. Proportional Distribution of Deaths by Mechanism of Injury: 2009–2015



	2009	2010	2011	2012	2013	2014	2015
MVC	152	153	159	161	153	171	139
Motorcycle	40	31	42	37	41	23	48
Pedestrian	28	30	31	32	32	23	33
Gunshot	85	92	92	115	89	100	133
Stabbing	16	11	11	14	9	10	21
Falls	157	193	185	182	218	202	200
Other	86	90	94	85	72	68	78

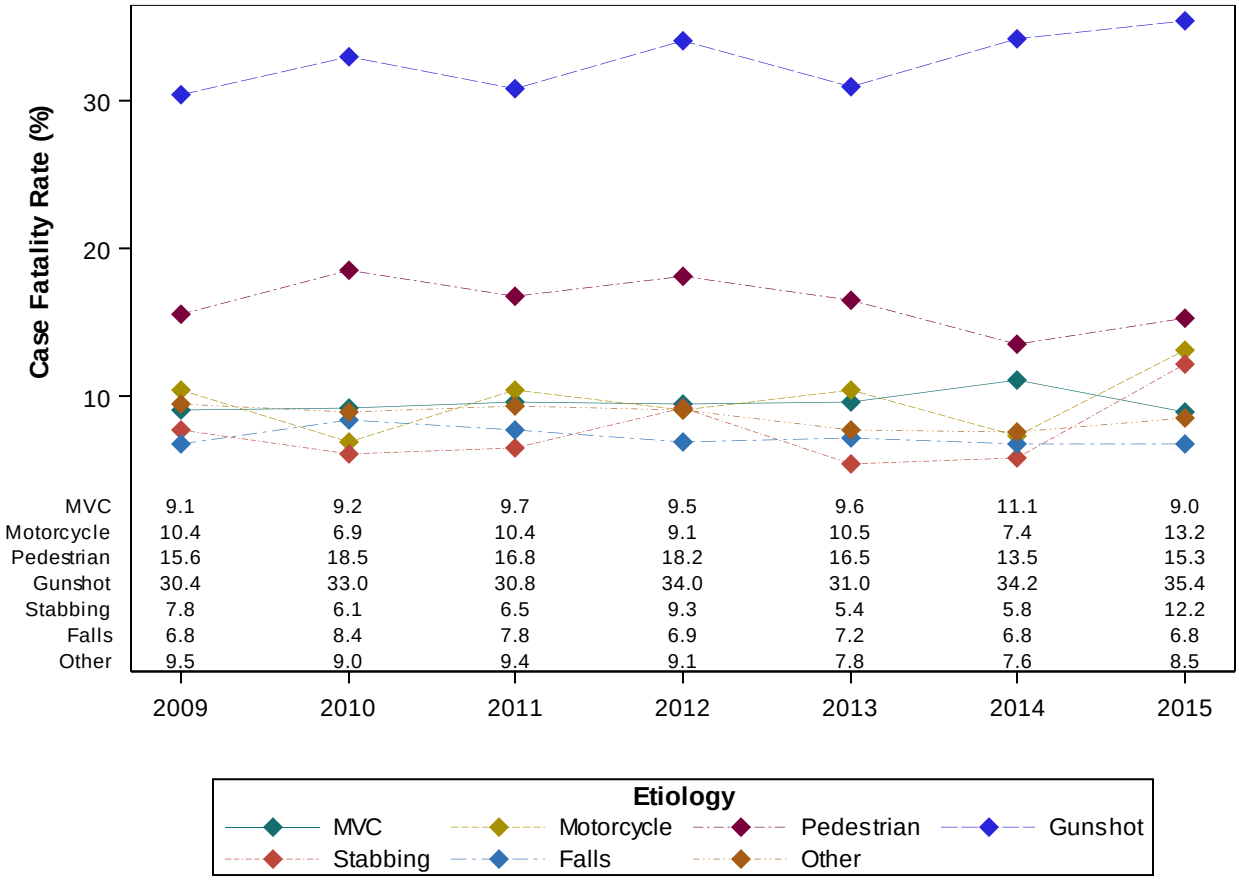
Falls consistently accounted for the greatest proportion of deaths, followed by MVC, gunshot, and 'Other' mechanism of injury.

Chart 33. Mechanism of Injury by Outcome: 2009–2015



The left side y-axis indicates the number of trauma cases, whereas the right y-axis indicates the case-fatality rate by mechanism of injury. The majority of trauma deaths were due to MVC and fall; however, gunshot injuries had the highest case-fatality rate of 32.8%. The high case-fatality rate for gunshot wounds is driven in part by firearm suicides, which carry a very high case-fatality rate. Pedestrian injuries had the next highest rate at 16.3% and falls had the lowest at 7.2%. MVC and motorcycle had very similar case-facility rates of 9.6% and 9.7%, respectively.

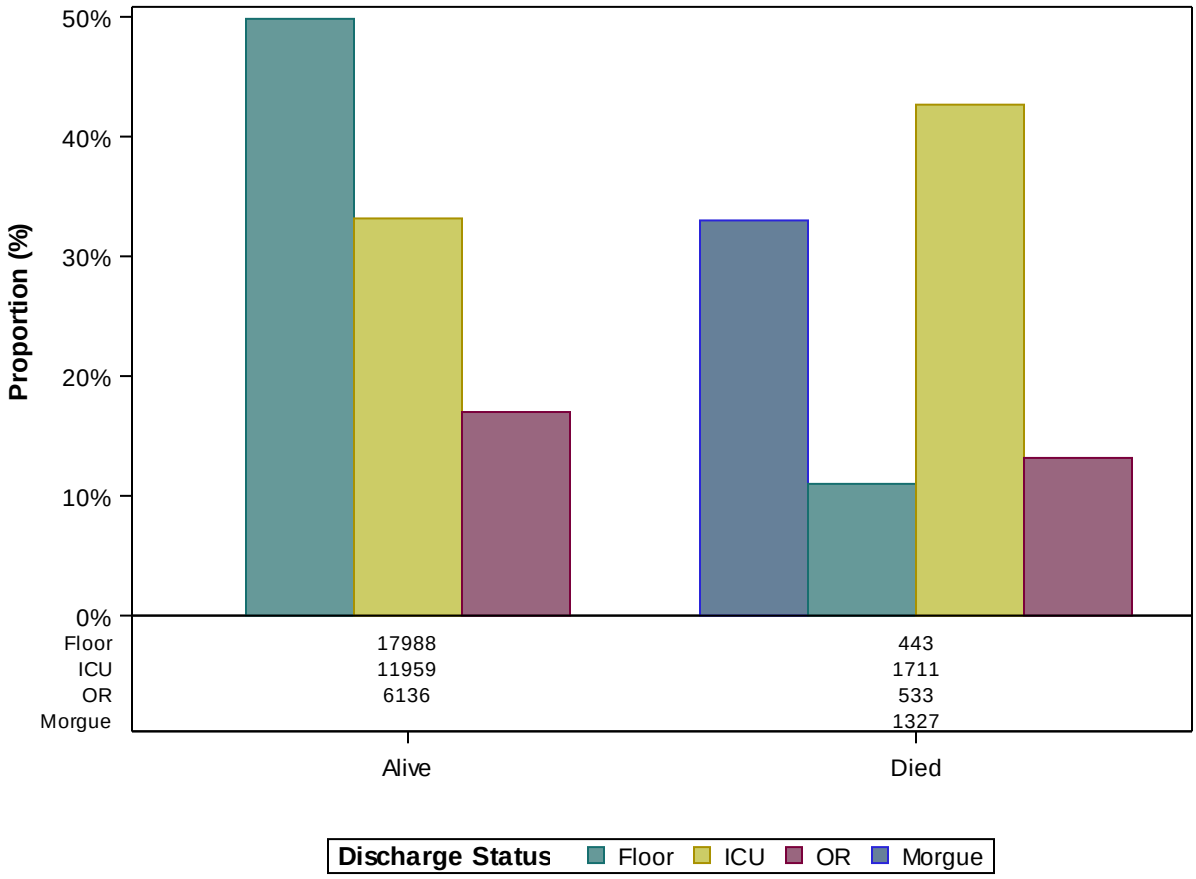
Chart 34. Case Fatality Rate by Mechanism of Injury: 2009–2015



