

# Trauma in Washington State

A chart report of the first 15 years, 1995-2009

2011

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**Feb 2011**



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## Purpose

This report is a collection of descriptive information for the first 15 years of the trauma system (1995-2009). It provides the trauma services community and the public at large with information regarding the status of Washington's Trauma System.<sup>1</sup> It gives a statewide overview of patient demographics, injury characteristics, pre-hospital and hospital care, and outcomes. Records included in this report meet the statewide trauma registry inclusion criteria (see Appendix I) and represent more than 220,000 patient encounters.

## What is new?

This report largely follows the outline of the 2006 report, titled *Trauma in Washington State: A chart report of the first 10 years, 1995-2004*.

In addition to some new charts here and there to cover emerging issues, it also includes Appendix II with regional comparisons for most subjects discussed in the main body of the report. Many of these regional charts show the percentages in the figure and display the number of total cases during 2007-2009 in the table immediately below the chart.

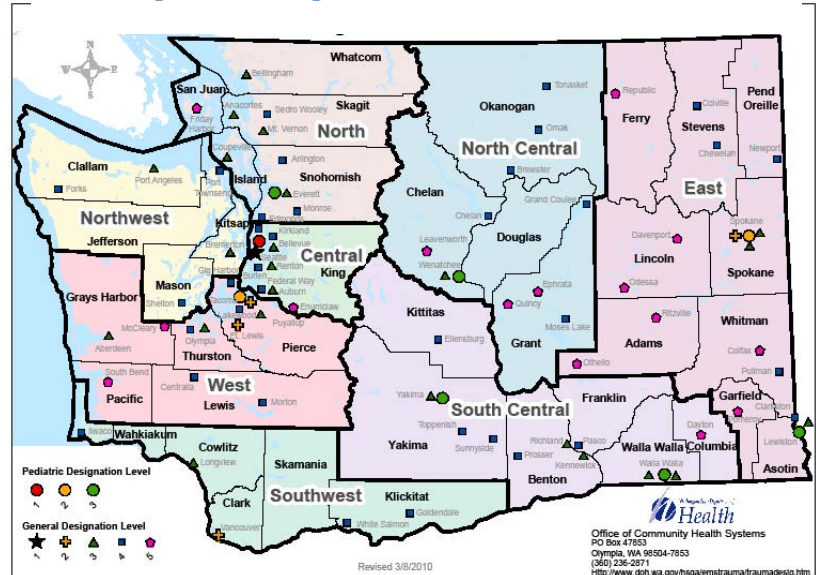
The charts are also directly reachable following a hyperlink above each statewide chart from the main report. Having statewide and regional information side-by-side will enrich the information provided and help with regional and statewide quality improvement activities. This report features hyperlinks to increase targeted information access. Table of contents and table of figures incorporate hyperlinks to specific sections and figures.

## Why is trauma care important?

Trauma is a disease of epidemic proportions. Each year, over 140,000 Americans die from this killer. It has been aptly called the last major plague of the young as trauma kills more Americans between the ages of one and thirty-four than all other diseases combined. Trauma is, however, more than a plague of the young: Trauma is the leading cause of death for all people under age forty-four, and the leading cause of disability for all people under age sixty-five. It has also become a significant cause of death and disability among the elderly due to rising numbers of senior falls.

Thirty to forty percent of all trauma deaths occur within hours of the injury, usually from shock and/or internal bleeding. Many of these deaths are preventable with an effective, organized trauma

Figure 1: Washington State Trauma Services (3/8/2010)



<sup>1</sup> See Figure 1 for the locations of Washington's trauma services.

system. Moreover, all trauma deaths, and particularly those, which occur within minutes of injury and for which there are no effective medical treatments, are potentially avoidable through appropriate injury prevention actions.

Washington's trauma care system aims to assure that the required resources are available and the necessary infrastructure is in place to deliver the "right" patient to the "right" facility in the "right" amount of time. This system is built upon broad consensus and cooperation among divergent groups and around complex logistical, political, financial, legal and medical issues. Washington's system is comprehensive and includes a strong injury prevention component as well as the designation of rehabilitation services for post-acute trauma care.

Washington's trauma system is currently operational. Community-based prevention projects have been implemented statewide, trauma care facilities have been designated, the statewide trauma registry is in place, and regional quality assurance/improvement committees are meeting to address trauma quality issues at a local level.

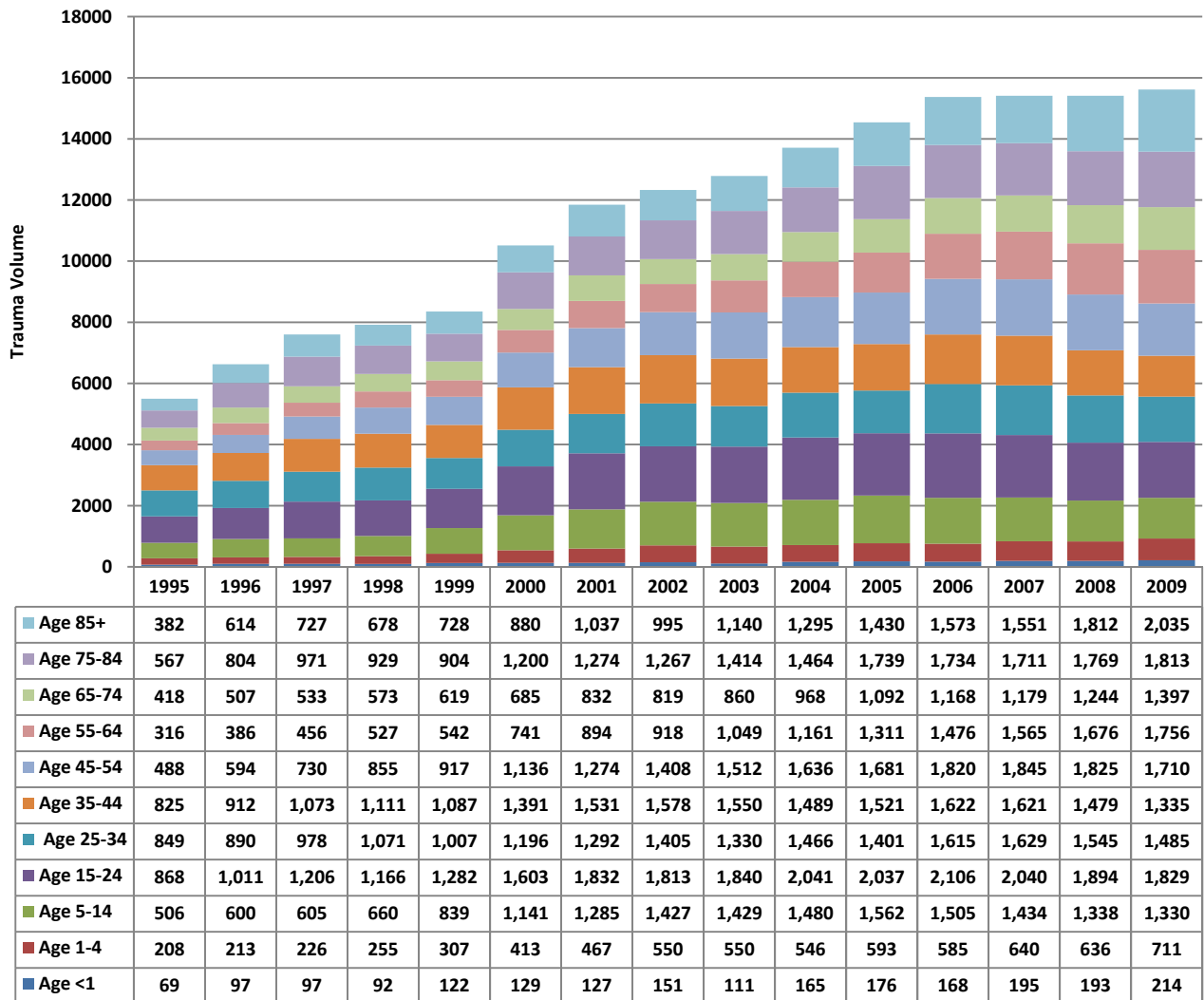
## Patient characteristics

### Age:

Trauma affects people of all ages and is the leading cause of death among persons aged 1-44 years according to [Centers for Disease Control and Prevention](#). It is also among the top ten for all age groups. Over the last 15 years, Washington's trauma volume saw a three-fold increase while the geriatric (age 55+) volume quadrupled.

**Figure 2: Trauma Volume by Age and Year**

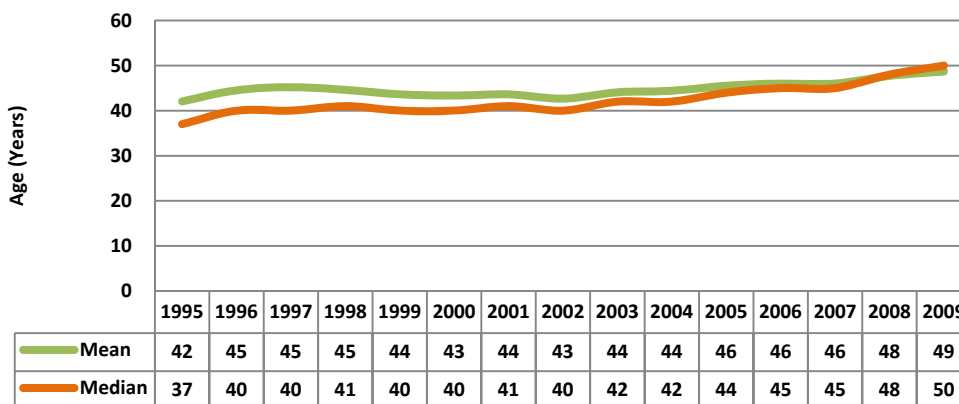
[For regional comparisons, see Appendix II Figure 2b](#)



The median age of trauma patients in Washington has increased from 36 years in 1995 to 50 years in 2009. The mean (average) age has also increased during this time. Consistent with an aging Washington population, the trauma registry data highlight a trend towards more trauma occurrences in older adults. In part, this trend reflects more elderly fall patients meeting the criteria for entry into the trauma registry. While hospitals are not required to submit data for patients with isolated hip fractures, many elderly falls result in additional injuries. Traumatic brain injury (TBI) is also a major cause of trauma incidence among the elderly.

**Figure 3: Mean and Median Age of Trauma by Year**

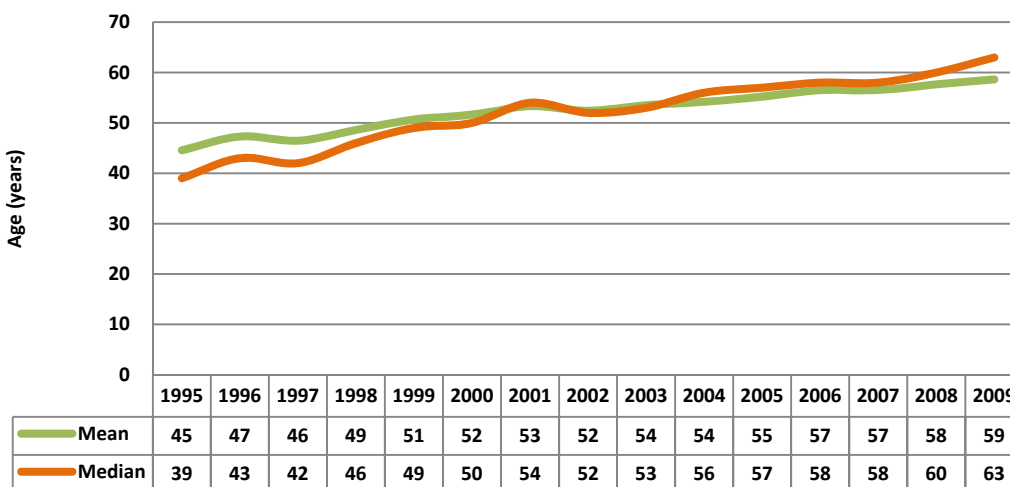
[For regional comparisons, see Appendix II Figure 3b](#)



The median age of trauma patients who died rose from about 36 to 63 between 1995 and 2009. This increasing trend in age at death reflects an aging population, with more trauma deaths occurring among the very old, primarily due to falls. Age is an independent predictor of mortality in trauma patients, due in part to the presence of co-morbidities (e.g., diabetes, heart disease) that are more common in older patients. Older patients on blood thinners are at especially high risk of dying from TBI.

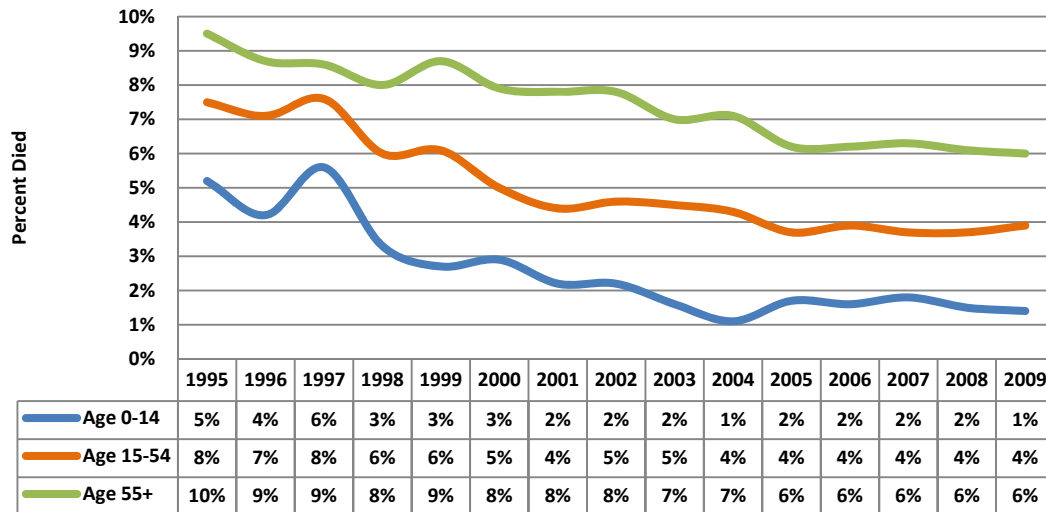
**Figure 4: Mean and Median Age of Trauma Deaths**

[For regional comparisons, see Appendix II Figure 4b](#)



The risk of trauma deaths increases by age. The older the patient is, the more likely the outcome is death. Even though death rates of trauma declined during 1995-2009 for all age groups, the rates of geriatric patients (age 55+) remained consistently high.

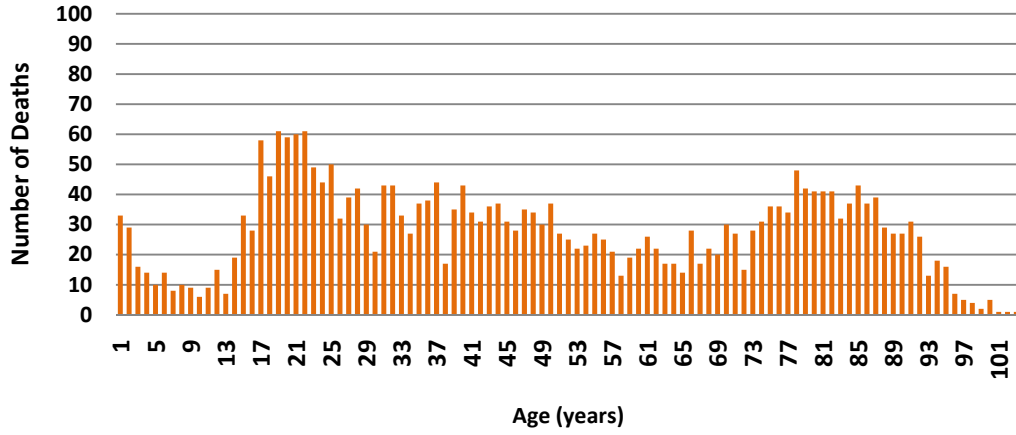
**Figure 5: Trauma Mortality by Age and Year**



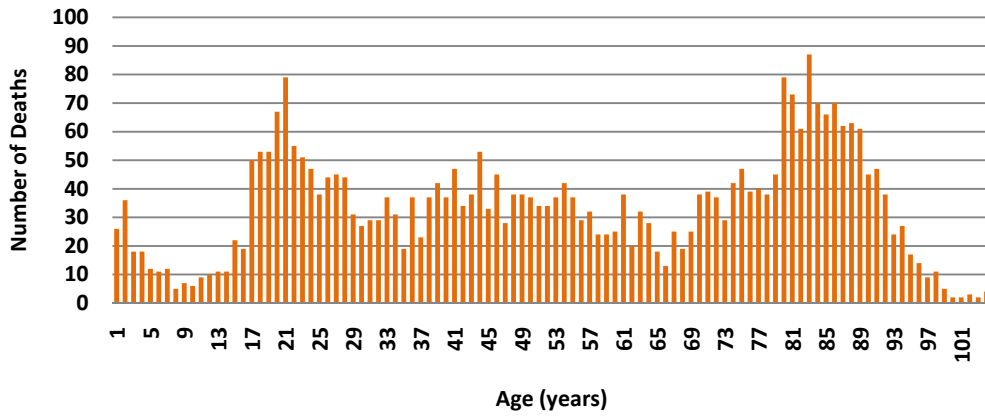
The pattern of trauma deaths is also predictable, with first peak among infants. Deaths decline until the early teen years, then climb steadily through age 18 years. Overall, a great number of deaths occur in teenagers and young adults between the ages of 15 and 24. After this age, deaths remain relatively steady until age 40 when a decline begins. By age 70, deaths begin to increase due primarily to fall mechanisms. For trauma patients age 70 or older, more than 75% of trauma deaths are attributable to falls.

Over the last fifteen years, the concentration of deaths by age groups changed. Figure 6 below illustrates that during 1995-1999, the greatest concentration of deaths was in teenagers and young adults between the ages of 15 and 24. On the contrary, Figure 8 referring to the most recent years shows that the greatest concentration is currently among the elderly age 80 and older. Once trauma was a deathly disease of the young, yet it has now become the disease of the old. This change is attributable to many factors: (1) changing age structure in the general population – i.e., baby boomers coming of age, (2) many injury prevention programs that effectively reduced the burden of trauma in young ages, e.g., work and road safety programs, and (3) changes in lifestyle i.e., living longer and being more active and adventurous in old age.

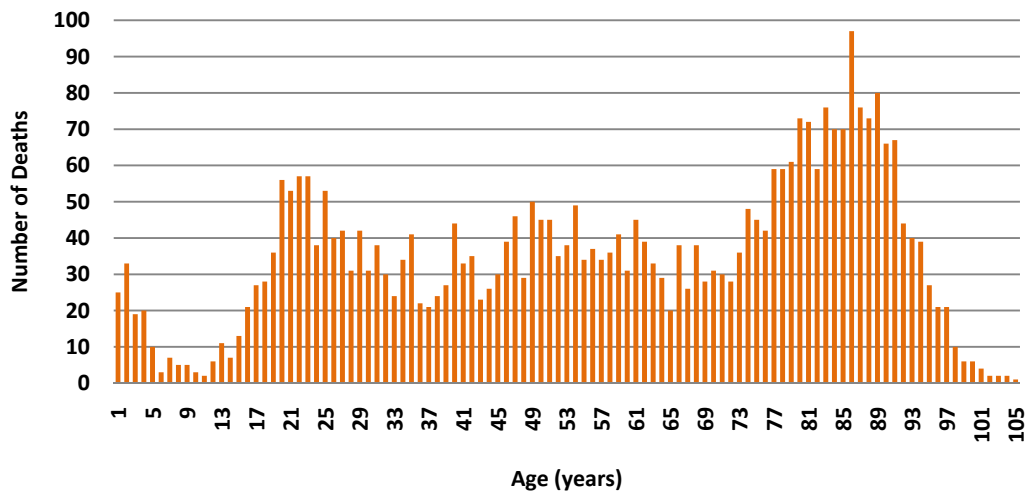
**Figure 6: Frequency of Trauma Deaths by Age, 1995-1999**



**Figure 7: Frequency of Trauma Deaths by Age, 2000-2004**



**Figure 8: Frequency of Trauma Deaths by Age, 2005-2009**

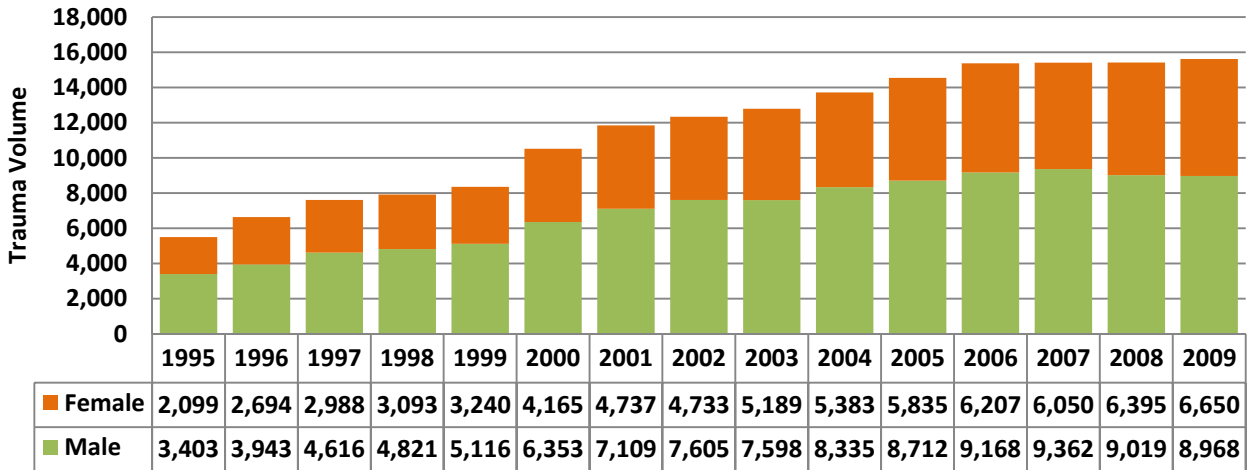


**Gender:**

Men represent a greater share of the trauma volume than do women. However, the proportion of female trauma patients increased from about 38% in 1995 to 43% in 2009. About 70% of trauma in people less than 65 years of age occurs among men, while in people age 65 and older, males represent approximately 40% of trauma volume. Recent increase in elderly trauma cases goes hand in hand with the recent increase in female trauma.