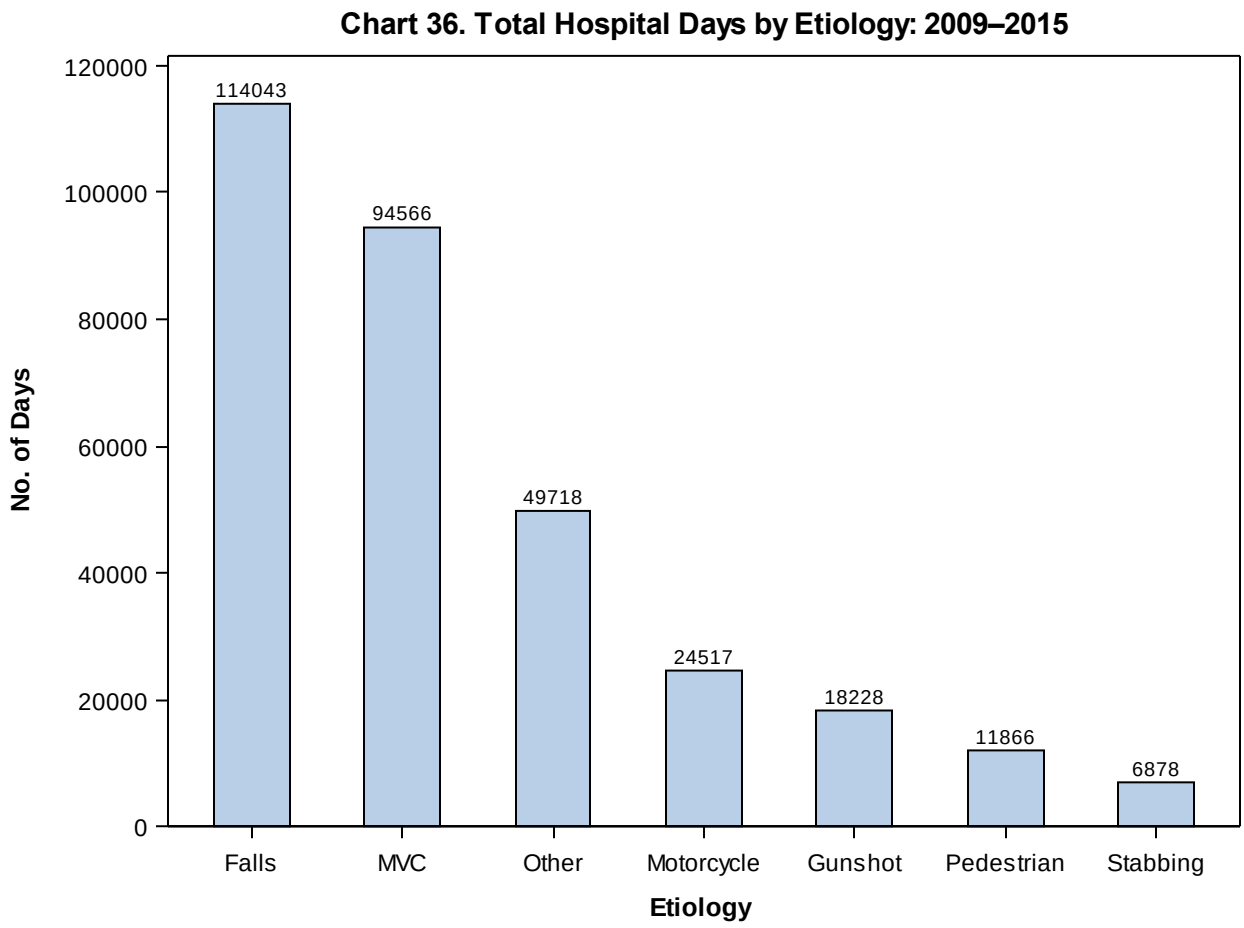
	2009	2010	2011	2012	2013	2014	2015
MVC	9.1	9.2	9.7	9.5	9.6	11.1	9.0
Motorcycle	10.4	6.9	10.4	9.1	10.5	7.4	13.2
Pedestrian	15.6	18.5	16.8	18.2	16.5	13.5	15.3
Gunshot	30.4	33.0	30.8	34.0	31.0	34.2	35.4
Stabbing	7.8	6.1	6.5	9.3	5.4	5.8	12.2
Falls	6.8	8.4	7.8	6.9	7.2	6.8	6.8
Other	9.5	9.0	9.4	9.1	7.8	7.6	8.5

This chart further examines specific case-fatality rates by mechanism of injury and year. The greatest variation was seen for the four least frequently reported etiologies: gunshot, motorcycle, stabbing, and pedestrian injuries. The case-fatality rates for the other etiologies were fairly stable over 2009–2015.

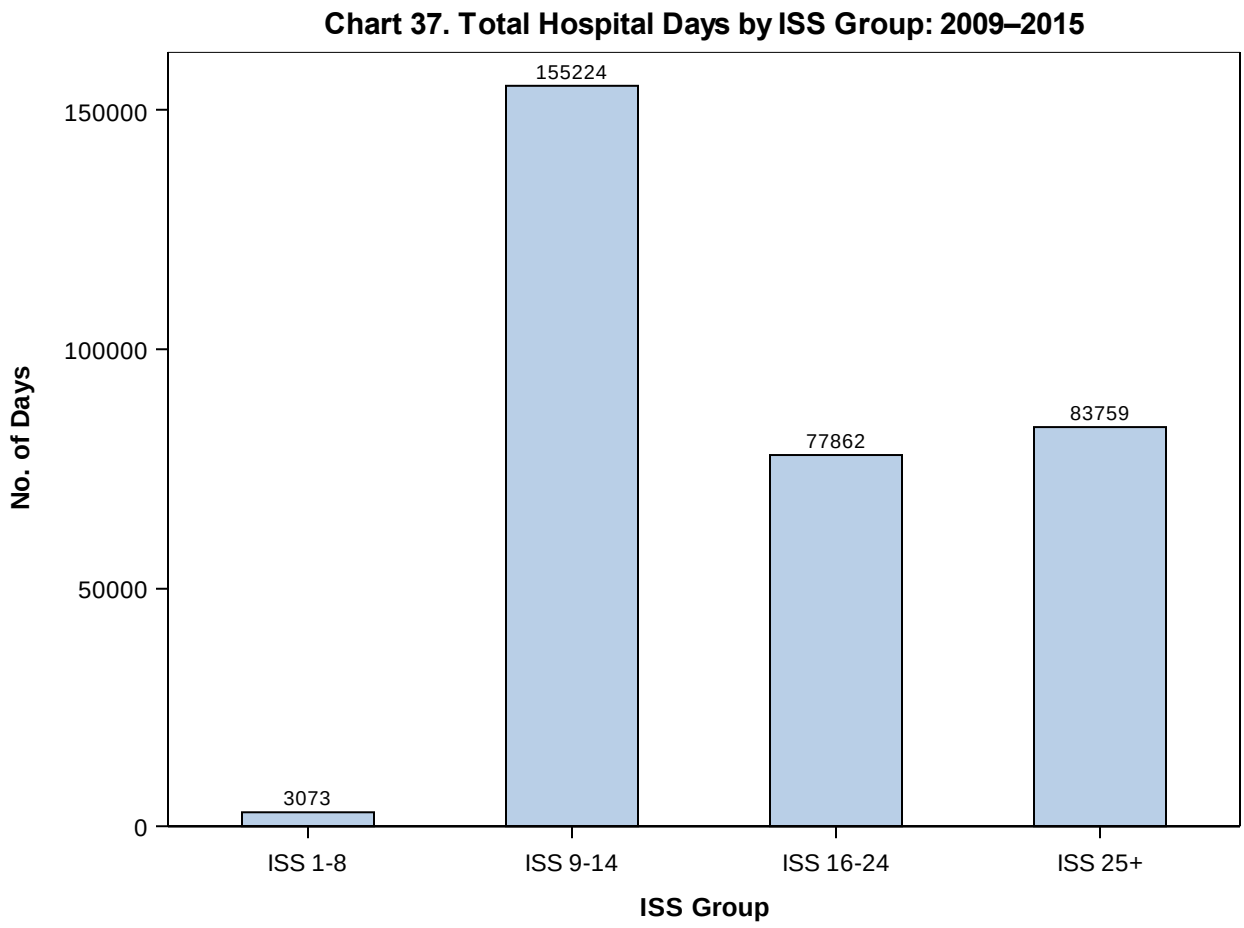
Chart 35. ED Disposition by Discharge Status: 2009–2015



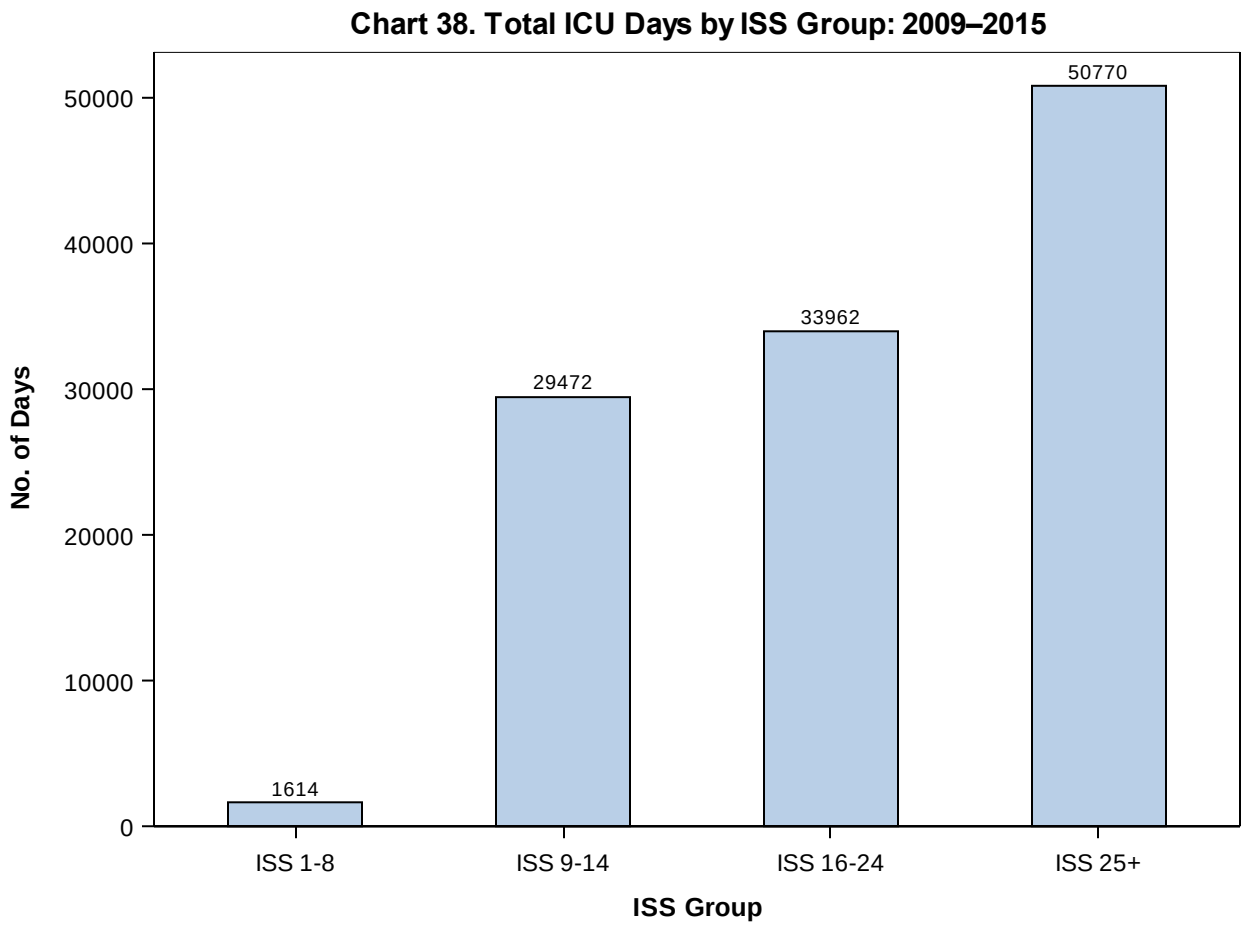
Among survivors, almost half of the patients were sent to the floor from the ED. The ICU was next most frequent discharge location for survivors. Among those that died, 42.6% of the patients were sent to ICU and 33.1% of the patients were discharged directly to the morgue from the ED indicating the death occurred very soon after arrival.



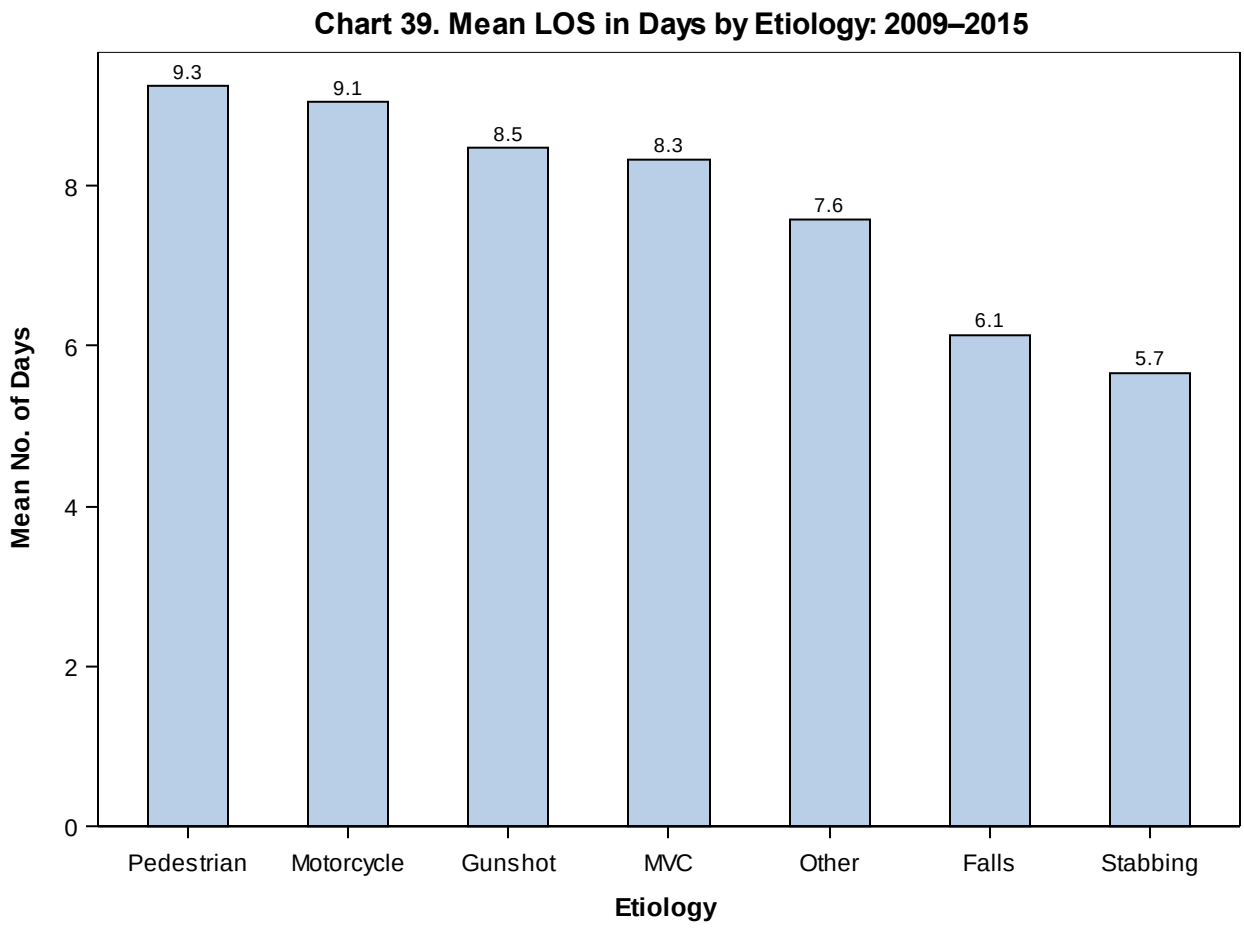
Total hospital days by etiology followed the frequency of reported trauma patients for each injury etiology. Falls and MVC were the most frequently reported etiology, and therefore constituted the largest total number of hospital days.



Patients in the ISS 9–14 group accounted for the largest number of total hospital days (48.5%). The patients in the ISS 25+ group had the second largest number of total hospital days (26.2%) even though the number of patients in this group was less than that of ISS 16–24 group (24.3%).

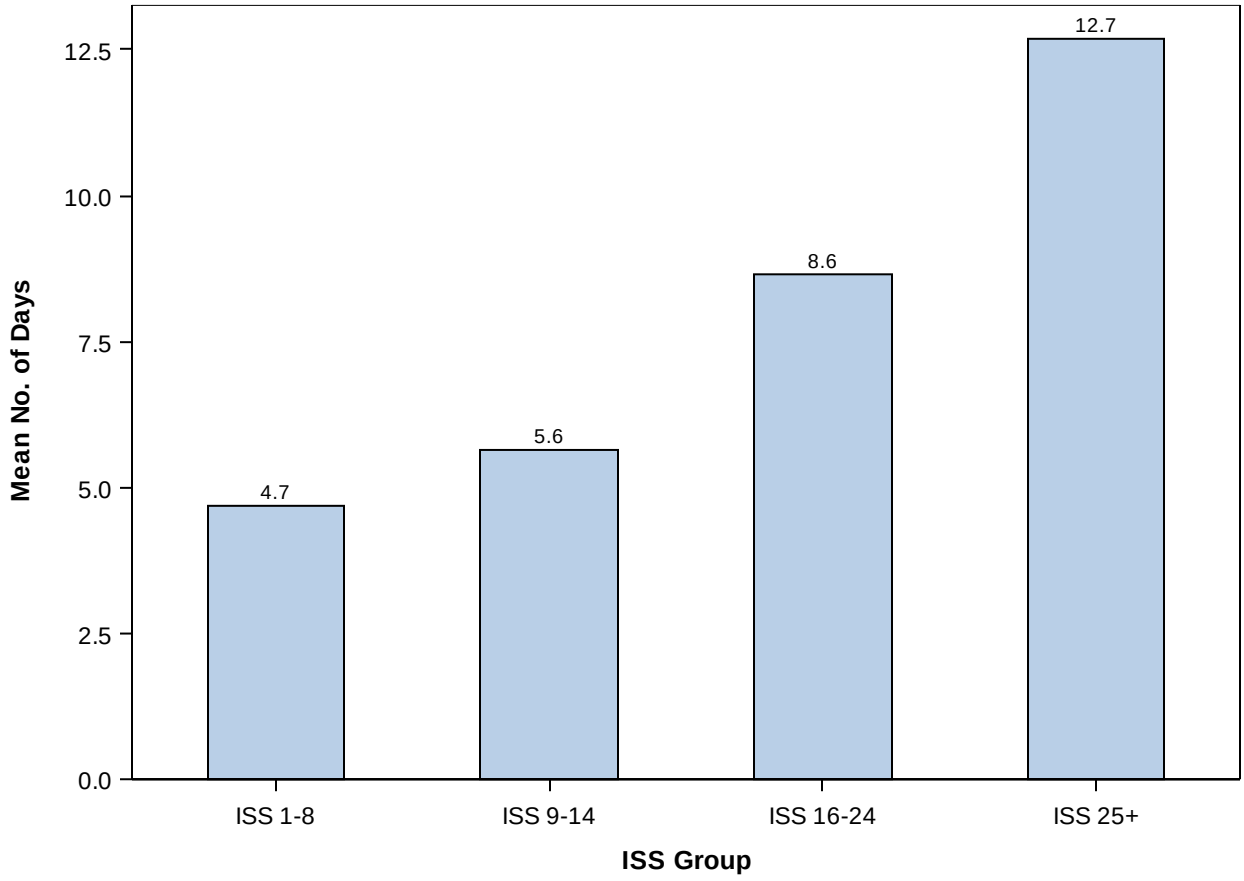


The greatest number of the total ICU days was accounted for by patients in the ISS 25+ group (43.8%), followed by the ISS 16–24 group (29.3%).