**Figure 9: Trauma Volume by Gender and Year**

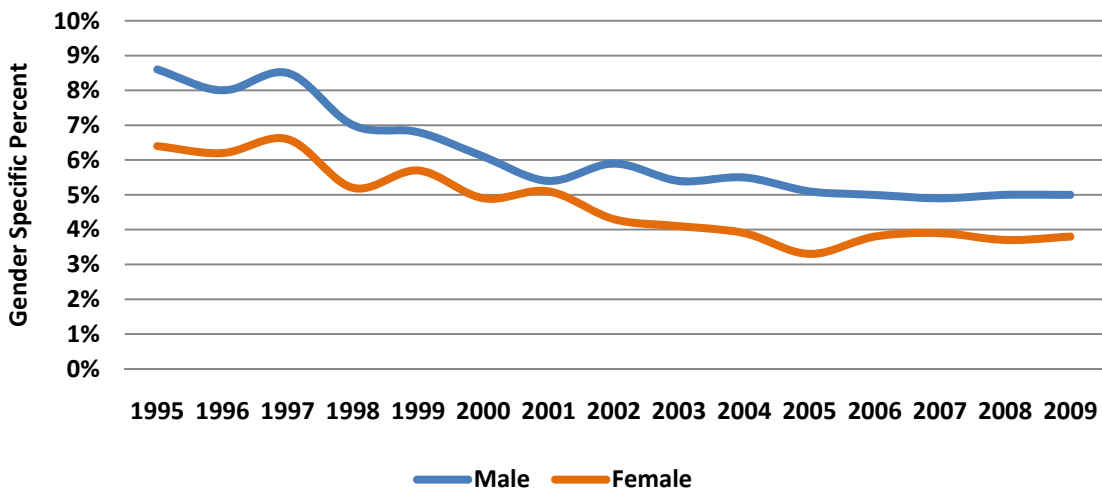
For regional comparisons, see Appendix II Figure 9b



The proportion of men who die of trauma is greater than for women, even though case fatality rates for both genders had a downward trend. This trend has continued over the past 15 years.

**Figure 10: Trauma Case Fatality by Gender and Year**

For regional comparisons, see Appendix II Figure 10b

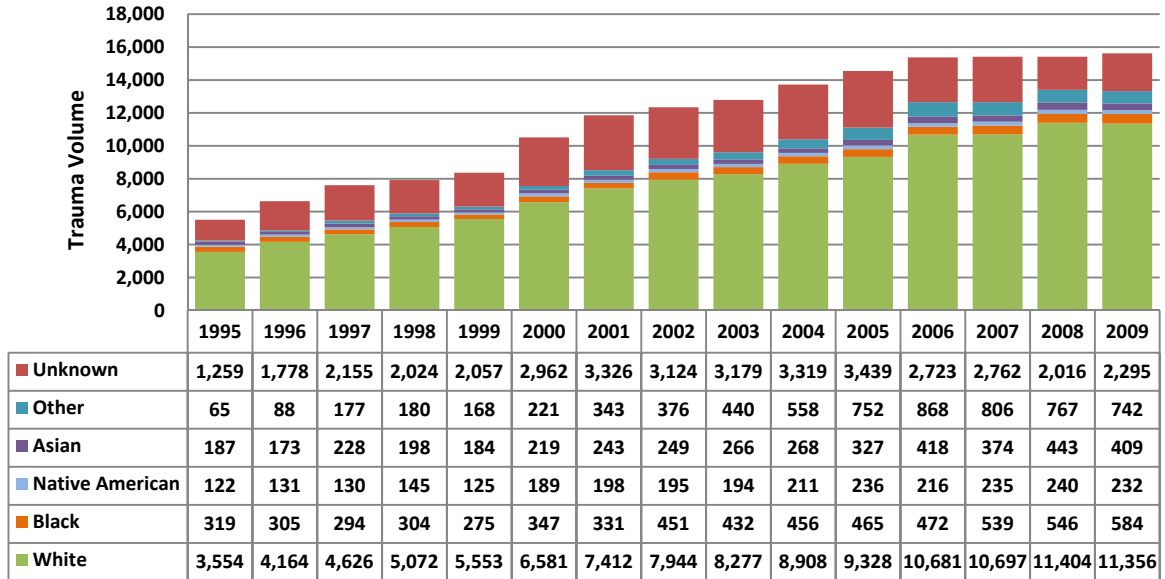


**Race:**

Patient race remains difficult to collect, with more than 15% of records missing race data consistently. Race data are missing from some hospitals more than others, with more than 50% of records missing race from 10 hospitals. Thus, any regional or statewide analysis of racial disparities regarding trauma outcomes should be taken with a grain of salt.

**Figure 11: Race of Trauma Patients by Year**

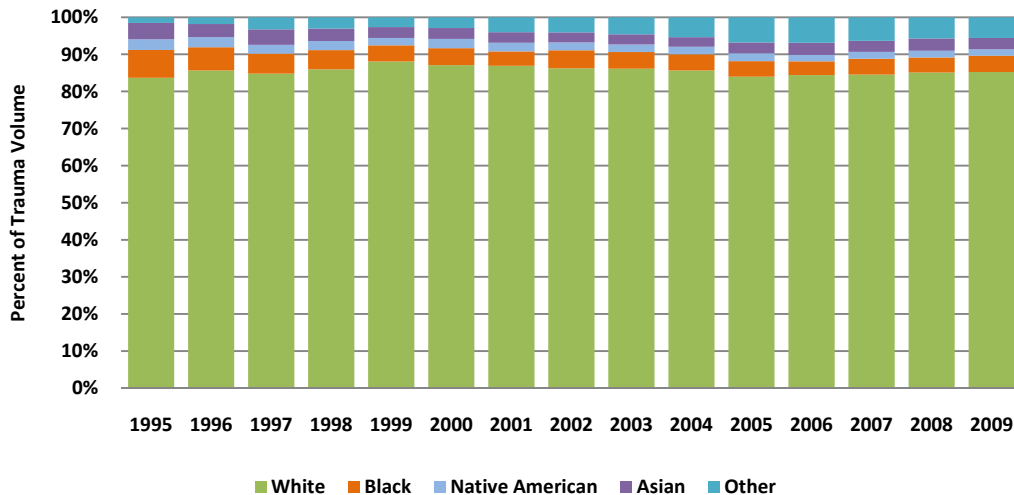
[For regional comparisons, see Appendix II Figure 11b](#)



For records with race data included, whites comprise about 85% of trauma volume. Overall during 2007- 2009, Blacks accounted for about 3% of all trauma, but about 18% of interpersonal violent trauma.

**Figure 12: Race of Trauma Patients by Year**

(Excluding Cases With Missing Race Data)



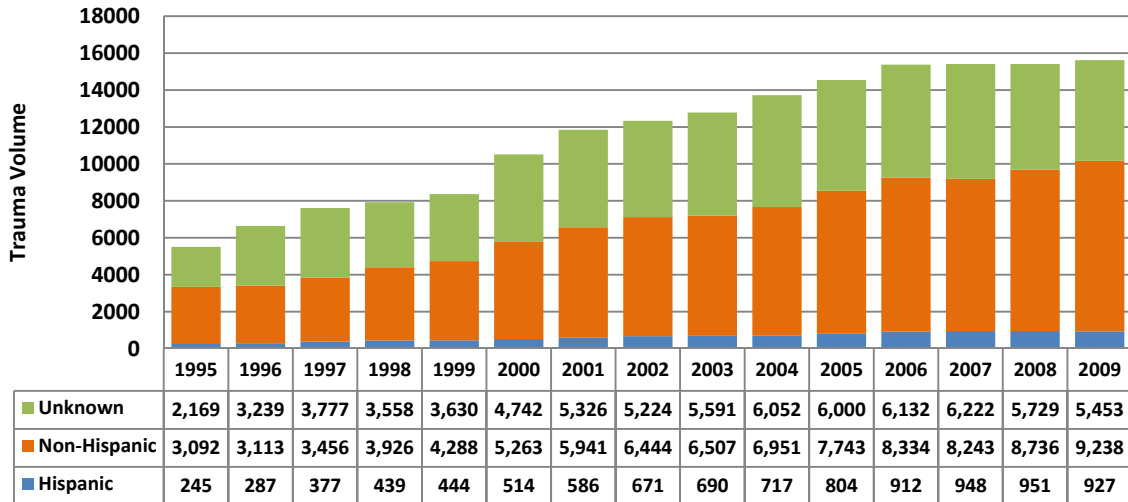


**Ethnicity:**

Similar to race, capturing ethnicity data remains a challenge for the trauma registry. In 2009, ethnicity was missing on about 35% of records. Missing is more than 90% of records in 10 particular hospitals.

**Figure 13: Ethnicity of Trauma Patients by Year**

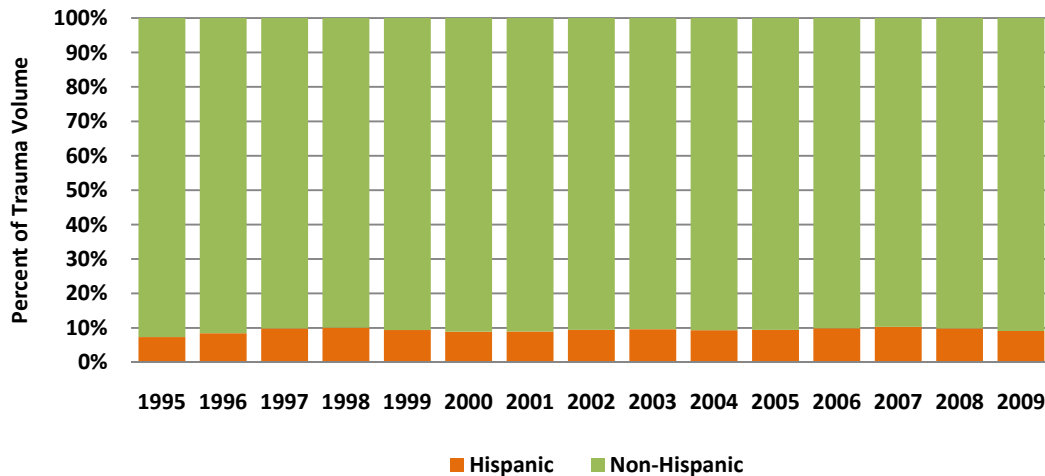
[For regional comparisons, see Appendix II Figure 13b](#)



When ethnicity data are available in the record, the people of Hispanic origin are about 10% of trauma. However, Hispanics disproportionately represented about 20% of all interpersonal violent trauma incidences during 2007-2009.

**Figure 14: Ethnicity of Trauma Patients by Year**

**(Excluding Cases With Missing Ethnicity Data)**

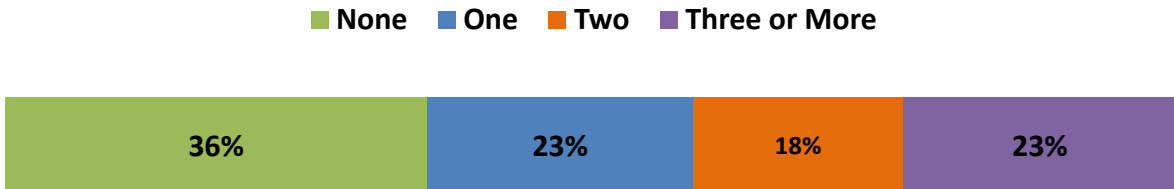


### Pre-existing conditions/co-morbidities:

More than half of trauma patients have one or more pre-existing conditions that may increase the likelihood of death from injury. One out of four (23%) trauma patients brings three or more pre-existing conditions with them to the hospital.

**Figure 15: Number of Pre-existing Conditions per Patient, 2007-2009**

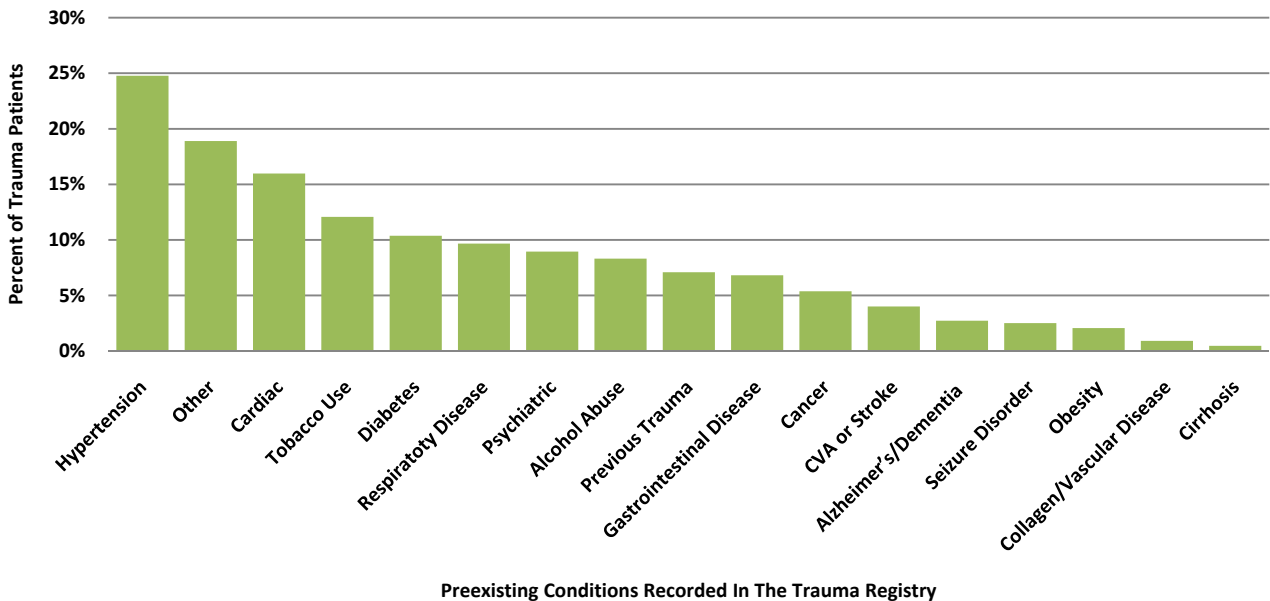
[For regional comparisons, see Appendix II Figure 15b](#)



About one in four trauma patients come to the hospital with hypertension, and about one in five patients have some form of heart disease in addition to their injuries. Especially in recent years, a widely observed trauma care issue is the management of INR (International Normalized Ratio) in patients on blood thinners due to cardiac related reasons. High INR levels could be deadly especially in older patients with TBI. In older patients, having late stage renal disease could also affect their survival outcomes even though this information is not currently collected in the Trauma Registry.

**Figure 16: Commonly Reported Pre-existing Conditions, 2007-2009**

[For regional comparisons, see Appendix II Figure 16b](#)



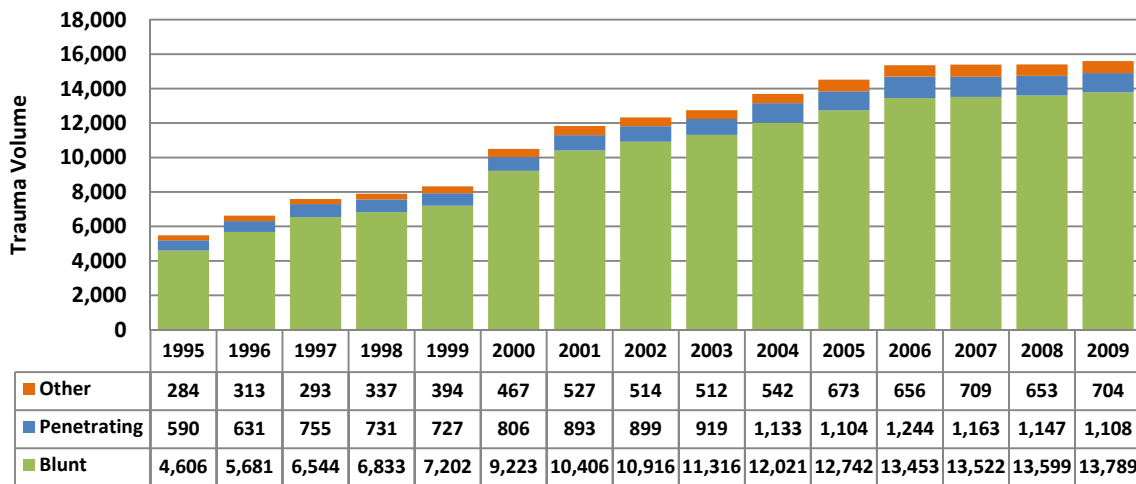
## Injury

### Injury type and mechanism:

Blunt trauma is much more common in Washington State than is penetrating trauma. In 2009, trauma cases were classified as 88.4% blunt force, 7.1% penetrating, and 4.5% other. The ‘other’ injury category includes a mix of injury mechanisms such as burns, drowning, asphyxiation, and electrocution.

**Figure 17: Injury Type by Year**

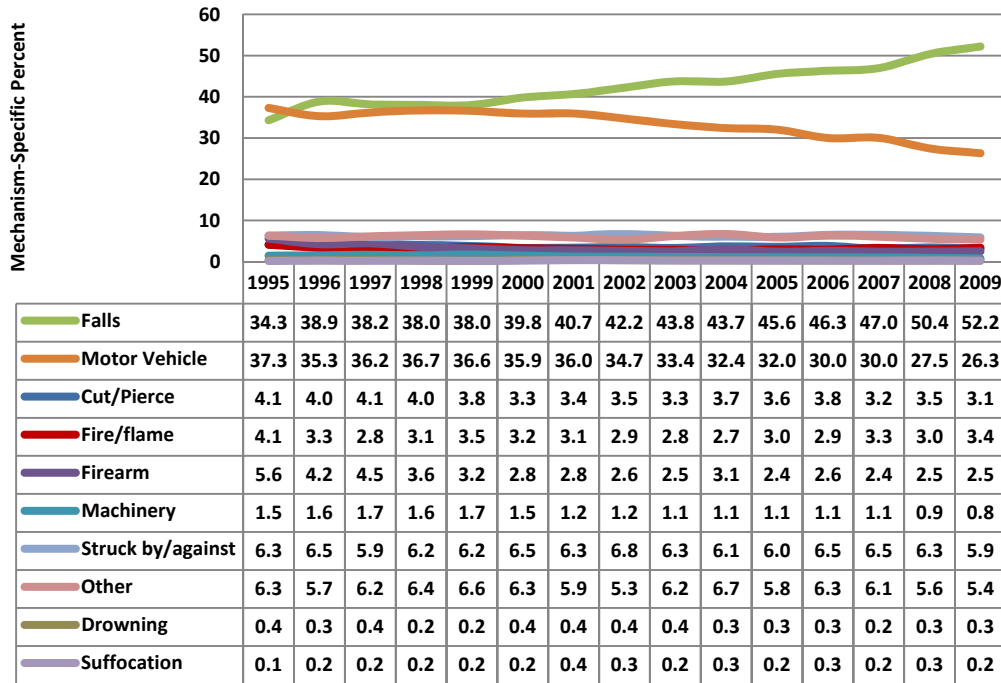
[For regional comparisons, see Appendix II Figure 17b](#)



Falls are the leading cause of trauma in the registry with about 52% of cases attributable to some type of fall in 2009. Falls include a wide spectrum of types from baby-walker falls in infants to ground-level falls in the elderly. Motor vehicle crashes are the second leading cause of trauma, representing about 26% of cases in 2009. Over the last 15 years, the percentage of motor vehicle crashes trended downwards while falls trended upwards. Effective injury prevention programs targeting road-safety and an increase in elderly trauma, particularly elderly falls, were two major factors behind these trends.