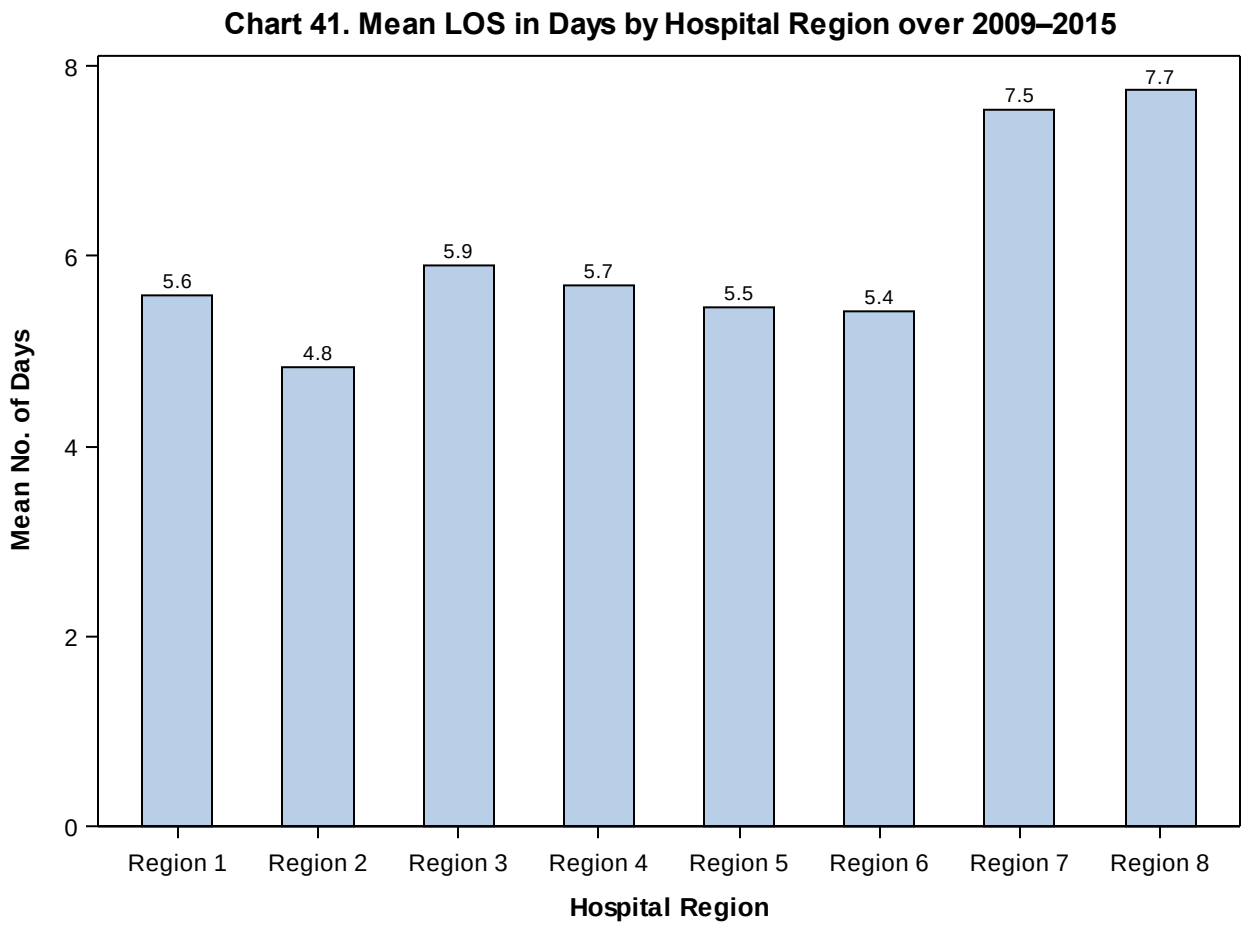


Pedestrian and motorcycle related trauma had the longest average stay with an average of 9.2 days in hospital. The shortest average stay was 5.7 days among stabbing-related patients.

Chart 40. Mean LOS in Days by ISS Group: 2009–2015

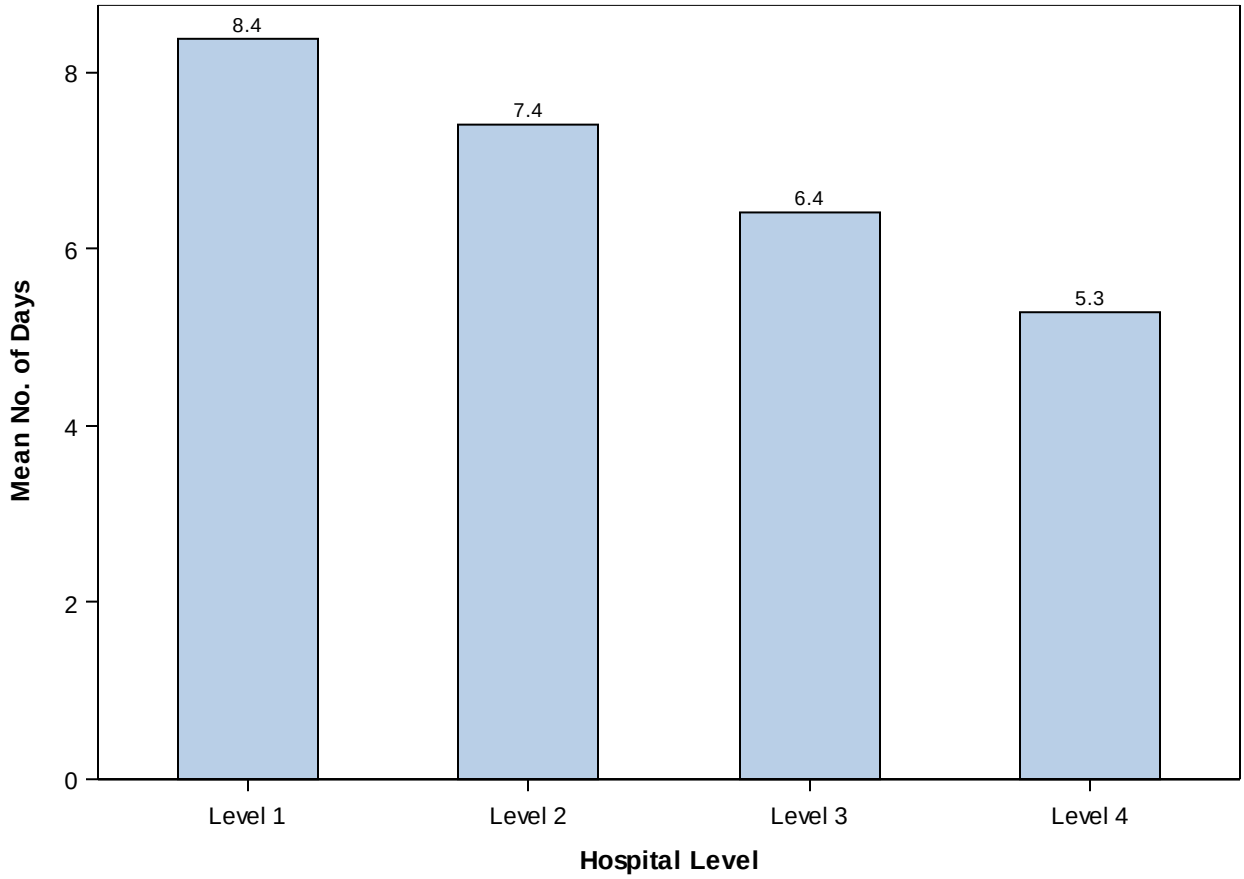


Patients in with an ISS 1-8 had an average length of stay of 4.7 days while patients in the ISS 25+ group had an average length of stay of nearly 2 weeks.