**Figure 18: Percentage of Trauma Cases by Mechanism of Injury and Year**

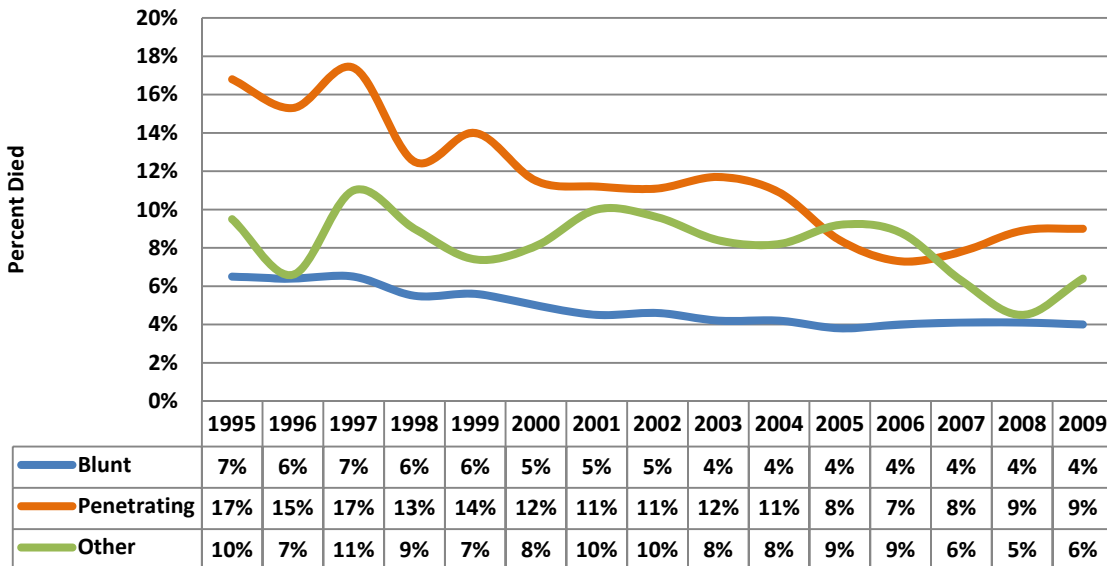
[For regional comparisons, see Appendix II Figure 18b](#)



Mortality for penetrating trauma is greater than for blunt or other types of trauma. A downward trend in mortality is observable for penetrating injuries during the first 15 years of the trauma system. Blunt and other injuries have remained relatively stable during this period.

**Figure 19: Trauma Mortality by Injury Type and Year**

[For regional comparisons, see Appendix II Figure 19b](#)

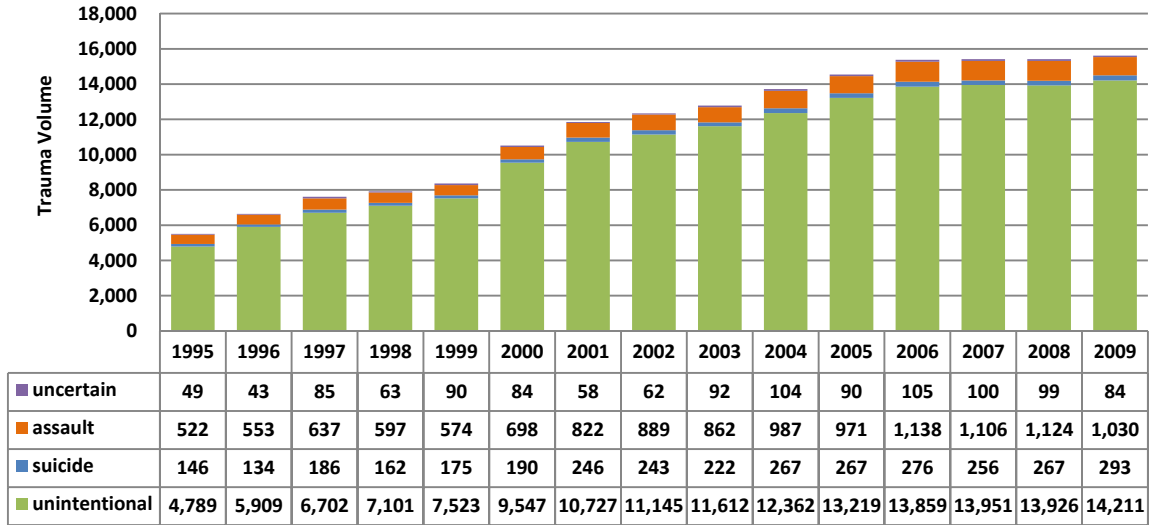


**Intent:**

In Washington State, approximately 90% of trauma is unintentional in nature. Assault and self-inflicted injuries account for the remaining 9% of cases. In about 1% of cases, the intent cannot be determined.

**Figure 20: Intent of Injury by Year**

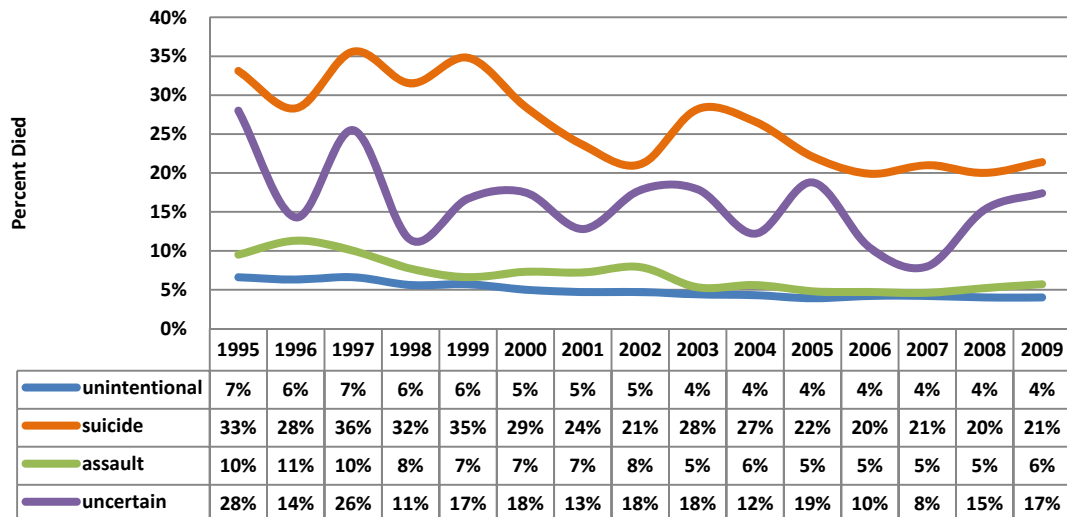
[For regional comparisons, see Appendix II Figure 20b](#)



Mortality is related to intent of injury, with the greatest mortality among trauma patients who have self-inflicted injuries (i.e., suicide attempts). In 2009, about 96% of patients with unintentional injuries survived compared to less than 80% of patients with self-inflicted injuries. In addition, nearly 96% of assault victims survived the same year, although gunshot victims have a worse survival rate than other types of assault such as knives. Over the years, the major declines in mortality occurred regarding trauma inflicted by suicides and assaults.

**Figure 21: Trauma Mortality by Intent and Year**

[For regional comparisons, see Appendix II Figure 21b](#)

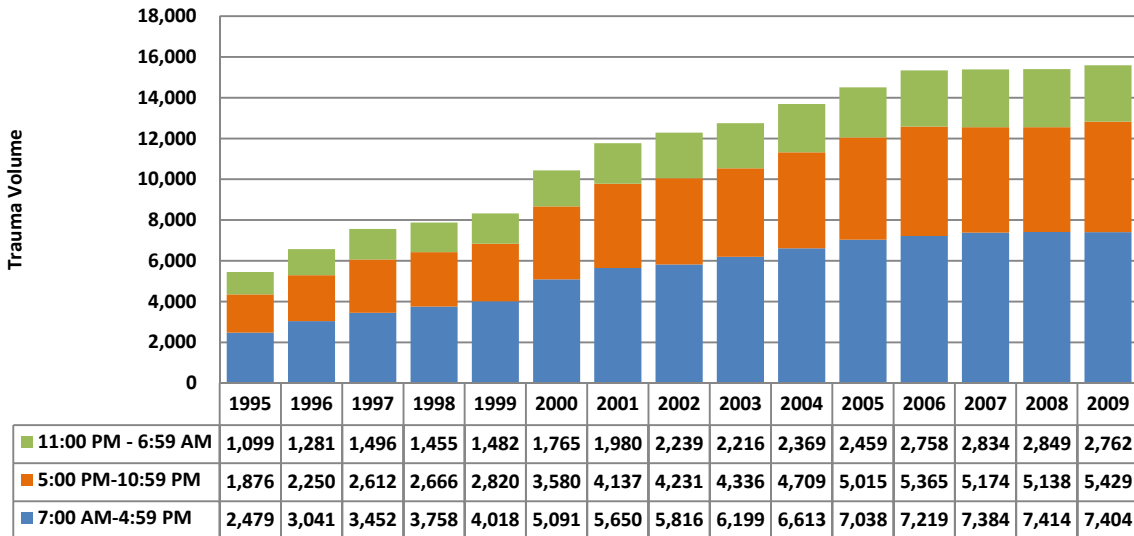


## Time and day of injury:

Nearly half of trauma cases arrive at the hospitals during the day (i.e., 7:00 AM – 5:00 PM). The remaining arrivals occur during the evening and night hours. Trauma centers must be ready and available at any time of day.

**Figure 22: Time of Trauma Patient Arrival at Hospital by Year**

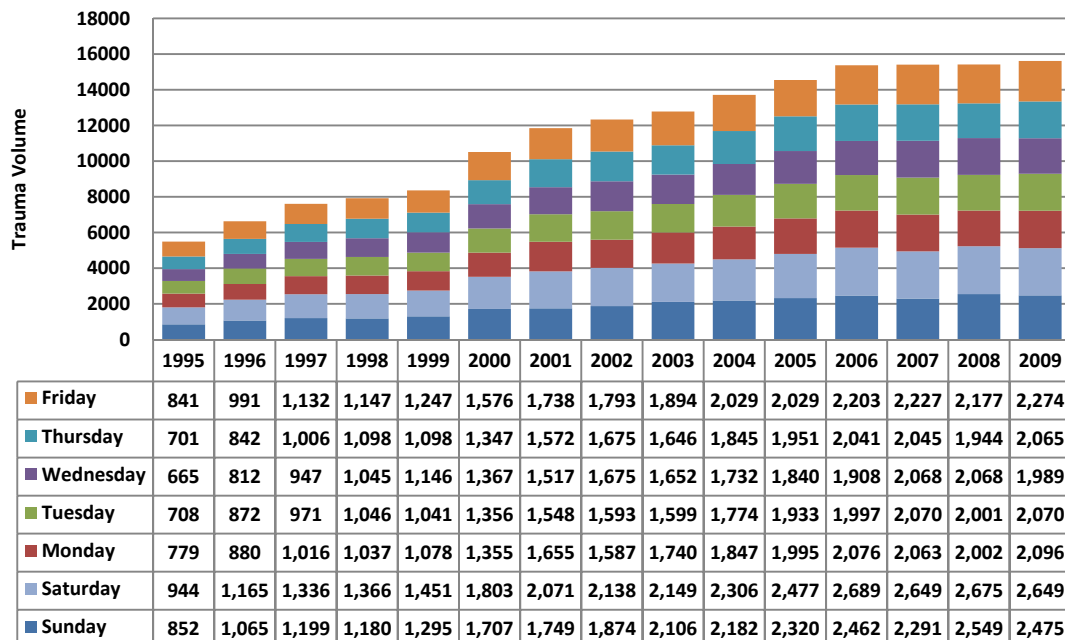
[For regional comparisons, see Appendix II Figure 22b](#)



In general, Saturday is the busiest day for trauma followed closely by Sunday. Trauma is more likely to occur on weekends than on weekdays with over 30% of trauma occurring on weekends.

**Figure 23: Trauma Volume by Day of Week and Year**

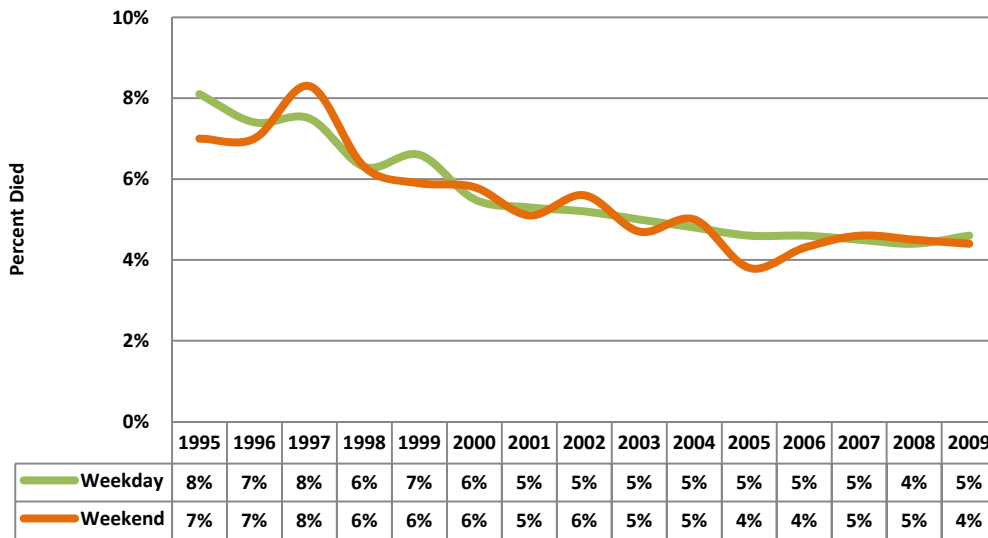
[For regional comparisons, see Appendix II Figure 23b](#)



The pattern of trauma by day of week has remained unchanged over the past 15 years. Whether injury occurs on weekdays or at weekends is not associated with mortality, providing evidence of consistent readiness on the part of Washington’s trauma system.

**Figure 24: Trauma Mortality by Day of Week and Year**

[For regional comparisons, see Appendix II Figure 24b](#)

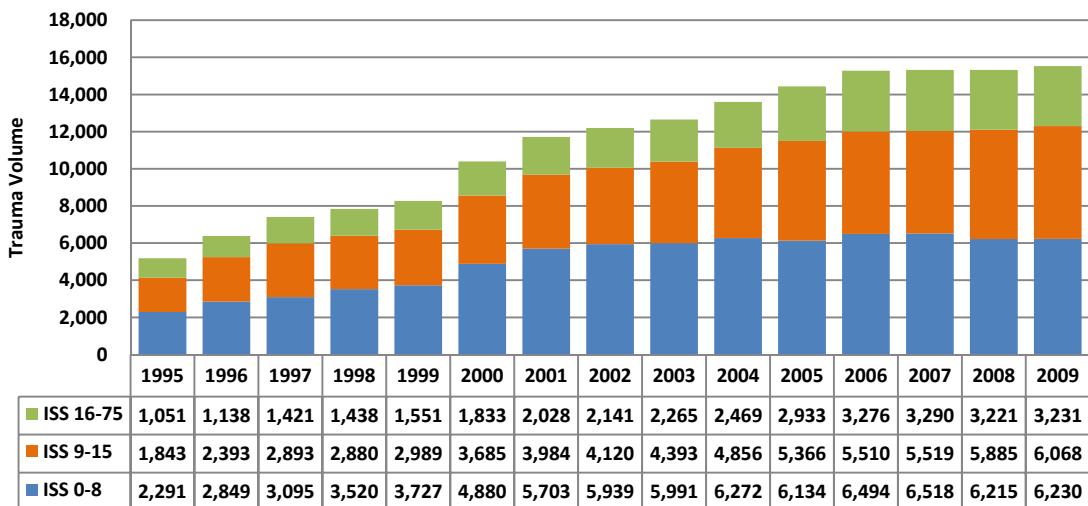


## Injury severity:

In general, about 20% of trauma in Washington is major injury with an Injury Severity Score (ISS) of greater or equal to 16. About 40% of the trauma registry cases are low acuity, with an ISS of less than nine. The rest are generally moderate.

**Figure 25: Trauma Volume by Injury Severity Score and Year**

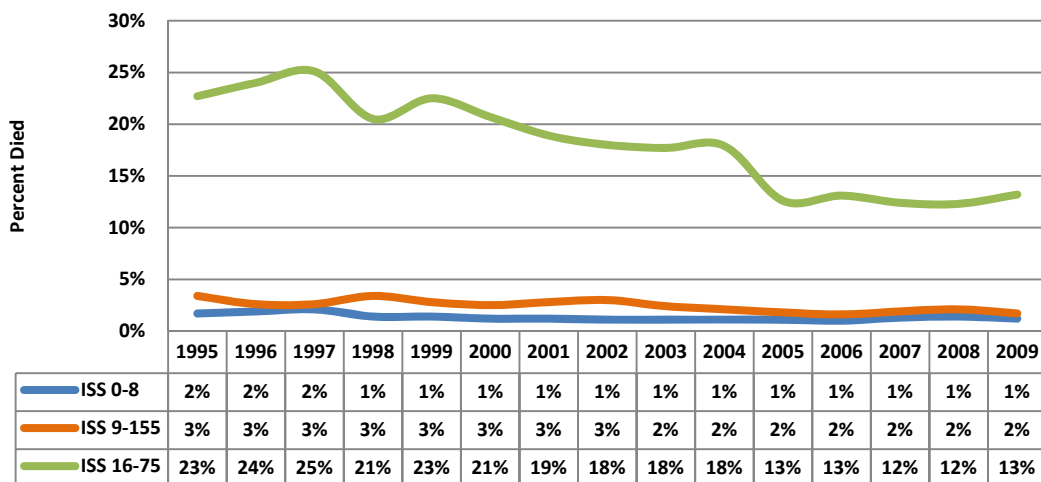
[For regional comparisons, see Appendix II Figure 25b](#)



Mortality is strongly related to severity of injury. Nearly 99% of patients with low acuity injuries survive compared to about 82% of patients with major trauma.

**Figure 26: Trauma Mortality by Injury Severity Score**

[For regional comparisons, see Appendix II Figure 26b](#)



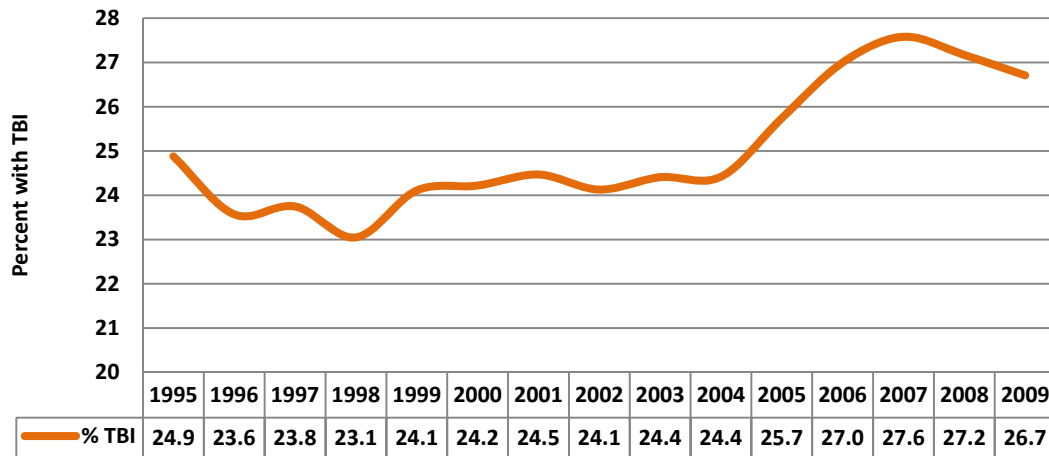


## Traumatic brain injury (TBI):

TBI cases in the trauma registry increased slightly in recent years from 2005 to 2009. In 2009, 4,172 records included a diagnosis of traumatic brain injury. Of these, 1,327 (about 32%) patients were transferred to a higher level of care.

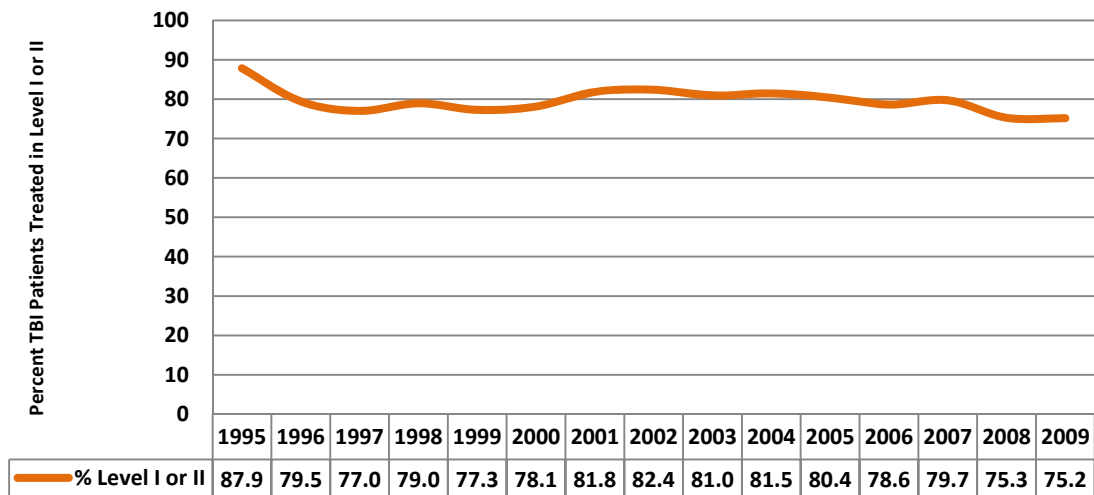
**Figure 27: Percentage of Trauma Patients Sustaining TBI by Year**

[For regional comparisons, see Appendix II Figure 27b](#)



Level I and II trauma services are required to have neurosurgical services available to the patient on a 24 hour/7 day per week basis. In 2009, about 75% of admitted TBI patients received care at a level I or II hospital. Some level III hospitals have neurosurgical resources and do admit patients with traumatic brain injuries.