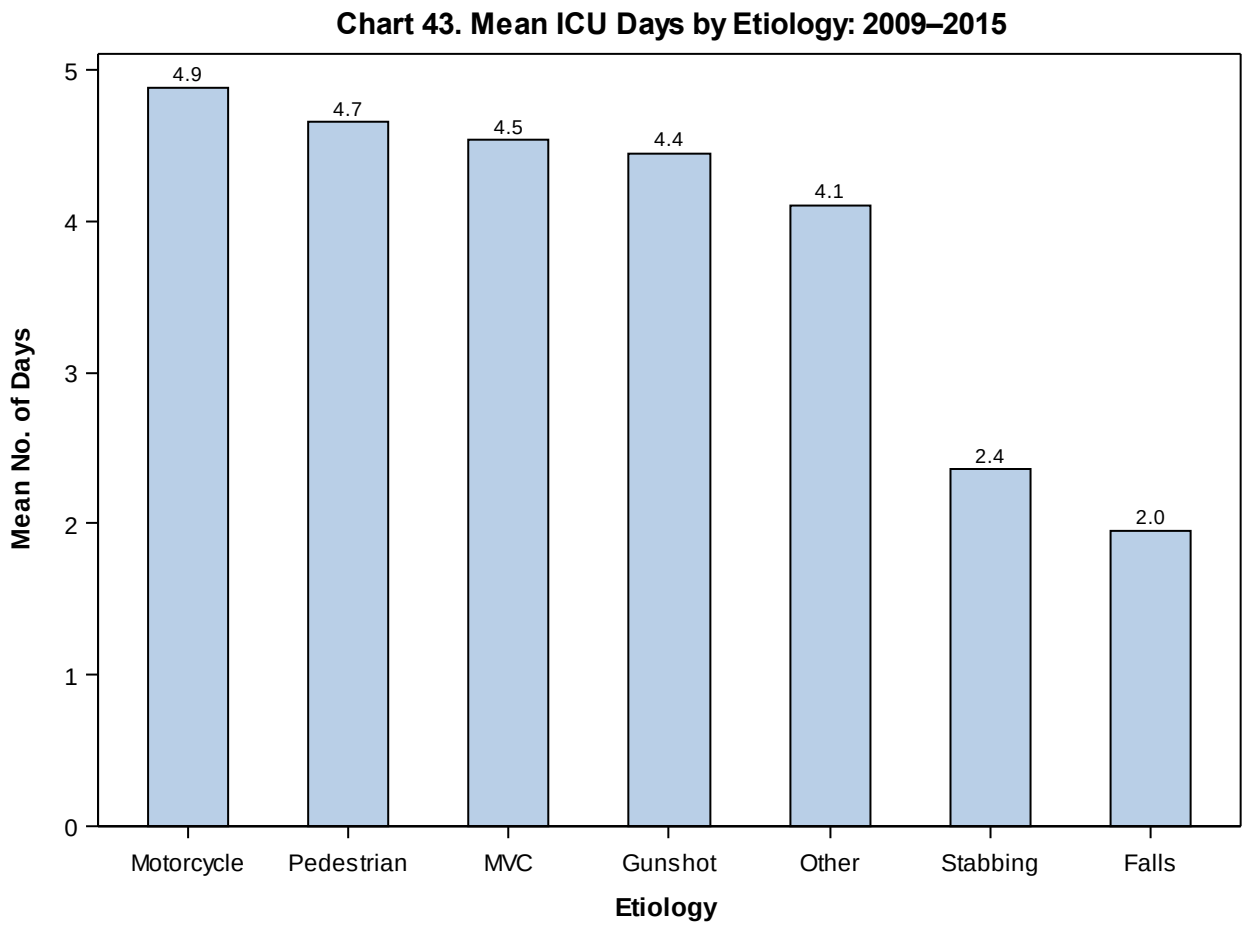


Trauma patients in Region 7 and 8 had almost the same average LOS at nearly 8 days. Mean LOS for patients cared for in other regions ranged from 5 to 6 days.

Chart 42. Mean LOS in Days by Hospital Level: 2009–2015

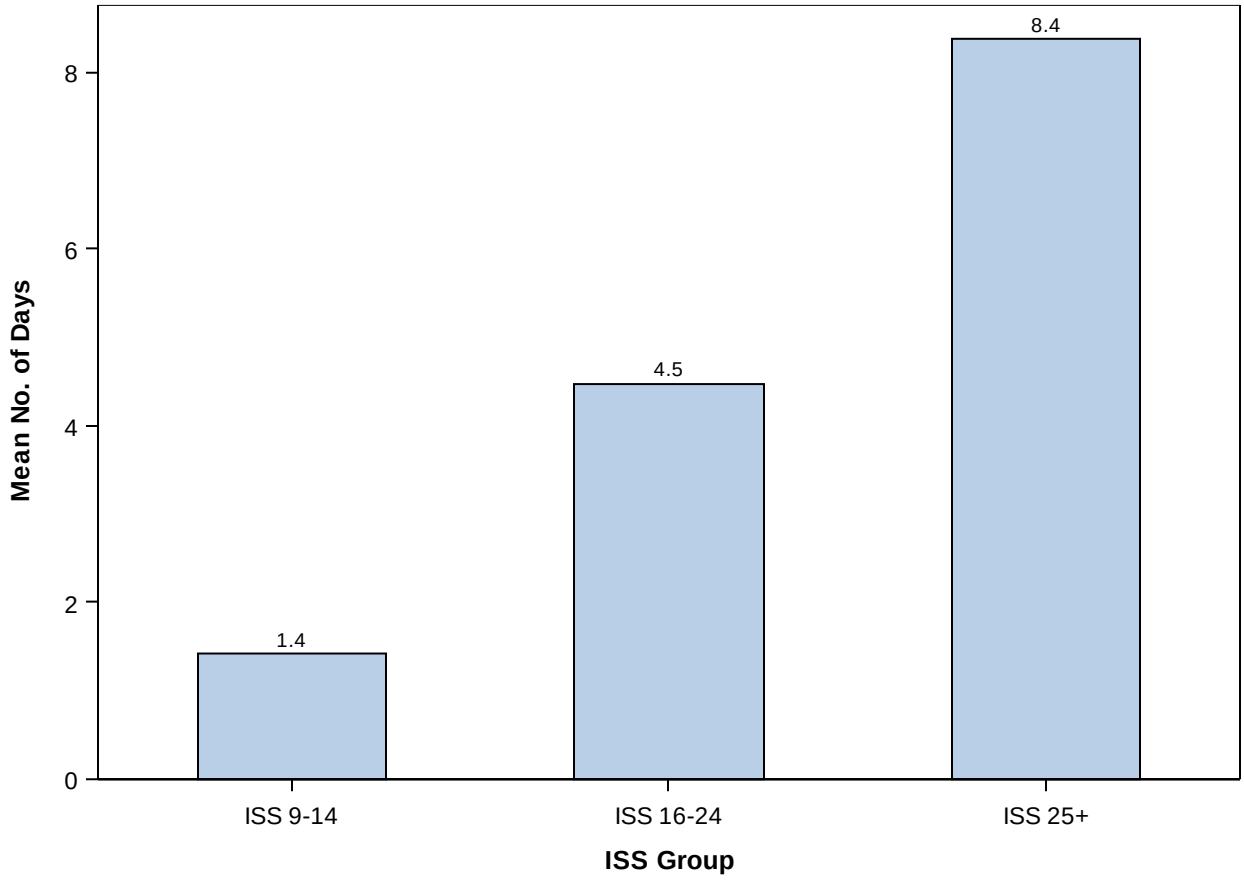


The patients treated in a Level I hospital stayed 8.4 days on average, followed by patients treated in a Level II for 7.4 days. The patients in Level III and IV stayed averaged 6.4 days and 5.3 days respectively over the 7-year period.



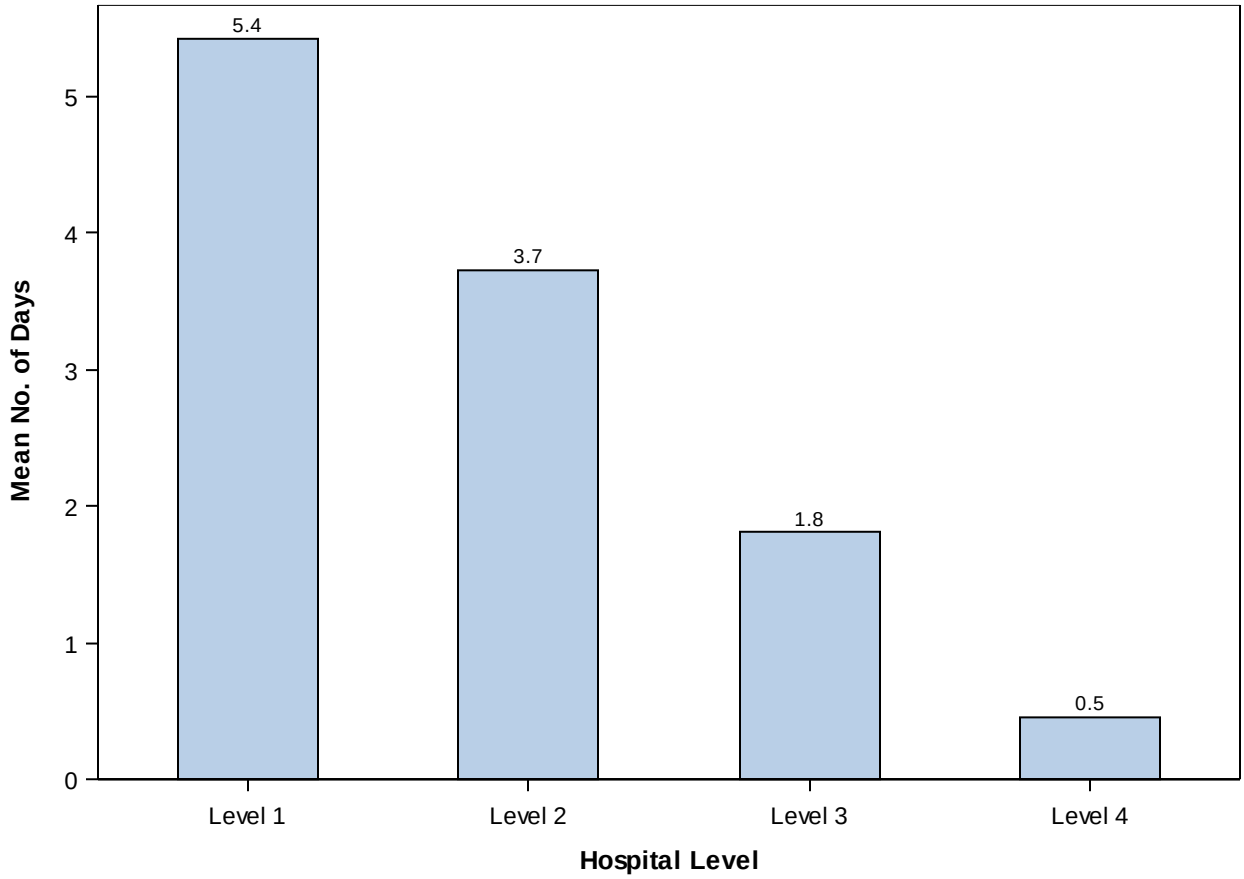
Trauma patients injured in motorcycle crashes had an average ICU stay of nearly five days. The patients injured due to pedestrian, MVC, and gunshot had average ICU stays of more than four days. The patients injured due to falls averaged only two days in ICU, the shortest among these etiologies.

Chart 44. Mean ICU Days by ISS Group: 2009–2015



Mean ICU days by ISS group are shown above. The ISS 1–8 group was excluded due to the large variability created by few patients. Patients with an ISS of 25+ stayed the longest in ICU due to their severe injuries. In contrast, the patients in ISS 9–14 group averaged just 1.4 days in ICU.

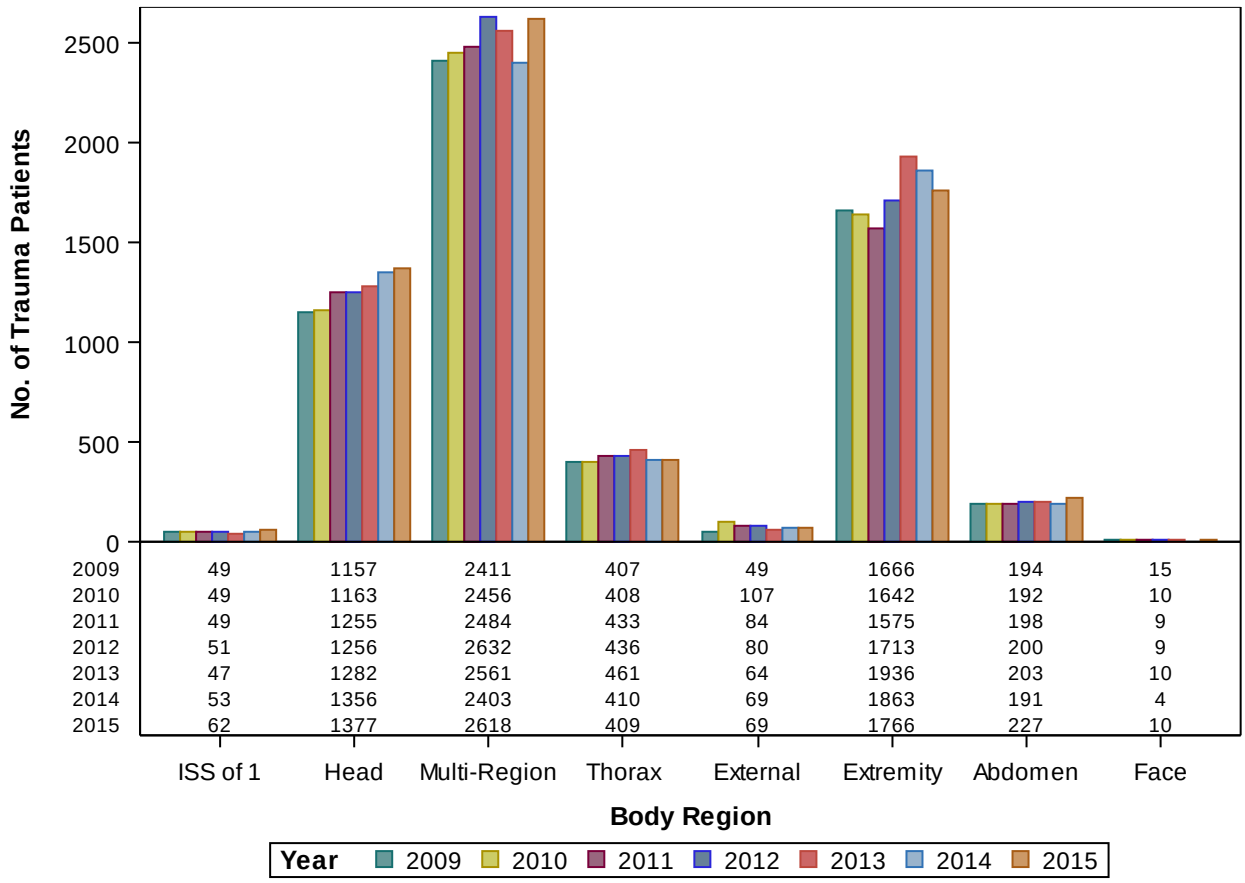
Chart 45. Mean ICU Days by Hospital Level: 2009–2015



The patients treated in a Level I hospital had the longest average ICU stay at 5.4 days , followed by patients treated in a Level II at 3.7 days. In contrast, ICU stays were much less common for patients treated in Level III and IV facilities overall and the stays were much shorter, averaging just 1.8 days and 0.5 days respectively.

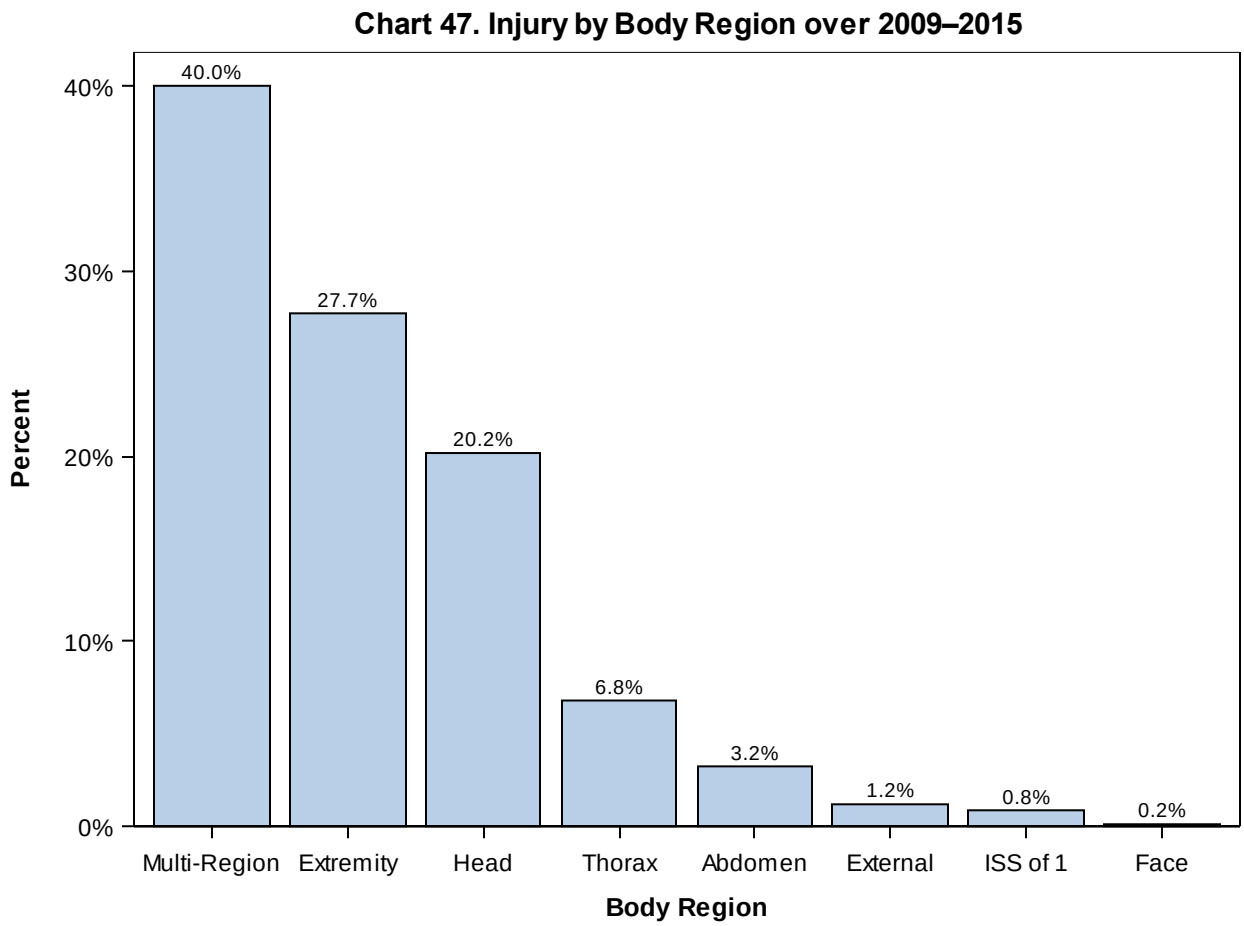
* Many level IV facilities do not have an ICU.