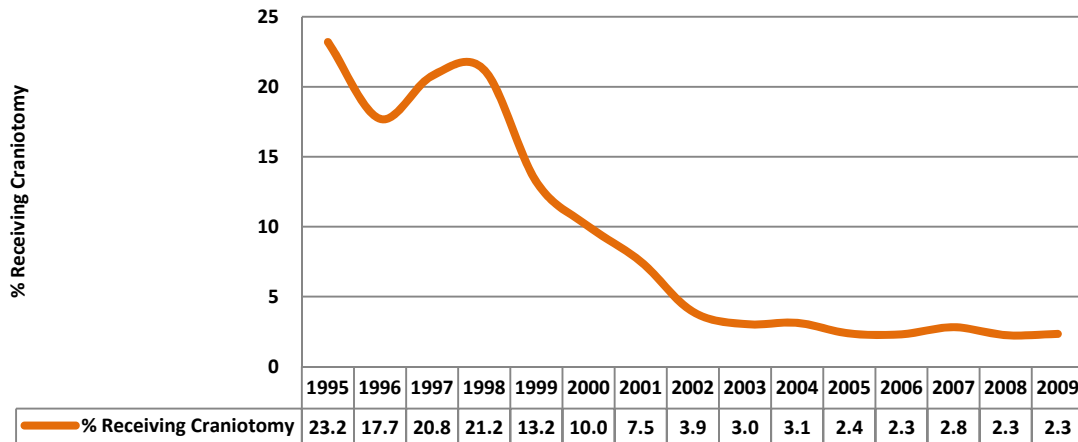
**Figure 28: Percentage of TBI Patients Receiving Definitive Care in a Level I or II Trauma Service by Year**



Treatment for patients with traumatic brain injury is shifting away from surgical management. About 23% of admitted TBI patients received a craniotomy in 1995, compared to 2.3% in 2009.

**Figure 29: Percentage of Admitted TBI Patients Receiving Craniotomy by Year**

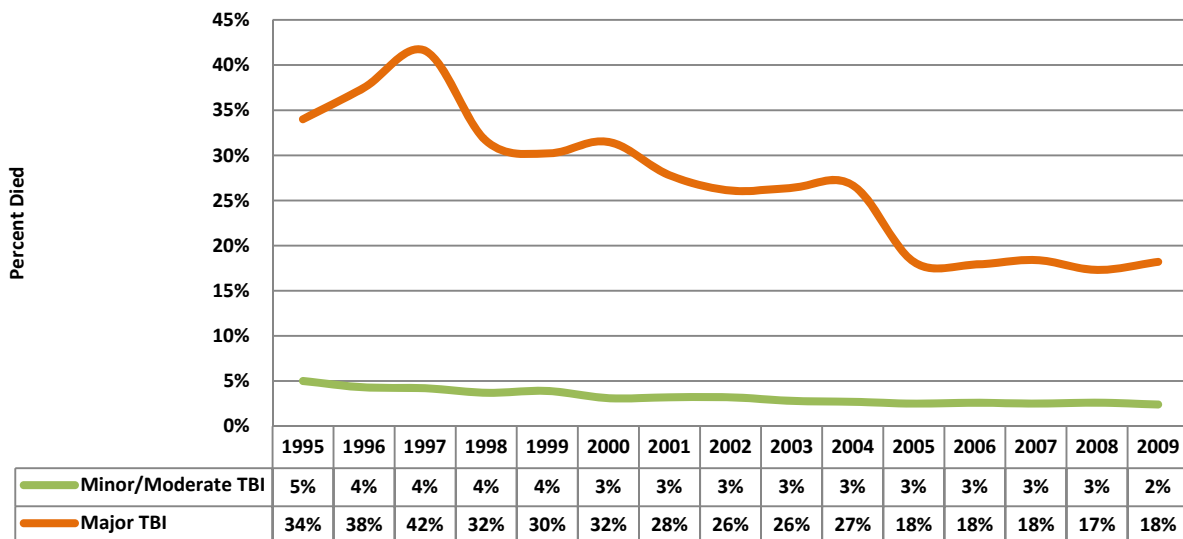
For regional comparisons, see Appendix II Figure 29b



Over the same period, mortality for all TBI patients has declined from about 15% in 1995 to 9.5% in 2009. However, mortality is strongly related to severity of brain injury. Mortality has remained very low for patients with minor or moderate traumatic brain injury although there was a decline from about 5% to about 2% during the first 15 years.<sup>2</sup> Much of the improvement in survival has occurred among patients with major traumatic brain injury where mortality has declined from about 34% in 1995 to about 18% in 2009.

**Figure 30: Mortality of TBI Patients by Year**

For regional comparisons, see Appendix II Figure 30b

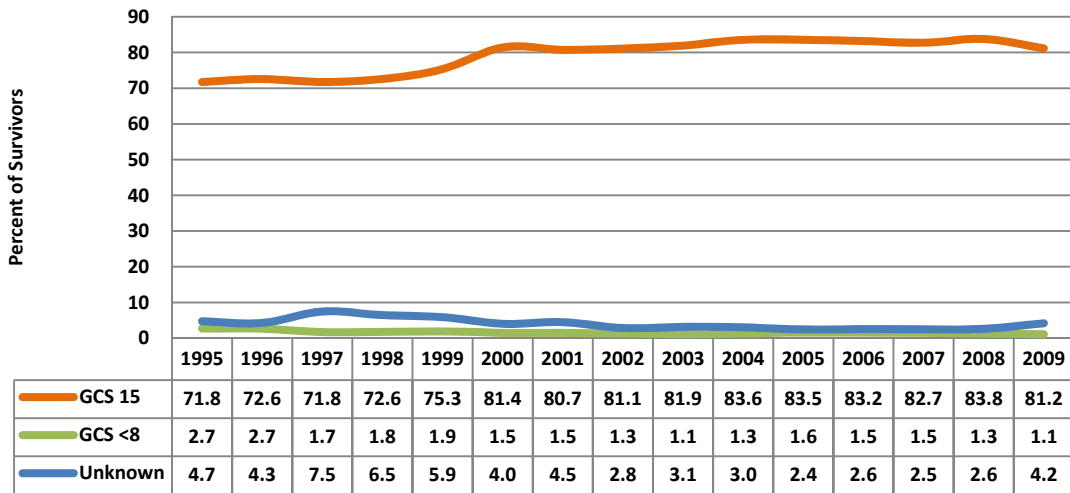


<sup>2</sup> Major traumatic brain injury is defined by the presence of one or more Abbreviated Injury Score (AIS) of four or greater to the head region. Minor/moderate TBI is defined by a maximum AIS score of three to the head region.

Disability for patients who survive a traumatic brain injury is an important outcome measure. The Glasgow Coma Score (GCS) is a widely used index that assesses the degree of coma in patients with brain injuries. A GCS of 15 is considered normal (no deficit), while a GCS of less than eight is considered a severe deficit. Since 2000, more than 80% of TBI survivors left the hospital without any cognitive impairment (i.e., GCS of 15). Conversely, about 1-2 % of annual survivors have very significant cognitive impairment, with a GCS of less than eight.

**Figure 31: TBI Survivors by Glasgow Coma Score at Discharge**

[For regional comparisons, see Appendix II Figure 31b](#)

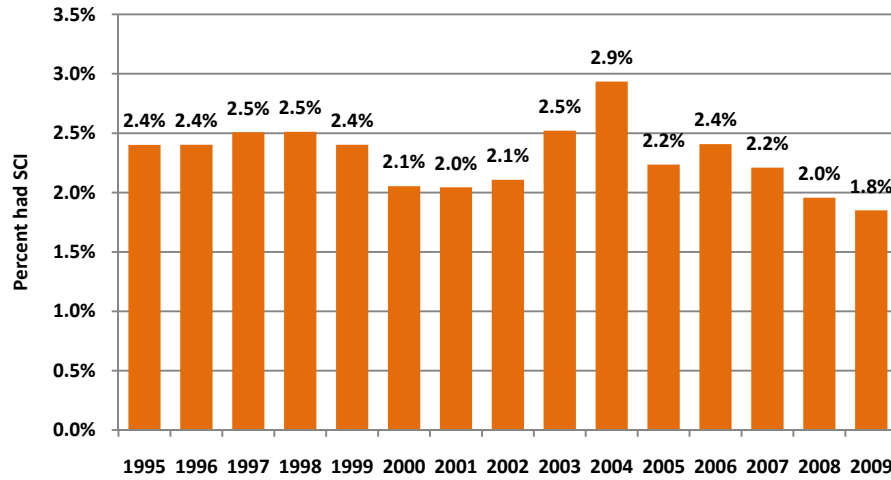


## Spinal cord injury (SCI):

In 2009, 213 individuals experienced a spinal cord injury significant enough to meet the trauma registry inclusion criteria. Of these, 28 (13.4%) died.

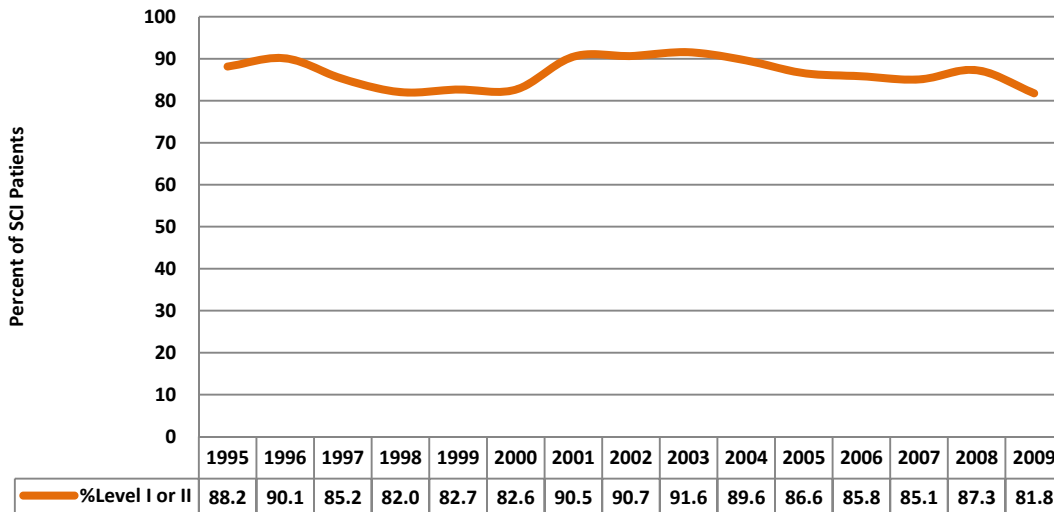
**Figure 32: Percentage of Admitted Patients with Spinal Cord Injury by Year**

[For regional comparisons, see Appendix II Figure 32b](#)



Most patients with spinal cord injuries receive definitive care at either a level I or level II trauma service.

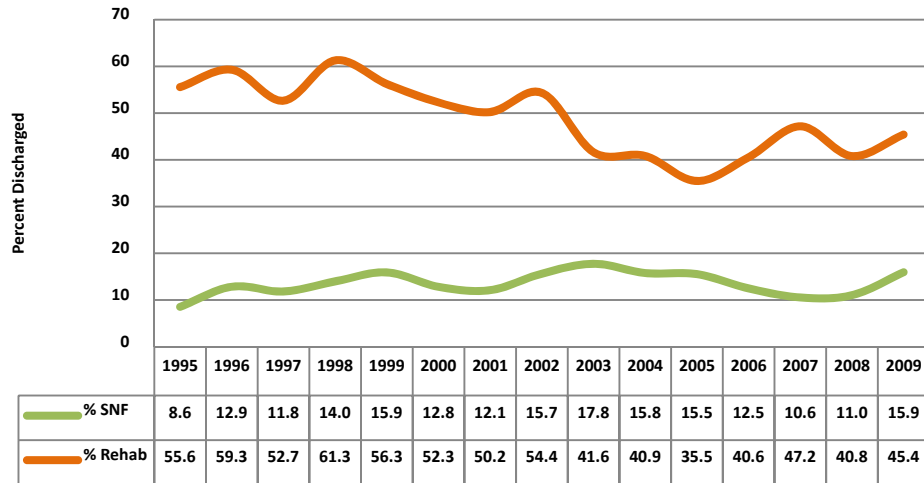
**Figure 33: Percent of Patients with SCI Receiving Definitive Care at a Level I or II Trauma Service by Year**



While about 56% of SCI survivors were discharged to a rehabilitation service in 1995, about 45% were discharged to a rehabilitation service in 2009. Part of this decline is due to more discharges to home, but discharges to skilled nursing facilities have increased during this time period, perhaps indicating increasing difficulty accessing rehabilitation services.

**Figure 34: Percentage of SCI Survivors Discharged to a Rehabilitation Service by Year**

[For regional comparisons, see Appendix II Figure 34b](#)

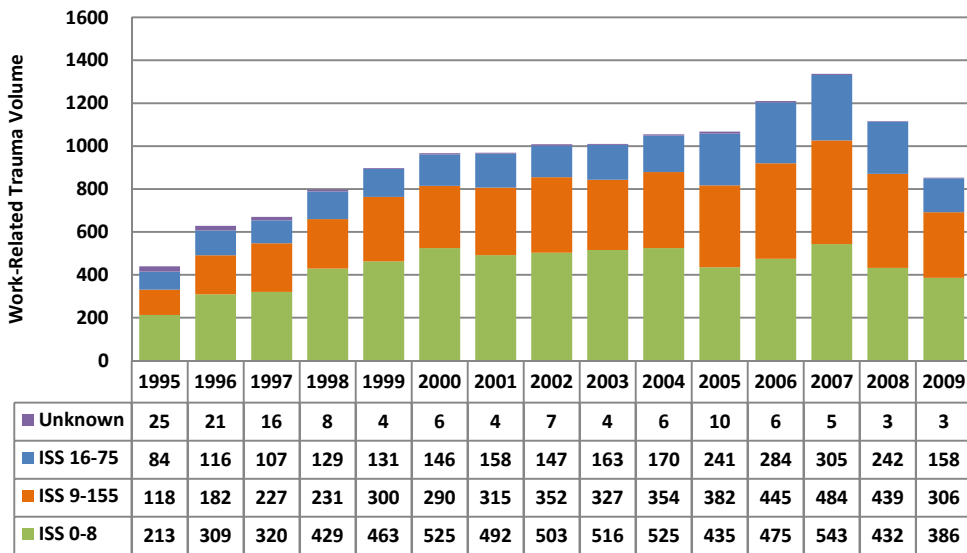


## Occupational trauma:

Less than 7% of yearly trauma volume is work-related. Falls are the most common mechanism of injury accounting for 1/3<sup>rd</sup> of all work-related trauma cases.

**Figure 35: Work-Related Trauma by Injury Severity Score and Year**

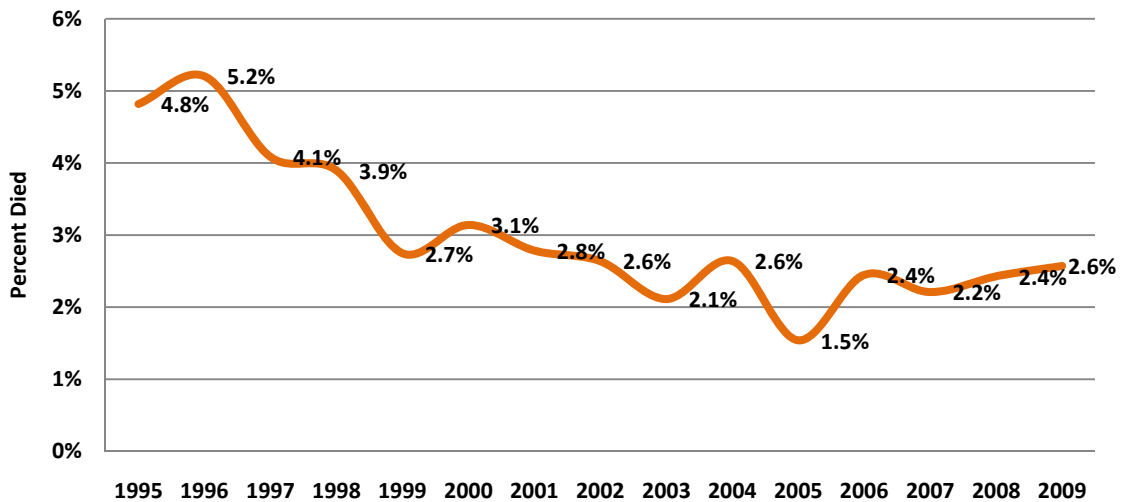
[For regional comparisons, see Appendix II Figure 35b](#)



In 2009, there were 39 work-related deaths in the trauma registry, representing a case fatality rate of 2.6%.

**Figure 36: Work-Related Trauma Mortality by Year**

[For regional comparisons, see Appendix II Figure 36b](#)



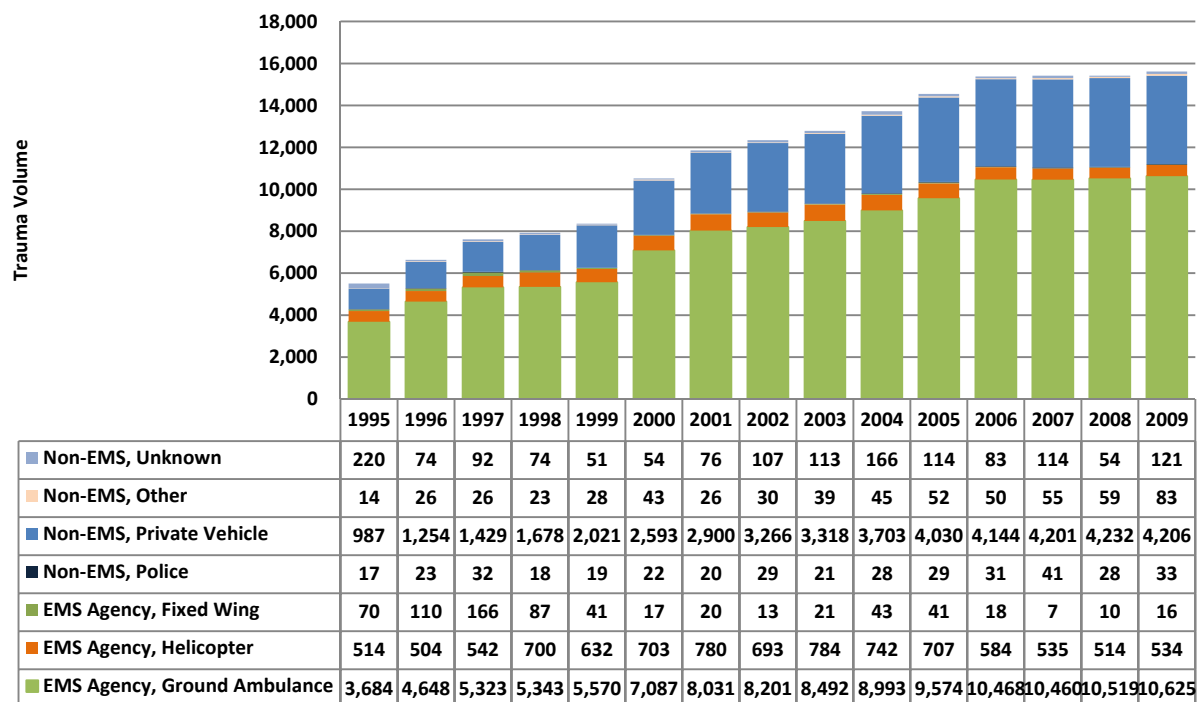
## Emergency medical services (EMS)

### EMS transport mode from the scene:

EMS transport trauma patients by ground ambulance, helicopter, and fixed-wing airplanes. Transport mode from the scene of injury is well documented in the trauma registry, with nearly 99% reporting. In 2009, about 69% of trauma patients arrived at hospitals by ground ambulance, with about another 6% arriving by helicopter. The remaining 25% of patients commonly arrived by private vehicle.

**Figure 37: Transport Mode from the Scene by Year**

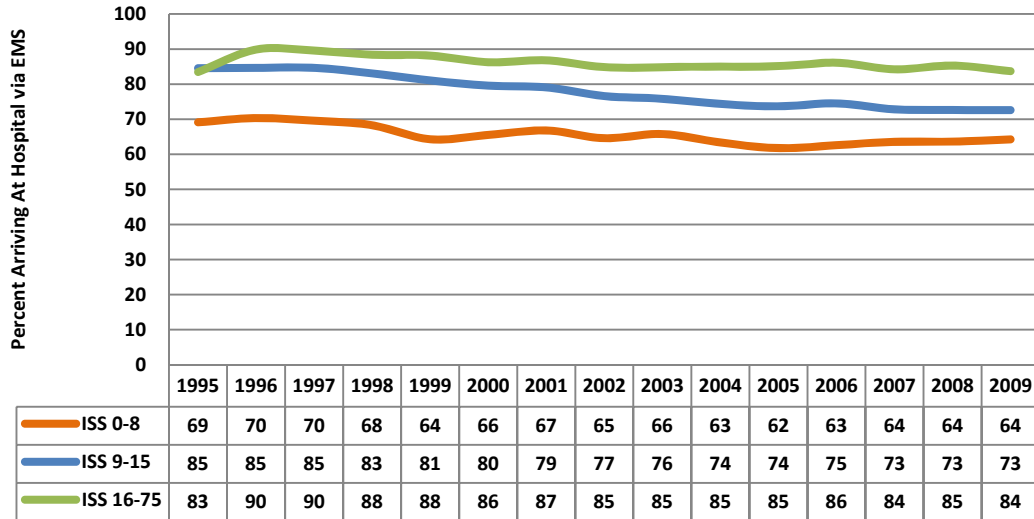
[For regional comparisons, see Appendix II Figure 37b](#)



Injury severity is associated with the use of EMS. About 84% of serious trauma patients (ISS 16+) were transported to a trauma service by EMS in 2009 while the percentage was lower in patients with minor to moderate injuries.