Chart 46. Injury by Body Region: 2009–2015



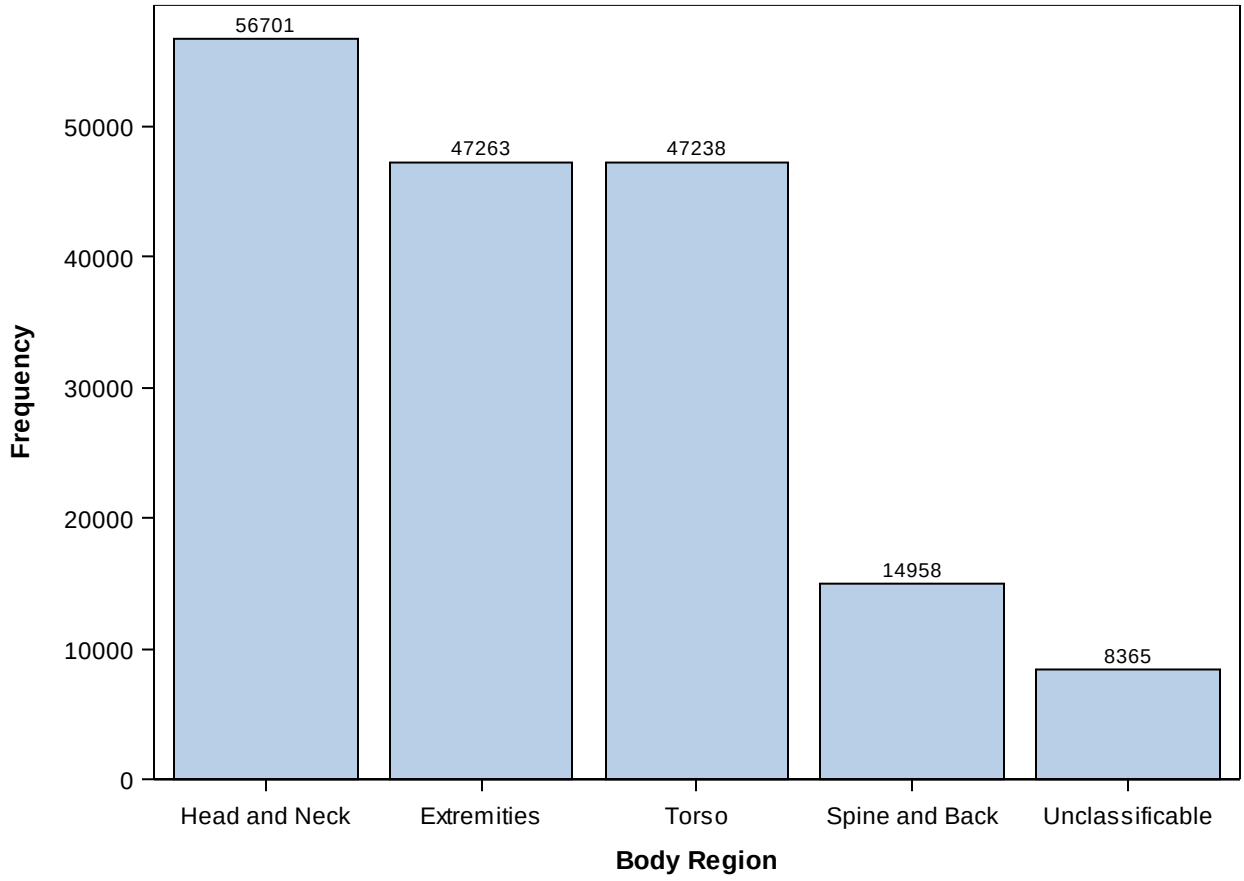
	ISS of 1	Head	Multi-Region	Thorax	External	Extremity	Abdomen	Face
2009	49	1157	2411	407	49	1666	194	15
2010	49	1163	2456	408	107	1642	192	10
2011	49	1255	2484	433	84	1575	198	9
2012	51	1256	2632	436	80	1713	200	9
2013	47	1282	2561	461	64	1936	203	10
2014	53	1356	2403	410	69	1863	191	4
2015	62	1377	2618	409	69	1766	227	10

This chart illustrates the frequency of injury by body region by year. It was common for a major trauma patient to have significant injuries (AIS 2+) to multiple body regions. The most frequently injured single body region was Extremity, followed by Head, Thorax, and Abdomen.



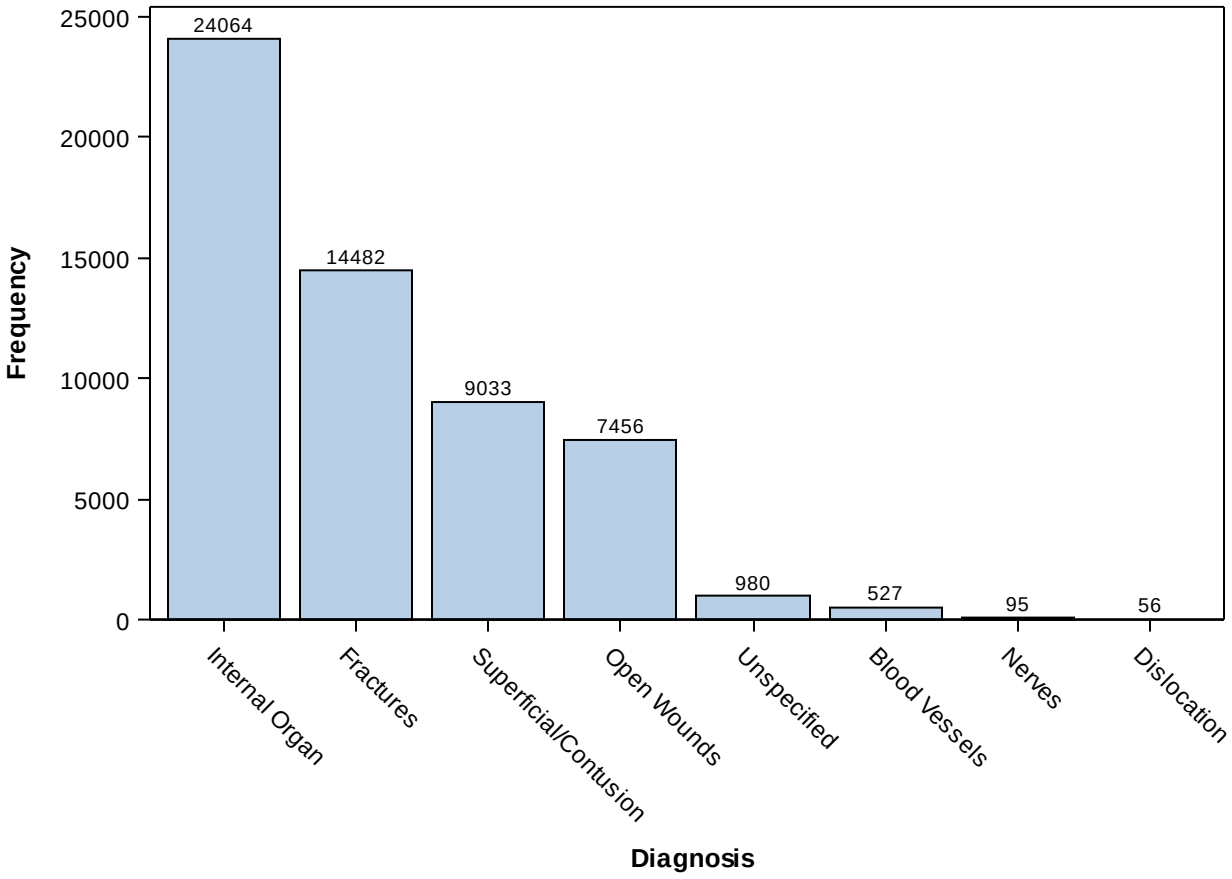
The proportional distribution of injury by body region is shown above. About 40.0% of major trauma patients had multiple body regions injured. Extremity, Head, and Thorax were the top three single body regions injured, together accounting for 54.7% of the patients.

Chart 48. Injury Distribution of Major Trauma Patients: 2009–2015



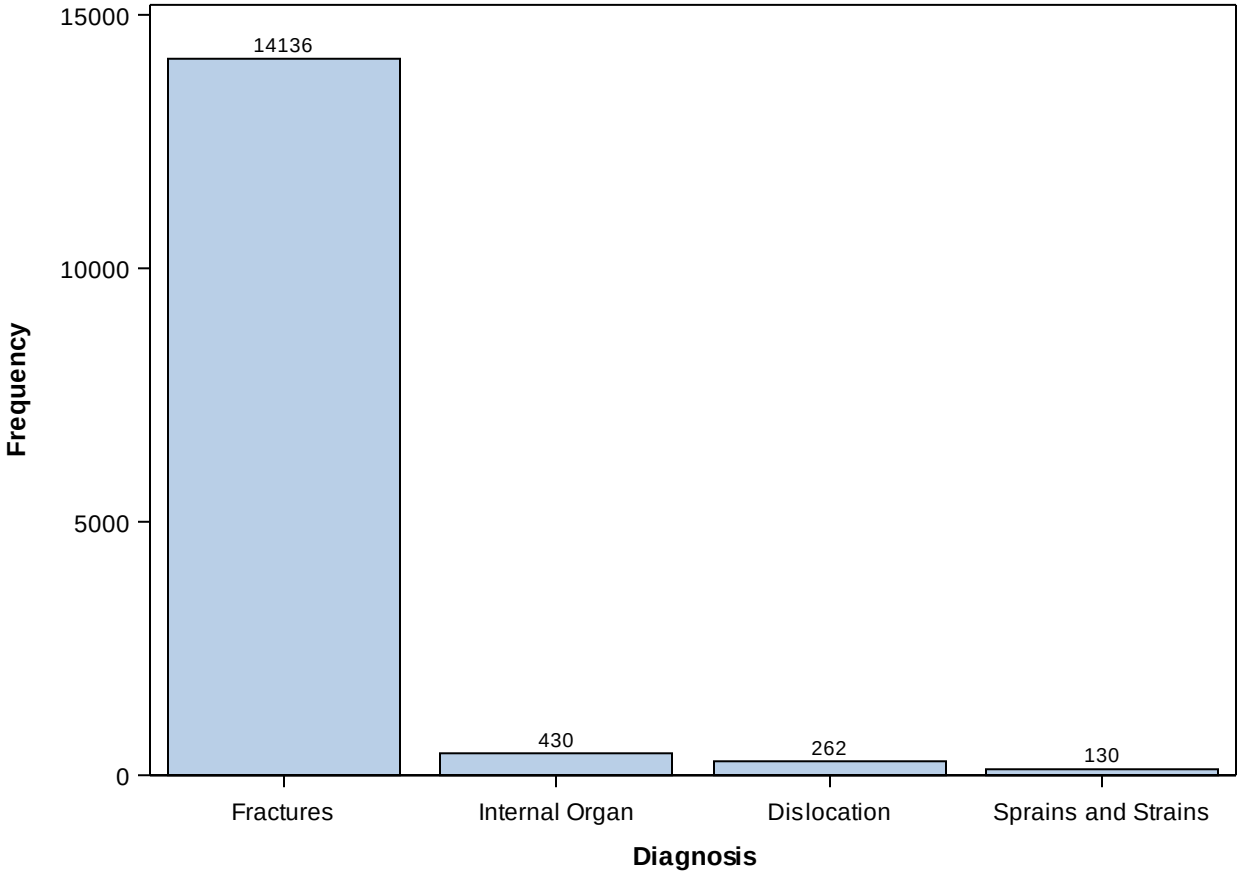
The Barrell Injury Diagnosis Matrix based on ICD-9 codes was used to classify body region and type of injury in the following charts. The chart above displays the injury distribution of major trauma patients over 2009–2015. Head and Neck was the most frequently injured body region, followed by the Extremities and Torso. The Barrell matrix utilizes individual diagnoses so patients may be counted more than once in charts based on this method of injury summary.