**Figure 38: Percentage of Trauma Patients Arriving at Hospital by EMS by Injury Severity Score and Year**

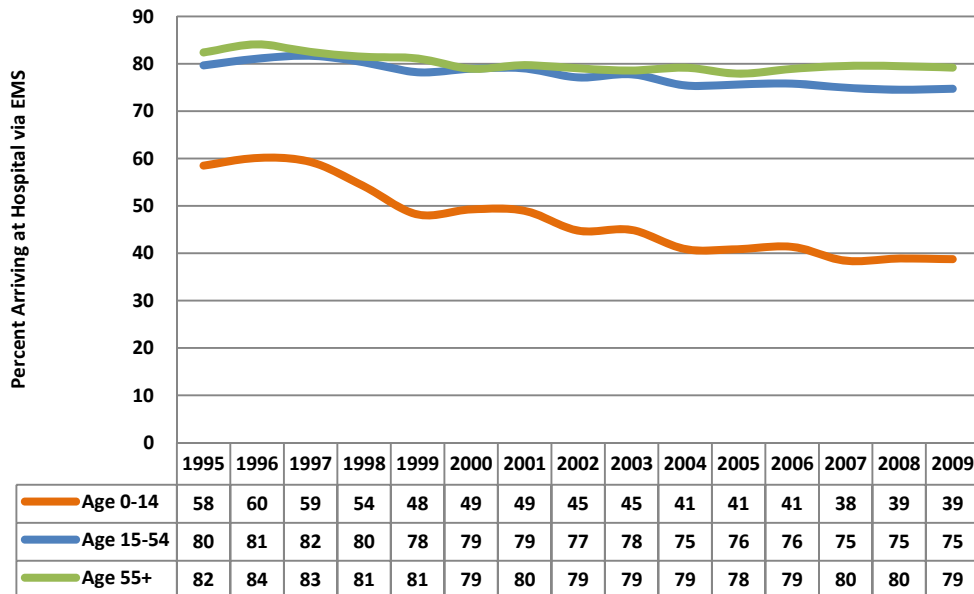
For regional comparisons, see Appendix II Figure 38b



At all levels of injury severity, children are less likely than adults to be transported to a trauma service by EMS.

**Figure 39: Percentage of Trauma Patients Arriving at Hospital by EMS by Children vs. Adults and Year**

For regional comparisons, see Appendix II Figure 39b



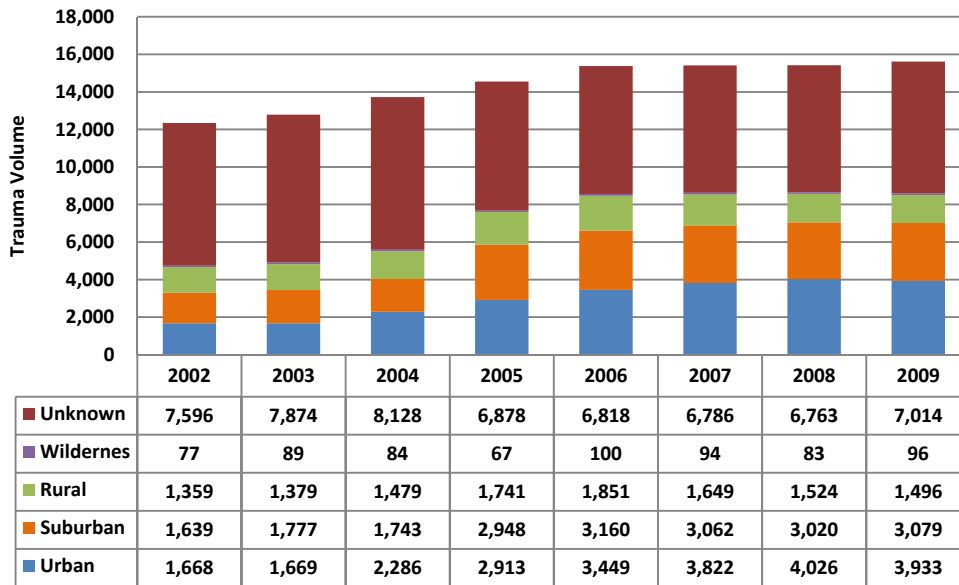


## EMS response areas:

Data on EMS response area are consistently missing for more than 40% of records. Furthermore, a commonly accepted definition for categorizing geographic response area is critically lacking. New developments in geographic information systems and electronic position should allow for better reporting of location data through the Washington EMS information system (WEMSIS), currently in development.

**Figure 40: EMS Scene Responses by Area and Year**

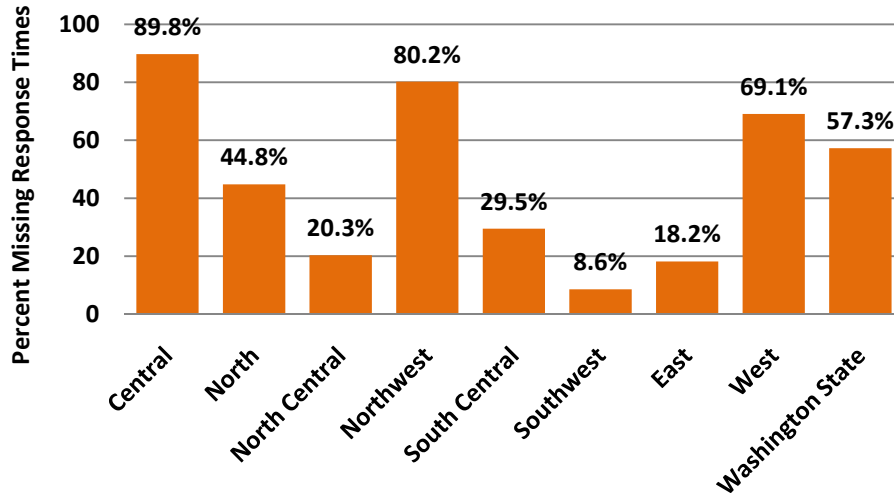
[For regional comparisons, see Appendix II Figure 40b](#)



### EMS response times:

During 2007-2009, statewide EMS response time data are missing for more than half of patients transported from the scene by EMS. Regional variability is especially high with some regions with more than 80% missing data and some regions with only 20% or less missing response time data. Advances in computer-aided dispatch systems have resulted in fewer run report forms including time data. As such, hospitals often receive a run form with limited or no time data from EMS.

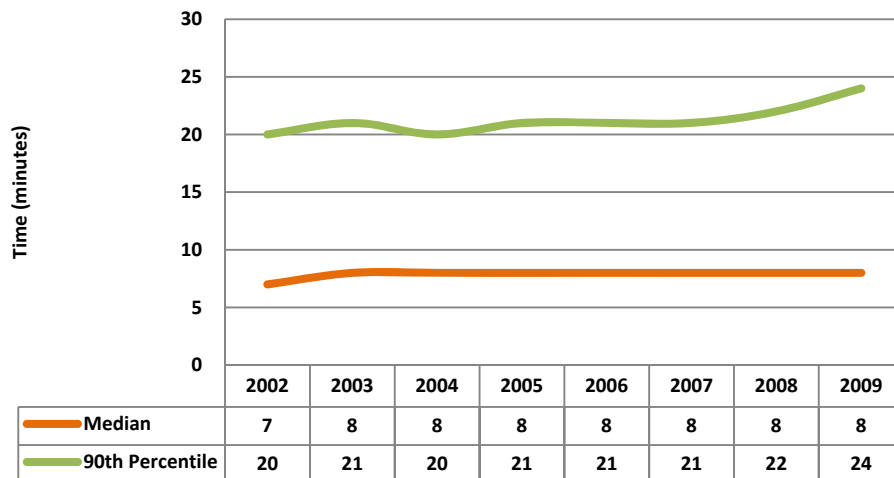
**Figure 41: Percentage of Scene Transports Missing Response Time Data by Region, 2007-2009**



When available, yearly median EMS response time is around 8 minutes for the combined areas of urban, suburban, rural, wilderness.

**Figure 42: EMS Response Times by Year**

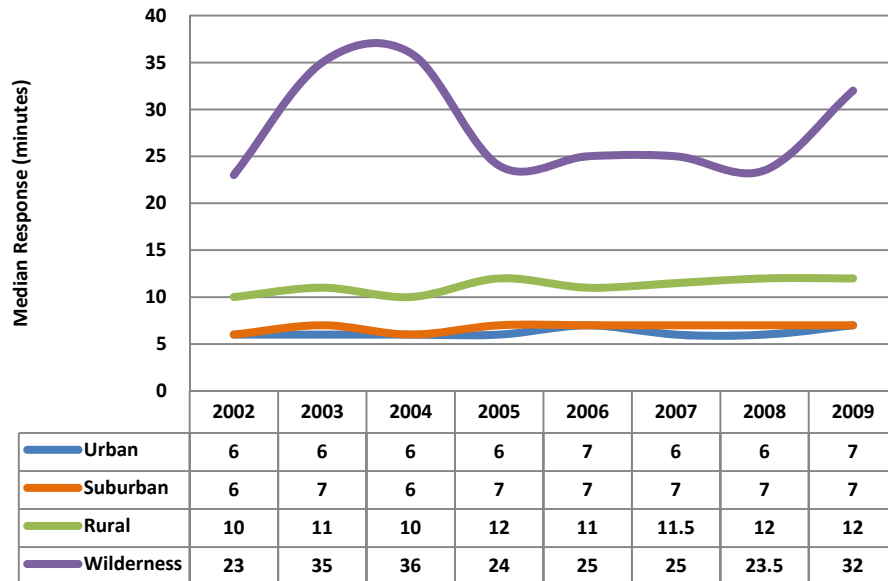
[For regional comparisons, see Appendix II Figure 42b](#)



It is no surprise that urban and suburban areas have the shortest yearly median response times while wilderness areas are hardest to reach with a yearly median of more than 20 minutes.

**Figure 43: Median Response Time to Scene by Area Type and Year**

[For regional comparisons, see Appendix II Figure 43b](#)

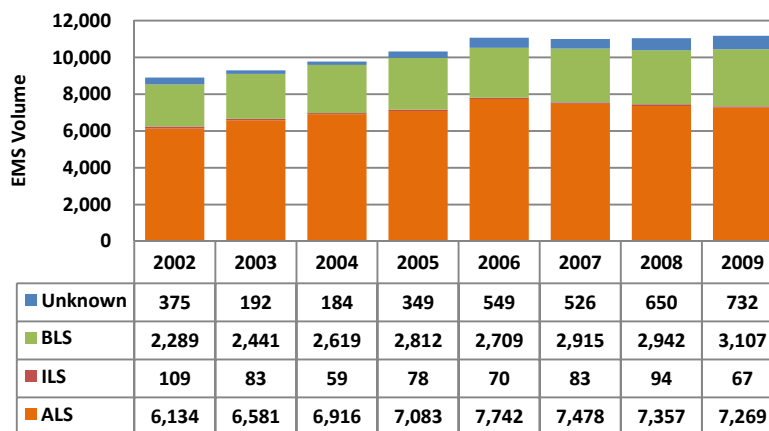


**Level of EMS service from scene:**

In 2009, about 70% of scene trauma transports received paramedic-level (advanced life support) care while for major trauma patients it was about 84%.

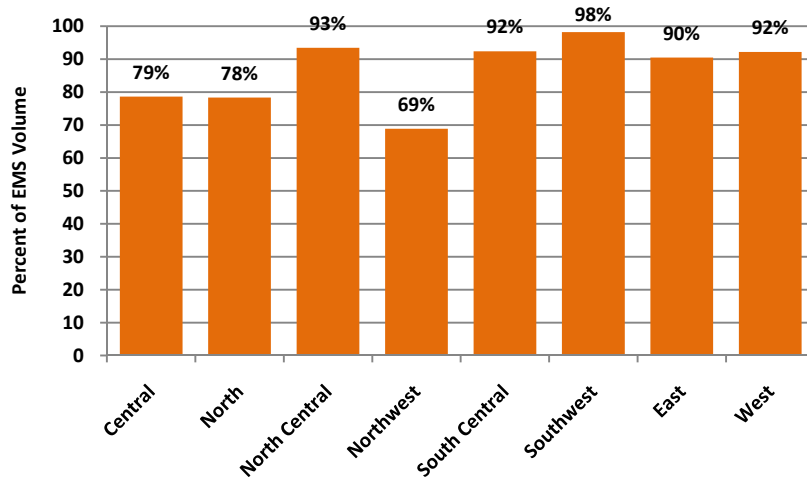
**Figure 44: Level of EMS Service from Scene by Year**

[For regional comparisons, see Appendix II Figure 44b](#)



Regional variation exists in the likelihood of receiving ALS care for major trauma patients, ranging from 69% in the Northwest region to nearly all (98%) in the Southwest region.

**Figure 45: Percentage of Major Trauma Patients Receiving ALS-level Care by Region, 2007-2009**



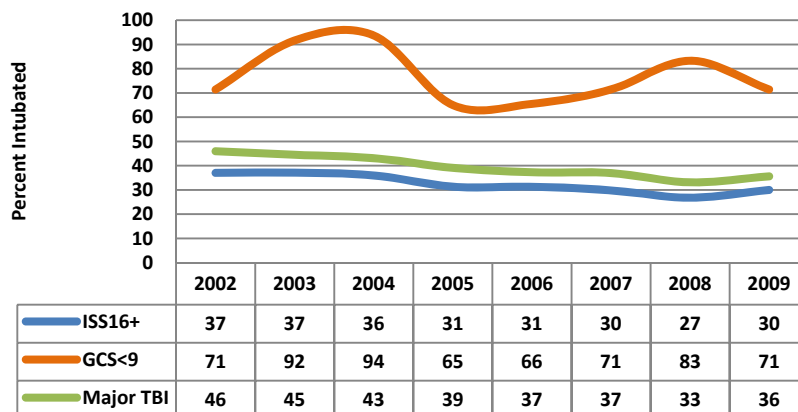
**Select field procedures performed:**

Endotracheal intubation is the insertion of a tube into the trachea to maintain the airway through either the mouth or the nose. The use of endotracheal intubation varies by injury severity and level of service at the scene. Advanced life support personnel are trained to intubate patients in the field, whereas this procedure is beyond the training and scope of basic life support personnel.

As seen in Figure 46 below, about 1/3 of major trauma patients transported from the scene are intubated yearly in the prehospital setting, although slightly more patients with major traumatic brain injury (TBI) receive intubations. For patients with significant cognitive impact (i.e., Glasgow Coma Score of less than 9 at the scene), 3 out of 4 patients in 2009 were intubated prior to arrival at the hospital.

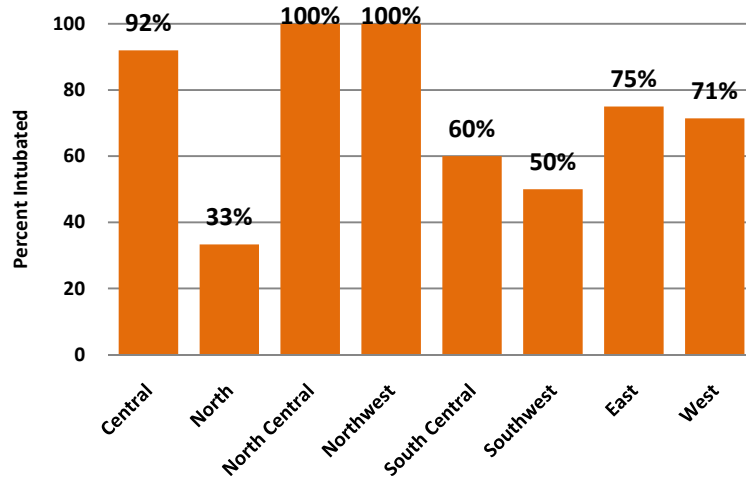
**Figure 46: Percentage of Selected Patient Groups Receiving Intubation in the Field by ALS Personnel**

[For regional comparisons, see Appendix II Figure 46b](#)



During 2007-2009, for ALS-level care of patients with a Glasgow Coma Score of less than 9 at the scene, the use of intubations in the field varied from about 100% in the North Central and Northwest regions to about 33% in the Northwest region.

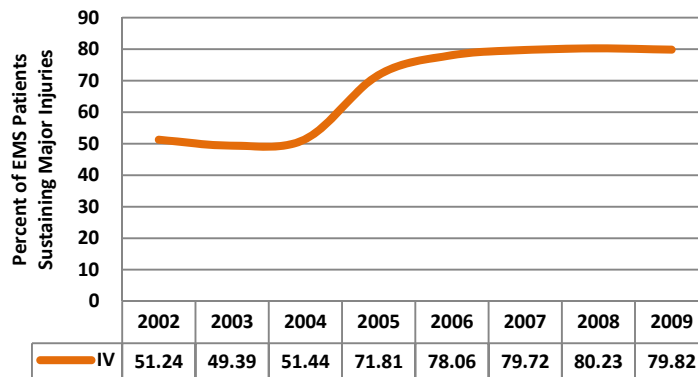
**Figure 47: Percentage of Patients with GCS Less Than Nine Receiving Intubation by Region, 2007-2009 (ALS Transports Only)**



The use of intravenous (IV) therapy in the field is common with severely injured (ISS 16+) trauma patients for fluid replacement or administering medications. Since 2006, about 80% of EMS patients received IV therapy in the field.

**Figure 48: Percentage of Major Trauma Patients (ISS 16+) Receiving IV Therapy in the Field by Year (ALS Transports Only)**

[For regional comparisons, see Appendix II Figure 48b](#)

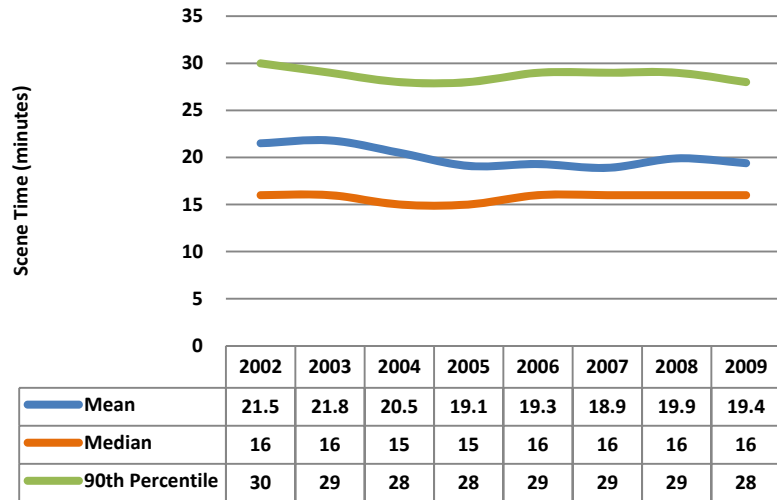


**Scene time:**

In 2009, the median scene time for trauma patients who did not require extrication was 16 minutes. On average, extrication, meaning extraction of trapped patients, adds over 7 minutes to scene time. Overall, the scene times remained with hardly any change during the last 8 years.

**Figure 49: Scene Time by Year (No Extrication)**

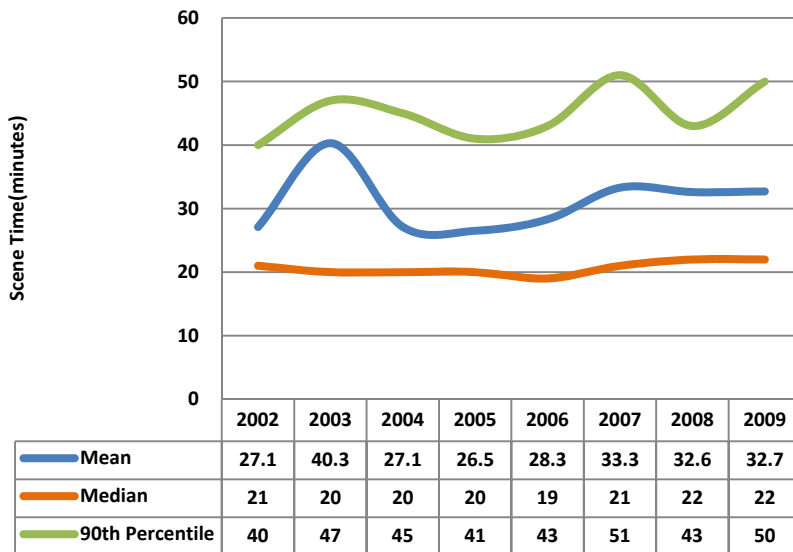
[For regional comparisons, see Appendix II Figure 49b](#)



The scene times are longer whenever extrication is involved. In 2009, the median scene time for trauma patients requiring extrication was about 22 minutes.

**Figure 50: Scene Time by Year (With Extrication)**

[For regional comparisons, see Appendix II Figure 50b](#)

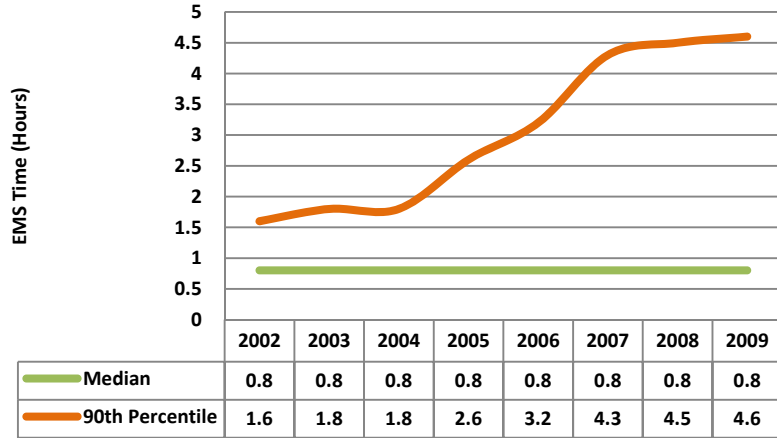


**The golden hour:**

Historically, the concept of the ‘golden hour’ has served as a foundation for organized trauma systems. The initial 60 minutes from time of injury to hospital care provides opportunity to prevent death in patients who would otherwise die due to lack of an airway and/or excessive blood loss.