Chart 49. Type of Injury by Head and Neck of Major Trauma Patients: 2009–2015



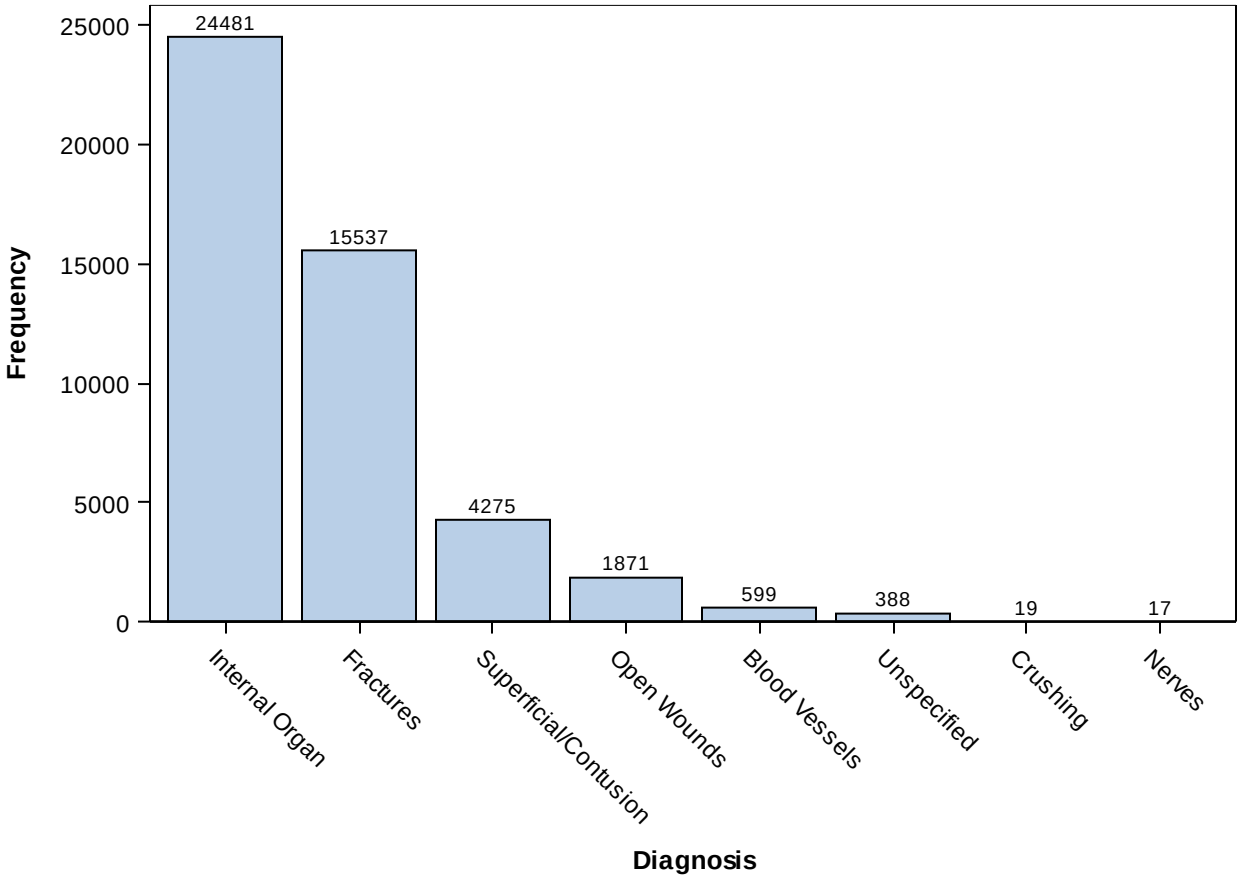
Internal organ injury was most common and accounted for 42.3% of injuries in the Head and Neck area. Fractures were next most common type of injury.

Chart 50. Type of Injury by Spine and Back of Major Trauma Patients: 2009–2015



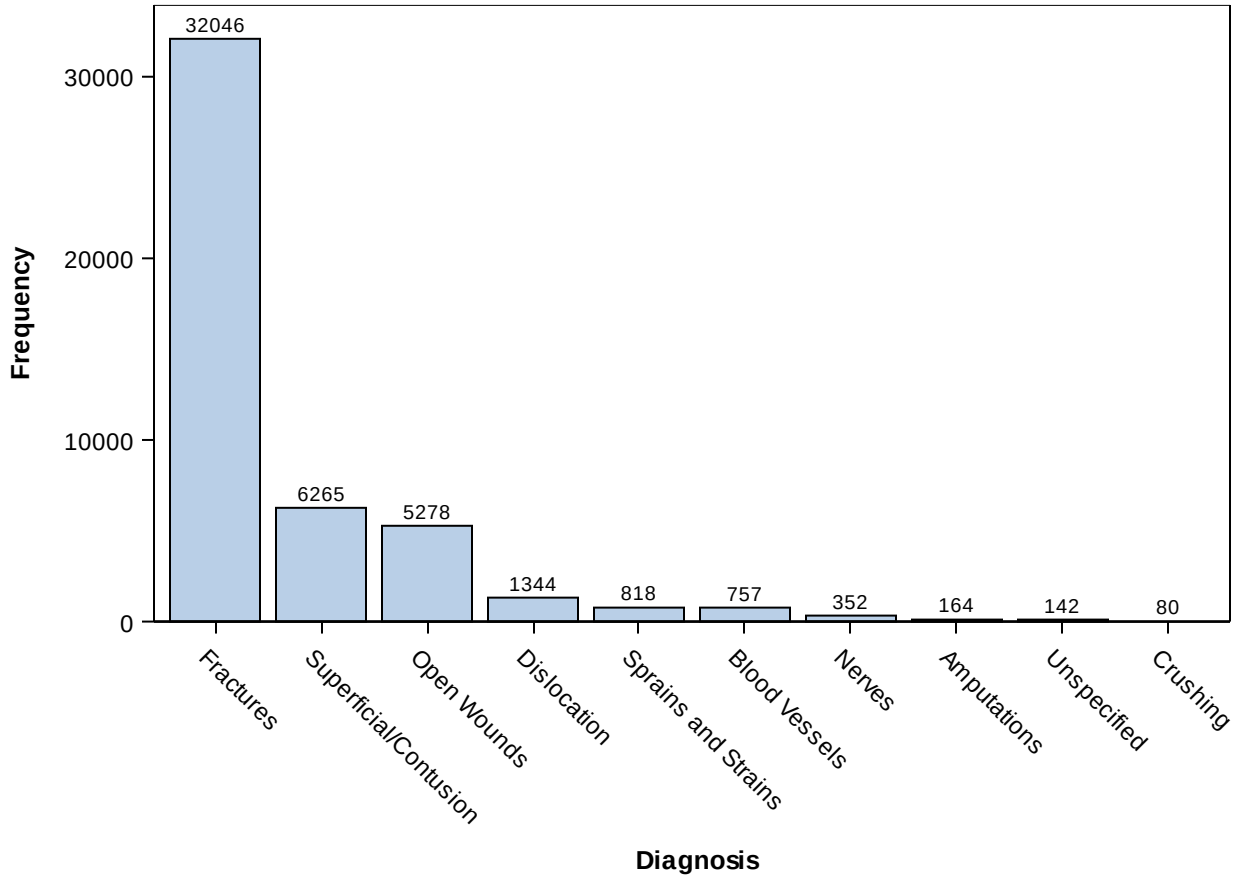
Fractures were by far the most common type of injury in the Spine and Back region accounting for 94.5% of the diagnoses.

Chart 51. Type of Injury by Torso of Major Trauma Patients: 2009–2015



The top three common injury types—internal organ, fracture, and superficial/contusion—accounted for 93.9% of total injuries by Torso.

Chart 52. Type of Injury by Extremities of Major Trauma Patients: 2009–2015



Fracture was the most common injury type to the extremities, accounting for 67.8%. Superficial/contusion injury and open wounds were the next most frequent injury types accounting for 13.3% and 11.2% respectively.