**Figure 51: Time from EMS Dispatch to Arrival with Patient at Hospital by Year**

For regional comparisons, see Appendix II Figure 51b

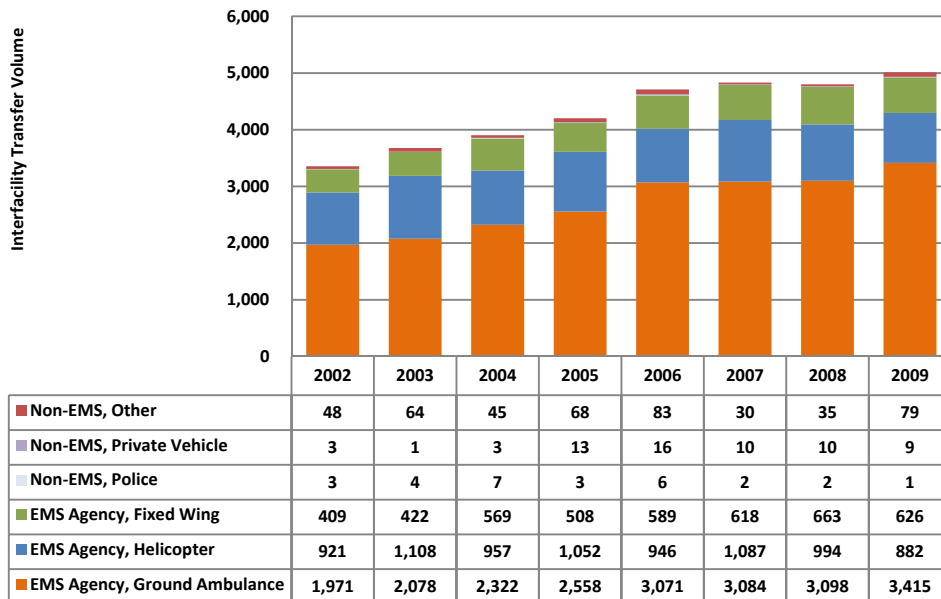


**Inter-facility transport mode:**

Air medical services are a major source of inter-facility transportation for trauma patients. In 2009, 36% of transfers were flown by helicopter or fixed wing to a receiving hospital.

**Figure 52: Transport Mode for Inter-facility Transfers by Year**

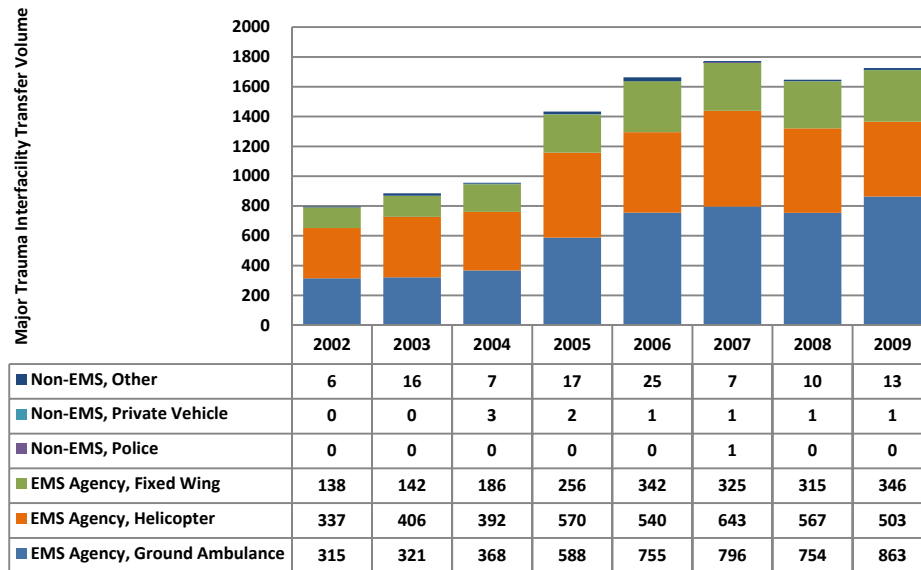
For regional comparisons, see Appendix II Figure 52b



For major trauma patients (ISS 16+), more than 50% of transfers involved the use of air medical resources in 2009.

**Figure 53: Transport Mode for Inter-facility Transfers of Seriously Injured (ISS 16+) Trauma Patients by Year**

[For regional comparisons, see Appendix II Figure 53b](#)

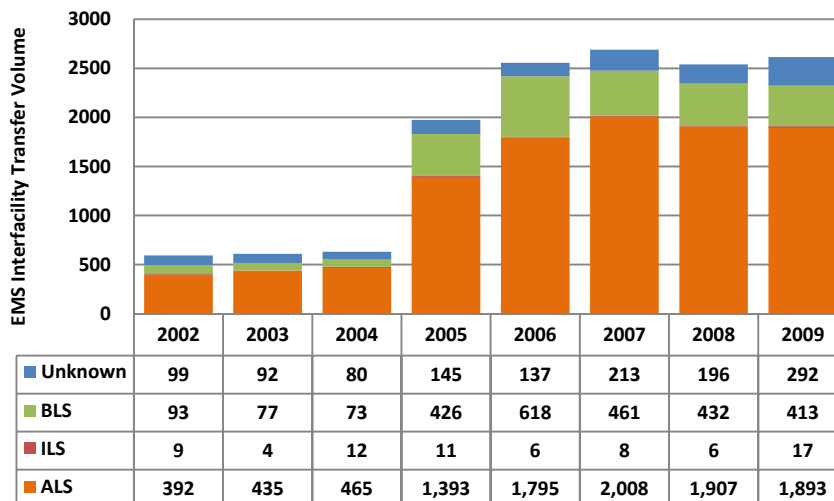


**Level of EMS service for inter-facility transfers:**

More than 3/4 of inter-facility transfers are performed by ALS-level personnel yearly. For major trauma patients, more than 90% of transfers every year are performed by ALS personnel.

**Figure 54: Level of EMS Service for Inter-facility Transfers by Year**

[For regional comparisons, see Appendix II Figure 54b](#)





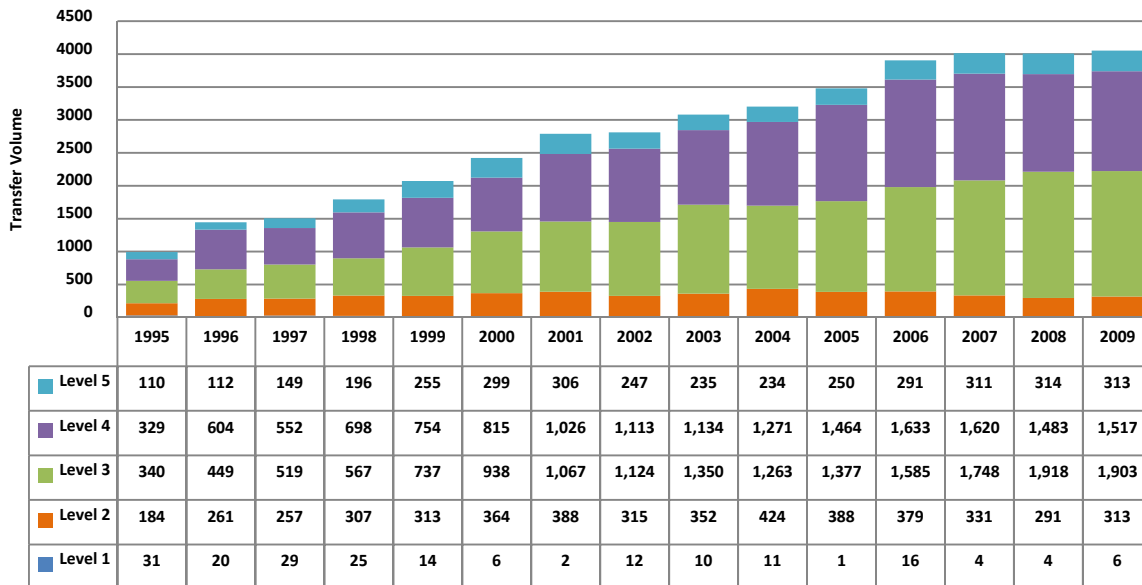
## Definitive care

### Inter-facility transfers:

Washington's trauma system aims to assure that patients are transported from the scene to a trauma facility within 30 minutes. Often, the nearby facility is a small, rural hospital with trauma designation of level IV or V. These initial receiving hospitals can provide resuscitation and stabilization prior to transfer to a higher level of care.

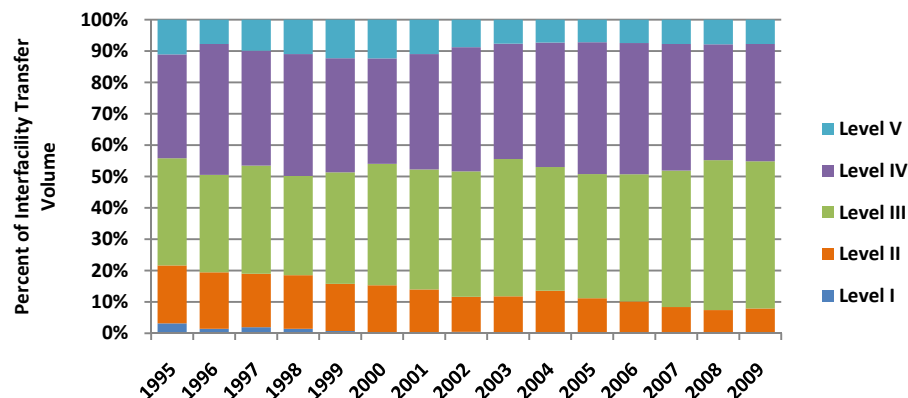
**Figure 55: Number of Transfers to another Acute Care Facility by Sending Hospital Designation Level and Year**

[For regional comparisons, see Appendix II Figure 55b](#)



Level IV and V facilities account for about 50% of yearly transfers within the trauma system. Level III facilities were the source of about 38% of transfers during 2007-2009, with a wide range of patients from severe multi-system trauma to relatively minor injuries with unique specialty needs. Over the years, the proportion of transfers from level II facilities decreased while transfers from level III facilities increased.

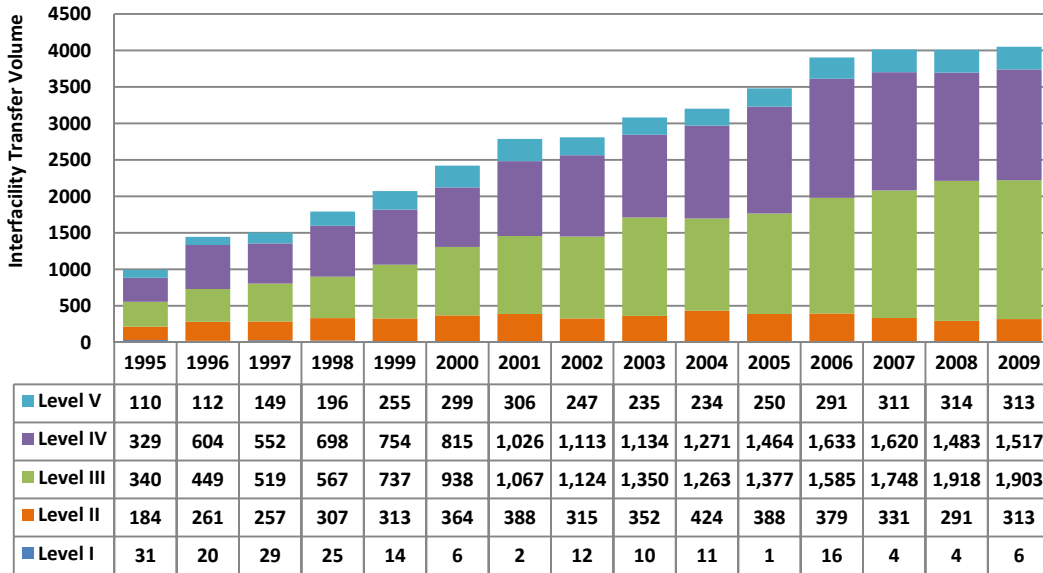
**Figure 56: Percentage of Transfers to another Acute Care Facility by Sending Hospital Designation Level and Year**



Since the inception of the trauma system, more than 60% of transferred patients are annually sent to a level I trauma service. About a quarter of yearly transferred patients are sent to one of Washington’s level II trauma services. Level III hospitals typically receive few trauma patients by transfer. Hospitals without trauma designation sometimes receive transfers, but typically, these are patients with relatively minor injuries who are transferred for managed-care coverage reasons.

**Figure 57: Number of Transfers to another Acute Care Facility by Receiving Hospital Designation Level and Year**

[For regional comparisons, see Appendix II Figure 57b](#)

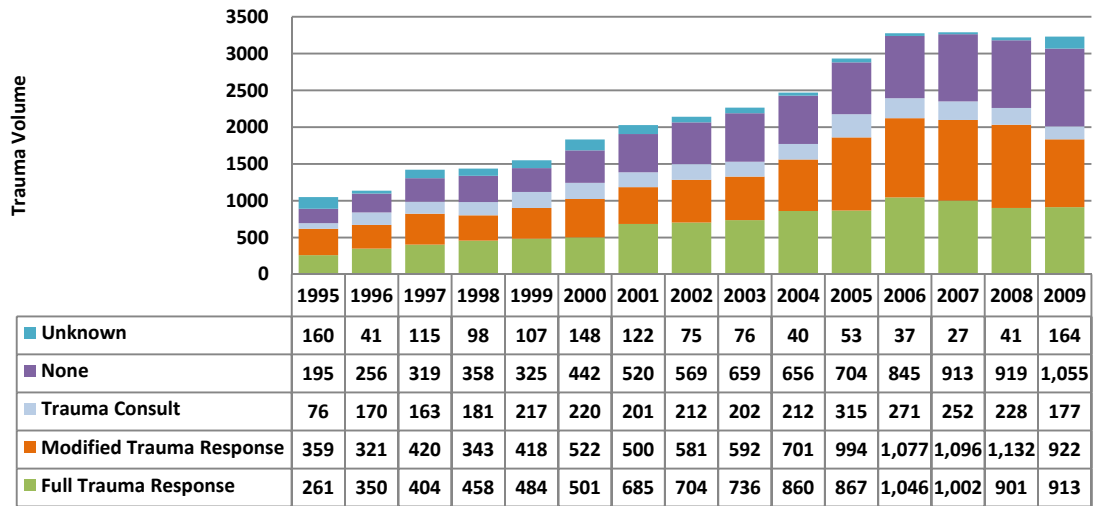


## Trauma team activation:

Trauma patients may require immediate surgical intervention to establish an airway and/or control bleeding. The trauma system emphasizes the importance of early mobilization of trauma teams in order to assure that optimal resources reach the patient in the least amount of time. In 2009, 30% of major trauma patients received full trauma team activations that include the response of a trauma/general surgeon.

**Figure 58: Trauma Team Activation Level for Major Trauma Patients (ISS>16)**

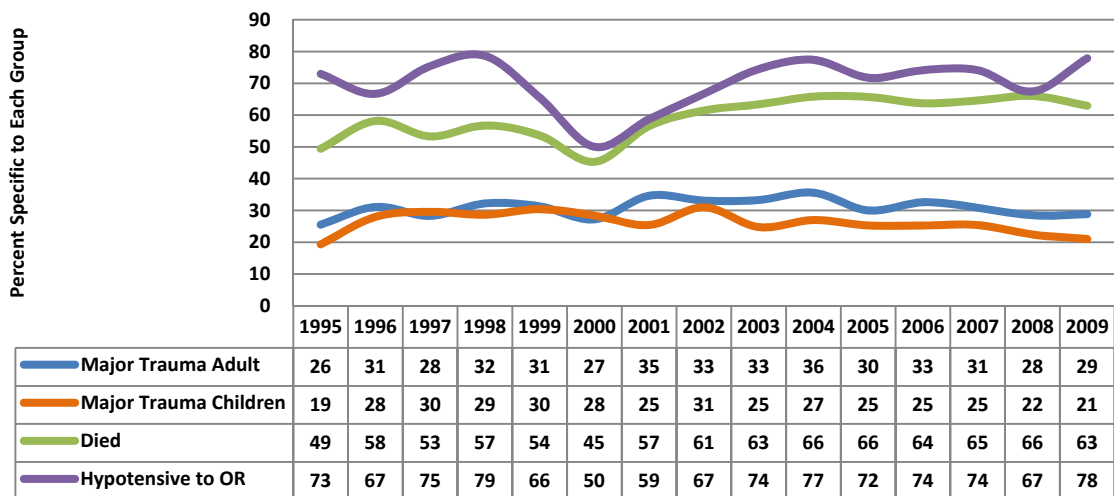
For regional comparisons, see Appendix II Figure 58b



For hypotensive patients<sup>3</sup> that required immediate surgical intervention, about 78% received full trauma team activations in 2009.

**Figure 59: Percentage of Selected Groups Receiving Full Trauma Team Activation by Year**

For regional comparisons, see Appendix II Figure 59b



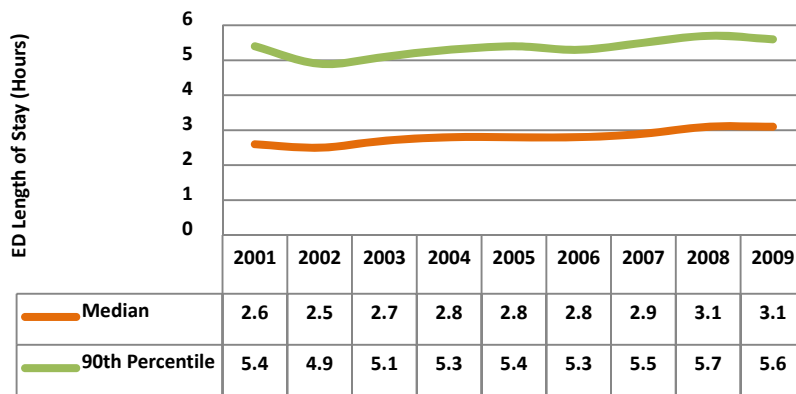
<sup>3</sup> Age-appropriate definitions for low systolic blood pressure: 0-12 months, systolic blood pressure < 60 mm Hg; 1-2 yrs, systolic blood pressure < 70 mm Hg; 3-5 yrs, systolic blood pressure < 75 mm Hg; 6-12 yrs, systolic blood pressure < 80 mm Hg; 13 and older, systolic blood pressure < 90 mm Hg.

### Time in the emergency department:

The American College of Surgeons includes an audit filter to examine transfer-out times of trauma patients occurring more than 6 hours after arrival in the emergency department. In Washington state, transfers generally occur much sooner than 6 hours, with a median of 3.1 hours to transfer in 2009. There was, however a 30-minute increase in the median ED times of transfer-out patients from 2.6 hours in 2001 to 3.1 hours in 2009.

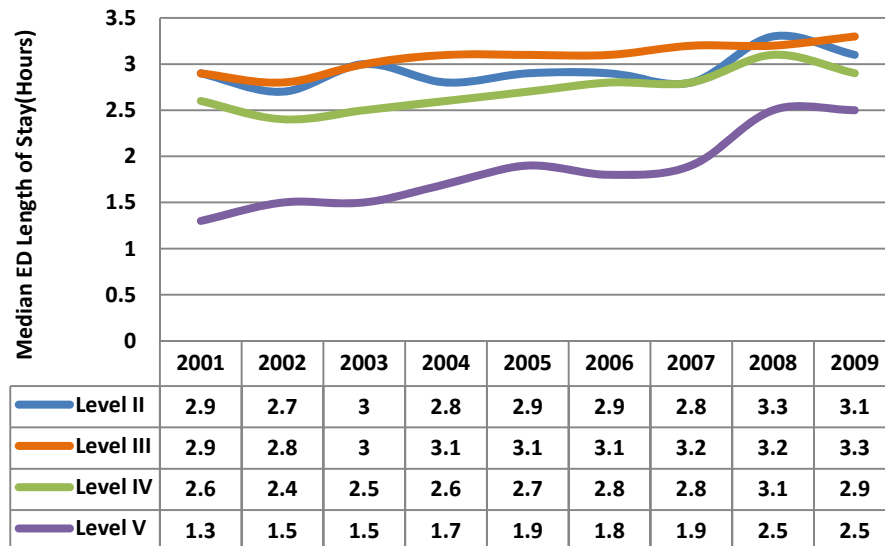
**Figure 60: Emergency Department Length of Stay Prior to Transfer by Year**

For regional comparisons, see Appendix II Figure 60b



Median ED times for patients who are transferred out increased steadily in all levels of trauma care while the most drastic increase has occurred in the level V facilities.

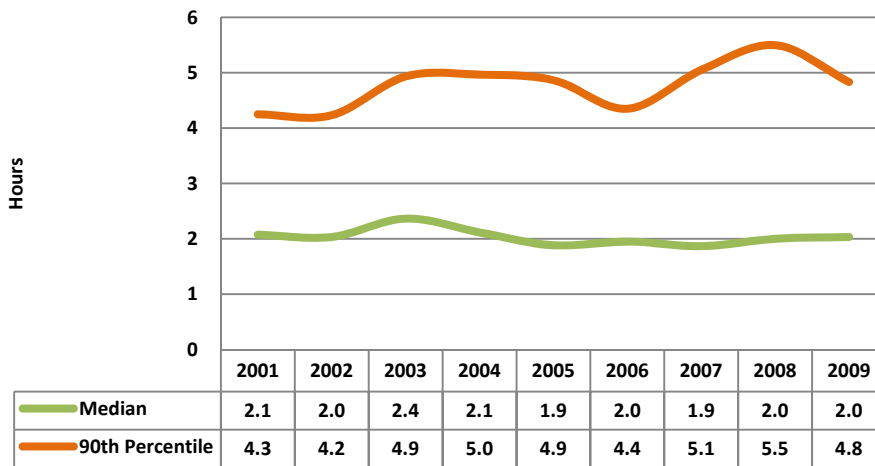
**Figure 61: Median Emergency Department Length of Stay Prior to Transfer by Level of Trauma Care and Year**



For major trauma patients sent directly to the operating room from the emergency department, the median time in the emergency department was about 2 hours in 2009, and about 90% of these patients reached the operating room within about 4.8 hours.

**Figure 62: Time from Arrival to Operating Room for Major Trauma (ISS 16+) Patients Sent Directly From the Emergency Department to Operating Room**

[For regional comparisons, see Appendix II Figure 62b](#)

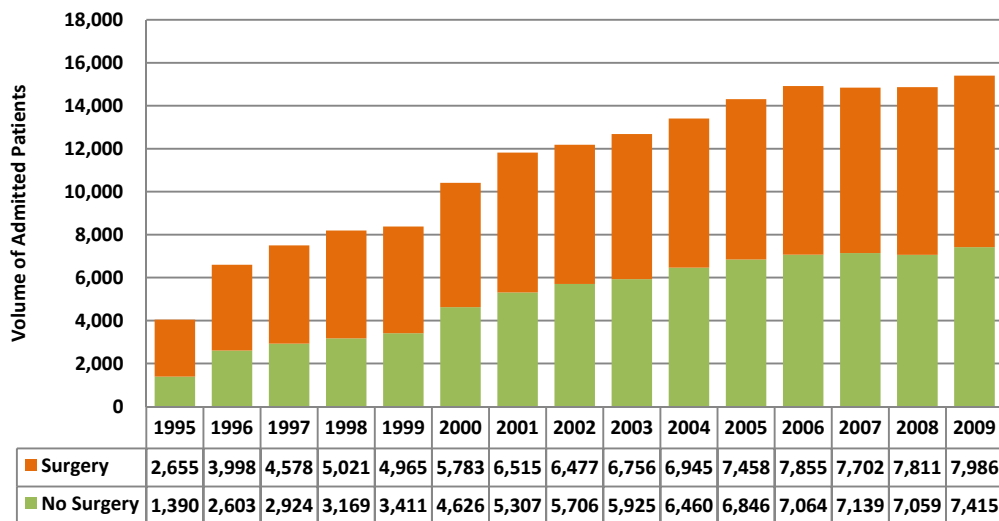


### Surgical care:

The volume of trauma patients requiring surgery at some point during their hospital admission has relatively stabilized since 2005 after a period of fast growth during 1995-2004. In 2009, about half (52%) of trauma patients received surgical interventions.

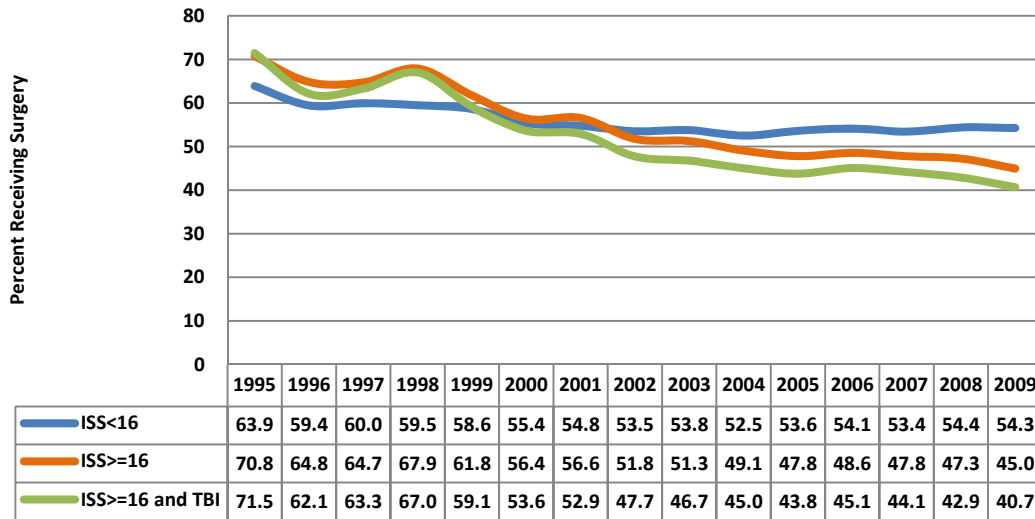
**Figure 63: Surgery Performed on Admitted Patients by Year**

[For regional comparisons, see Appendix II Figure 63b](#)



The percentage of patients receiving surgery has declined from 1995 to 2009. This trend is noticeable in patients with both low and high severity injuries as well as those with high acuity traumatic brain injuries.

**Figure 64: Percentage of Admitted Patients Undergoing Surgery by Injury Severity Score (ISS) and/or Traumatic Brain Injury**

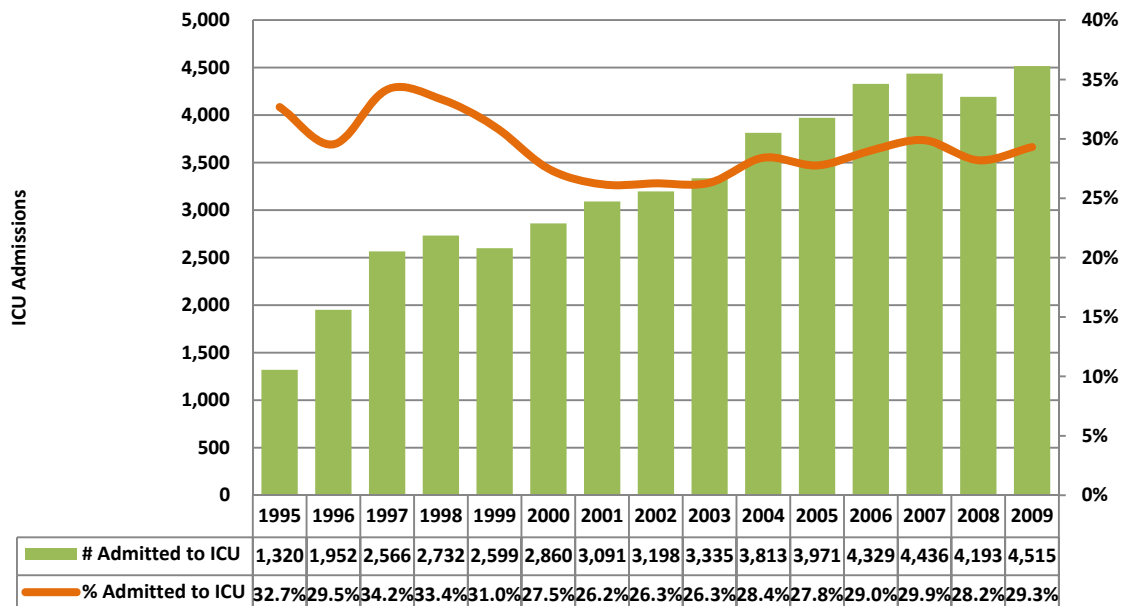


**Intensive/critical care:**

In 2009, 4,515 trauma patients were admitted to an intensive care unit. The proportion of admitted trauma patients receiving critical care has remained relatively stable over the past 6 years around 28-29%.

**Figure 65: Intensive Care Unit Admissions by Year**

[For regional comparisons, see Appendix II Figure 65b](#)

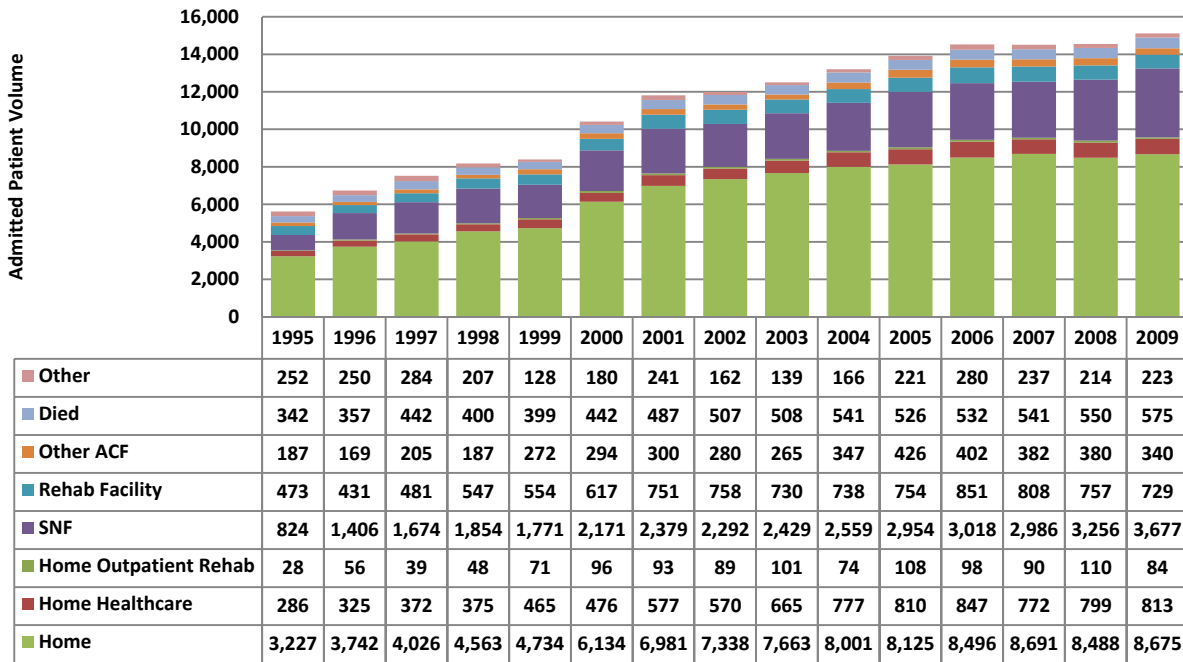


## Hospital disposition:

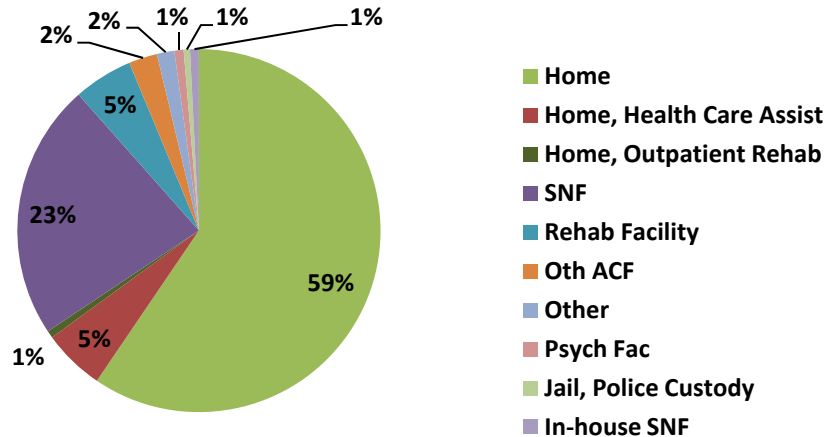
The percentage of admitted trauma patients who experience death in the hospital has dropped from about 6.1% in 1995 to 3.7% in 2009. About 2/3<sup>rd</sup> of all admitted patients are annually discharged to home, either independently or with supportive assistance. The percentage of patients discharged to skilled nursing facilities (SNF) has increased from about 15% in 1995 to 24% in 2009. Discharges to rehabilitation services, on the other hand, decreased from 8% in 1995 to 5% in 2009.

**Figure 66: Hospital Disposition for Admitted Patients by Year**

For regional comparisons, see Appendix II Figure 66b



**Figure 67: Hospital Disposition of Trauma Survivors, 2007-2009**



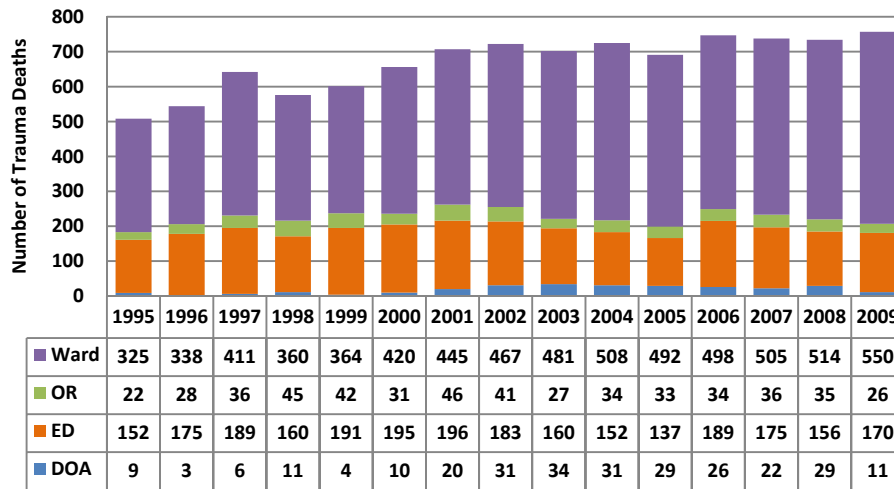
*Trauma outcomes*

**Trauma deaths:**

The overall number of trauma deaths in the state registry has increased with the increase in overall patient volume. The proportion of deaths pronounced in the emergency department has decreased from about 29.2% in 1995 to 22.5% in 2009. About 4-6% of deaths occur in the operating room, and this proportion has remained stable over the last fifteen years.

**Figure 68: Location of Death by Year**

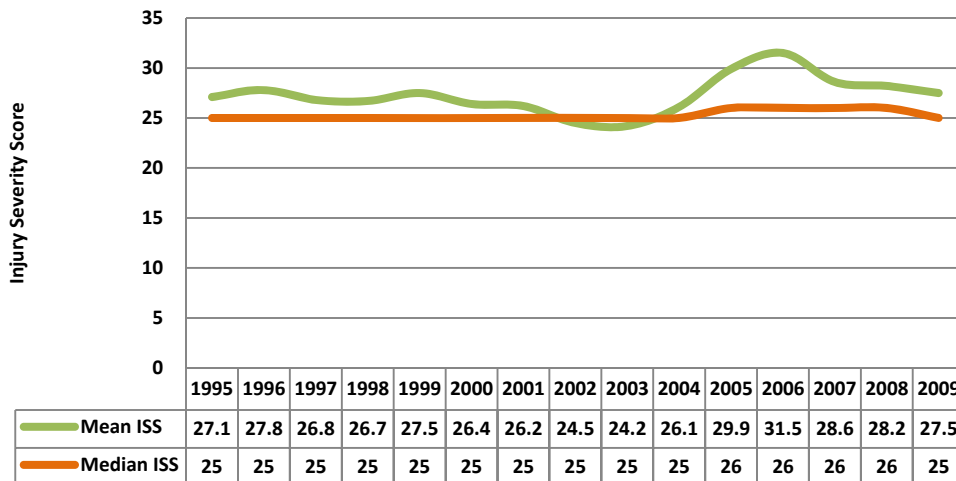
[For regional comparisons, see Appendix II Figure 68b](#)



The median Injury Severity Score of traumatic deaths has remained relatively unchanged over the first fifteen years of the trauma system.

**Figure 69: Injury Severity Score (ISS) of Deaths by Year**

[For regional comparisons, see Appendix II Figure 69b](#)



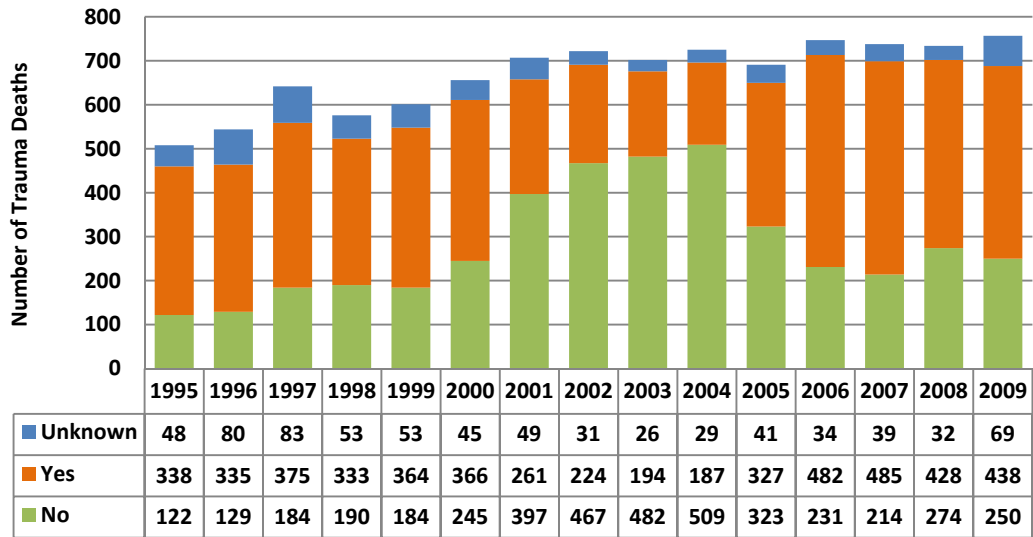


## Autopsies for trauma deaths:

Autopsies can provide important information for trauma quality improvement by providing definitive answers about the nature of trauma sustained and immediate causes of death. The percentage of trauma deaths receiving autopsies has decreased dramatically from 73.5% in 1995 to 26.9% in 2004. Since 2005, the percentage of trauma deaths receiving autopsies is on the rise again.

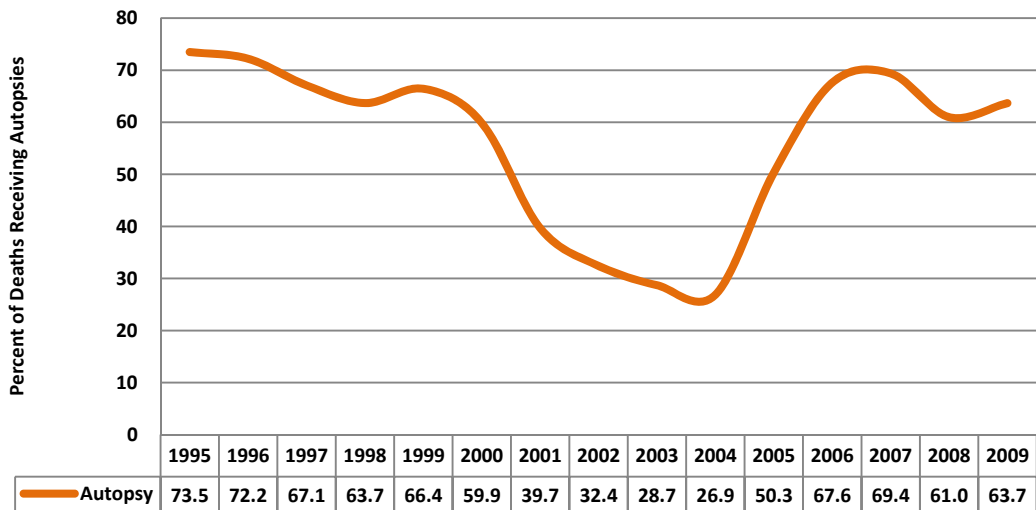
**Figure 70: Autopsies Performed by Year**

[For regional comparisons, see Appendix II Figure 70b](#)



**Figure 71: Percentage of Trauma Deaths Receiving Autopsies by Year**

[For regional comparisons, see Appendix II Figure 71b](#)

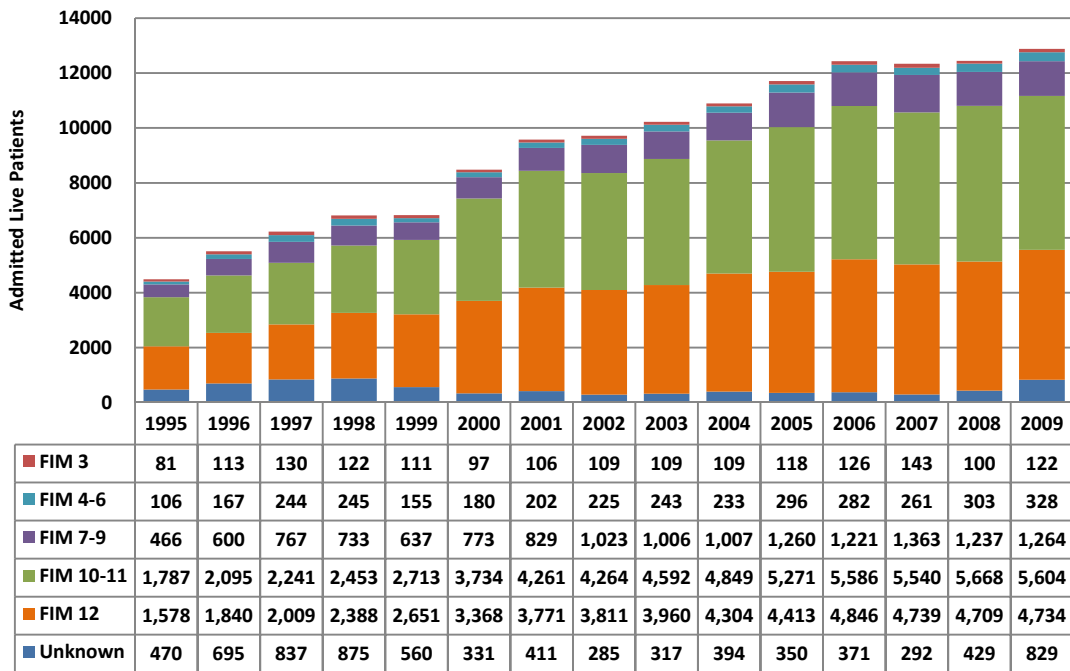


## Impairment and disability of survivors:

The trauma registry includes a functional independent measure (FIM) to characterize patient disability or impairment at discharge. The FIM components (self-feeding, expression, and locomotion) provide a useful summary measure of disability at discharge from acute care. This impairment may or may not be permanent, and the trauma registry does not include follow-up data on impairment after discharge. The FIM score ranges from 3 (totally dependent) to 12 (totally independent). More than half of admitted trauma patients who survive their injuries are discharged yearly with some impairment as evidenced by a FIM score of less than 12. Less than 1% of annual survivors age 15+ are totally dependent at discharge.

**Figure 72: Functional Independence Measure at Discharge for Survivors (Age >=15) by Year**

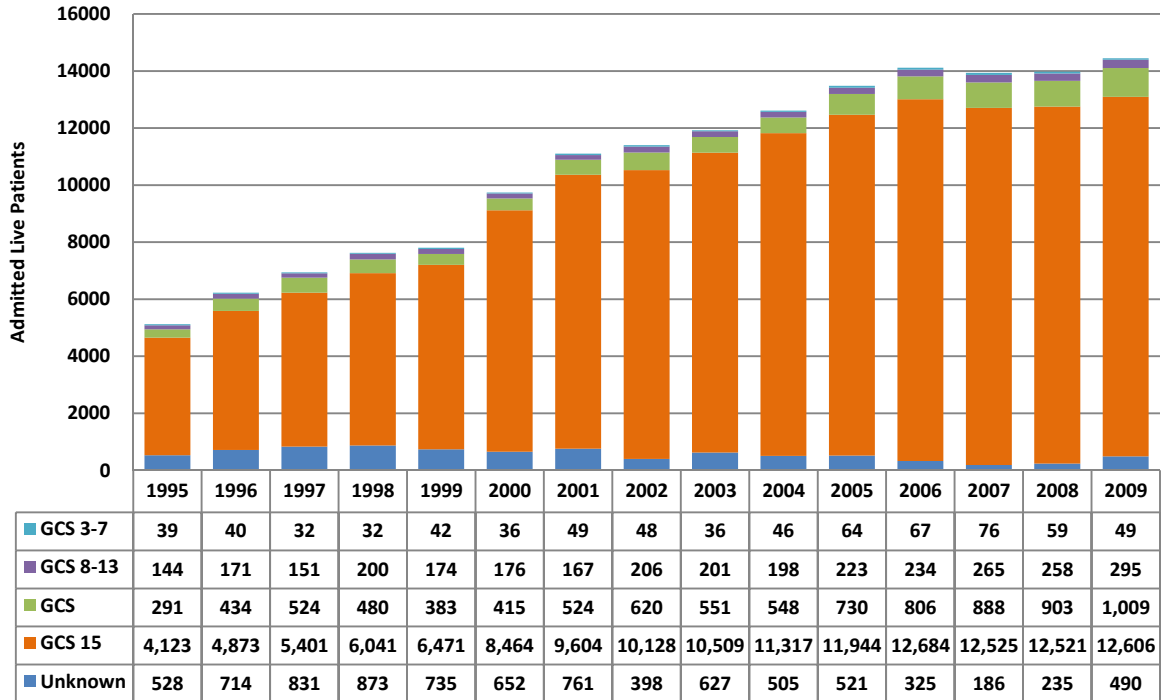
[For regional comparisons, see Appendix II Figure 72b](#)



Traumatic brain injuries may lead to long-lasting cognitive impairment. The trauma registry includes Glasgow Coma Scale (GCS) at discharge. The GCS is a widely used index that assesses the degree of coma in patients with craniocerebral injuries. The GCS components (eye opening, verbal response, and motor response) create a summary score ranging from 3 (comatose) to 15 (no coma indicated). In 2009, 87% of survivors aged 2 and older were discharged with a GCS of 15. Less than 1% were discharged with substantial severe cognitive impairment (GCS<8).

**Figure 73: Glasgow Coma Score at Discharge by Year (Survivors, Age 2+)**

[For regional comparisons, see Appendix II Figure 73b](#)

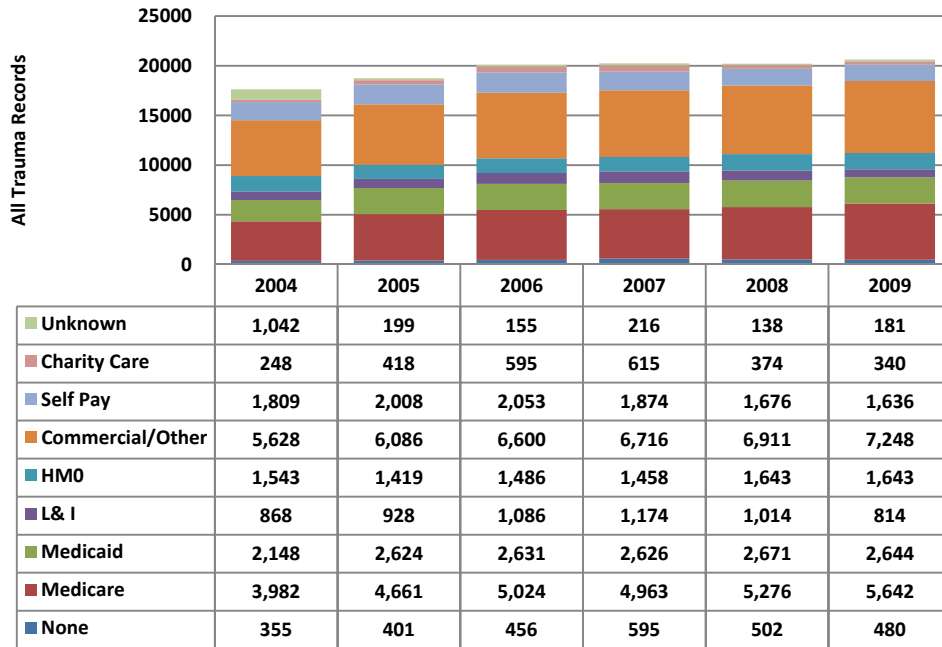


## Finance

Financial data from participating trauma services have improved, but remain challenging. About 6% of records were missing payer information in 2004 compared to less than 1% in 2009. Hospital charges are available only for about 58 % of records – which is a decline from 82% during 2001-2002.

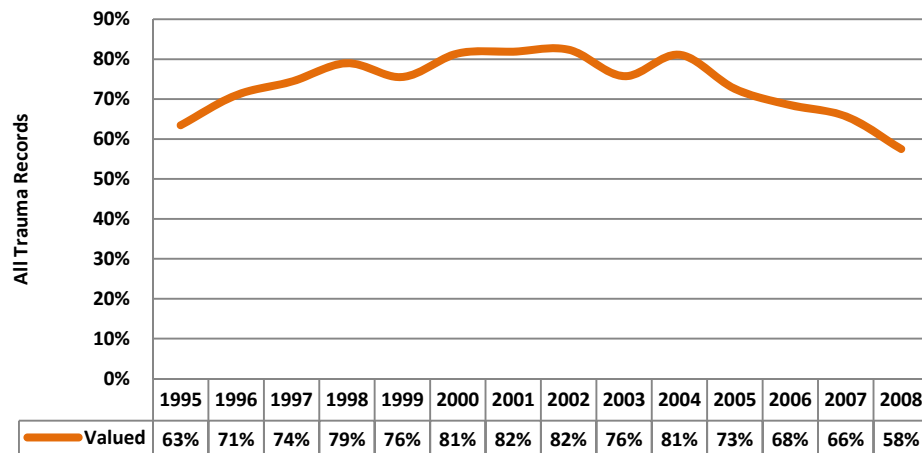
**Figure 74: Primary Payer by Trauma Records by Year**

[For regional comparisons, see Appendix II Figure 74b](#)



**Figure 75: Percentage of Trauma Registry Records with Hospital Charges Available**

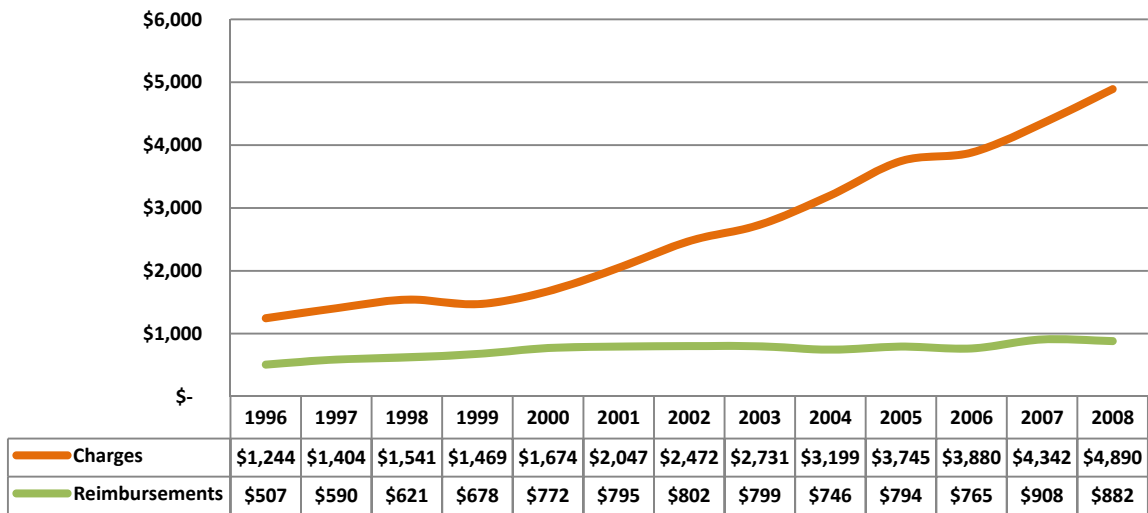
[For regional comparisons, see Appendix II Figure 75b](#)



Median charges appear to be increasing faster than median reimbursement for patients transferred from the emergency department to another acute care facility as well as for patients admitted to the hospital.

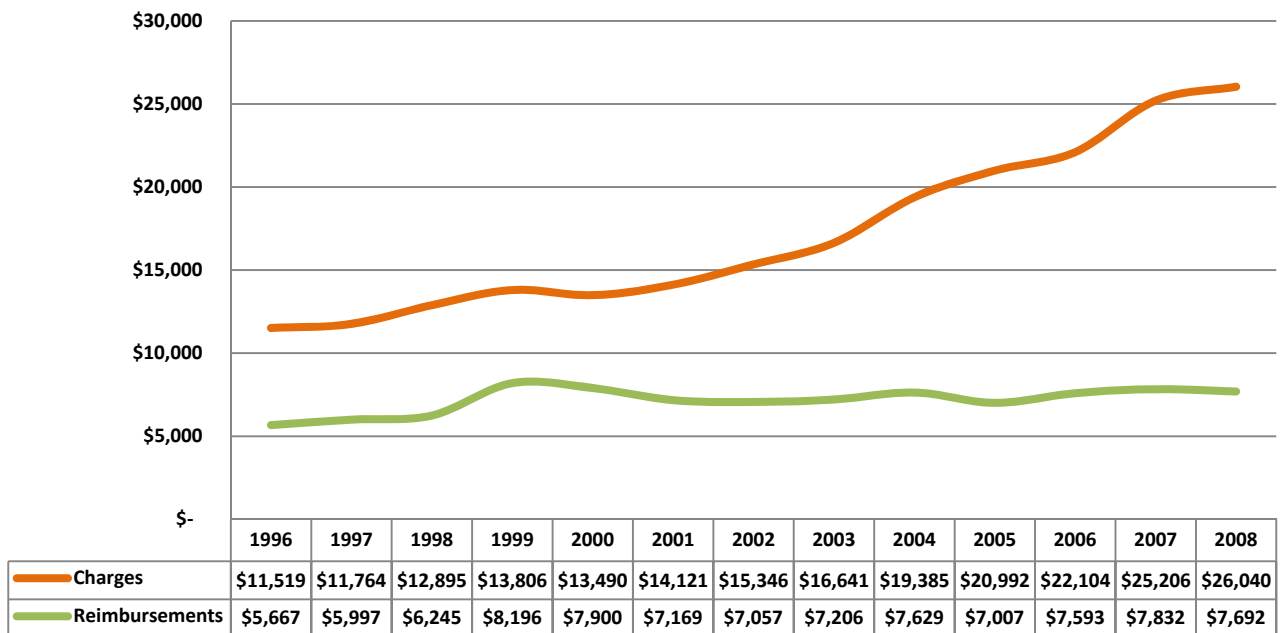
**Figure 76: Median Charges and Reimbursement by Year for Patients Transferred From ED to another Acute Care Facility**

[For regional comparisons, see Appendix II Figure 76b](#)



**Figure 77: Median Charges and Reimbursement by Year for Patients Admitted to the Hospital**

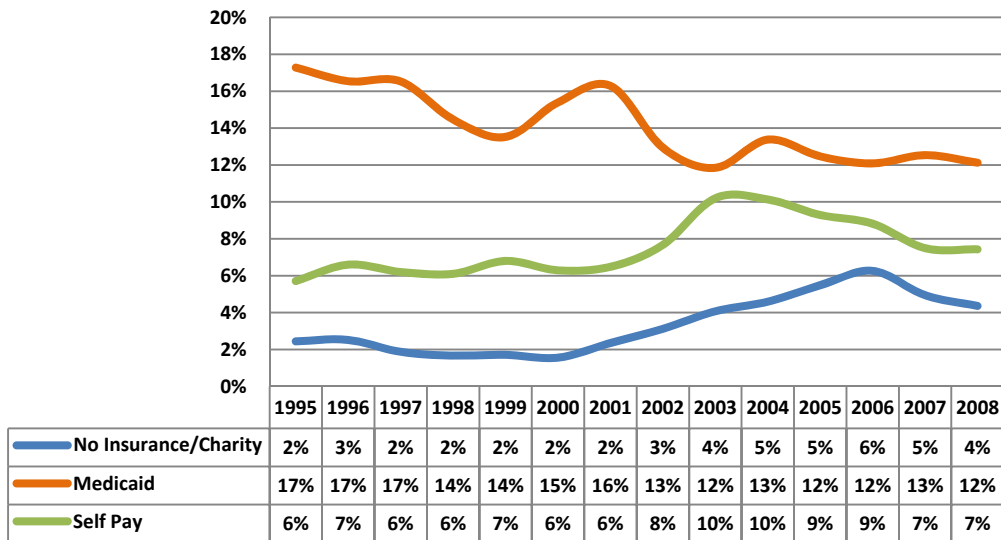
[For regional comparisons, see Appendix II Figure 77b](#)



The percentage of Medicaid patients has decreased from about 17% of trauma volume in 1995 to 12% in 2009. During the same period, self-pay patients and those identified as no insurance or charity care increased.

**Figure 78: Percentage of Patients with Medicaid vs. Self-Pay vs. No Insurance/Charity Care as Primary Payer by Year**

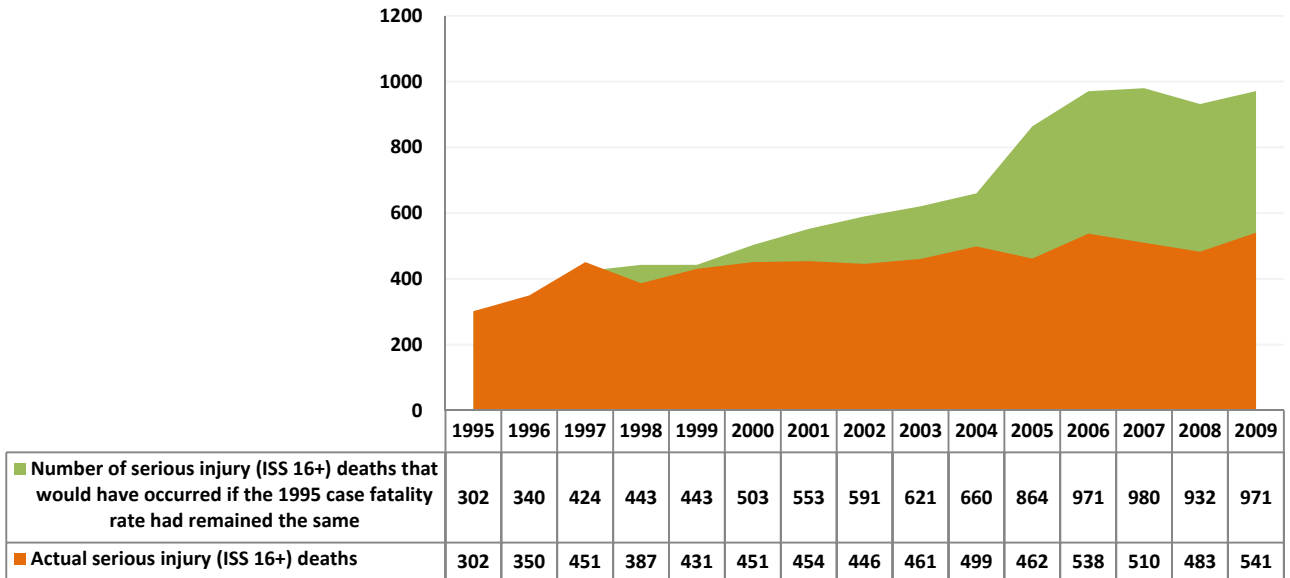
[For regional comparisons, see Appendix II Figure 78b](#)



## Potential lives saved

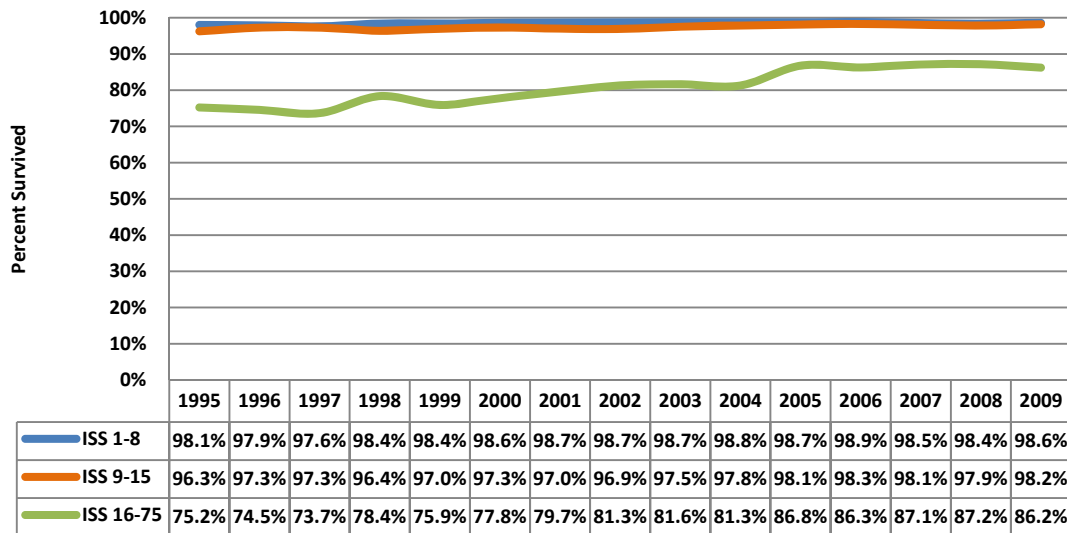
Since the Washington Trauma System began, in-hospital mortality has decreased. If the 1995 in-hospital performance continued through 2009, additional trauma deaths would have been expected.

**Figure 79: Potential Lives Saved**



The case survival rate for critically injured trauma patients steadily increased since inception, and leveled out during 2006-2009 at around 86%.

**Figure 80: Percentage of Trauma Survivors by ISS Group and Year**



## *Appendix I: Washington State Trauma Registry Inclusion Criteria*

### Washington State Trauma Registry Inclusion Criteria

*(Effective Jan 2002-Dec 2010)*

**Data must be reported to the Washington Trauma Registry (WTR) for all patients with a discharge ICD9-CM diagnosis code of 800-904, or 910-959, or 994.1 (drowning), 994.7 (asphyxiation), or 994.8 (electrocution) AND any one or more of the following:**

- All trauma patients who were dead on arrival at your facility; or
- All trauma patients who died in your facility; or
- All trauma patients transferred out to another facility by EMS/ambulance; or
- All trauma patients transferred in from another facility by EMS/ambulance; or
- All pediatric (age 0-14) trauma patients admitted to your facility; or
- All adult (age 15+) trauma patients admitted to your facility with length-of-stay more than 2 days (48 hours)

Note: *The diagnosis codes above include all sub-codes; e.g., 806 includes 806.00-806.99.*

While **isolated hip fractures/femoral neck fractures** (ICD9-CM 820 with no other significant injuries noted) in elderly patients are included in registry requirements, WAC 246-976-420, *DOH does not require you to report those injuries at this time. It is applicable to patients 65 and older.*

Patients with diagnoses of **foreign bodies** (ICD9-CM 930-939) are required to be included in the registry **only if** there is a resulting injury. In these cases, the resulting injury should be coded in addition to the foreign body.

**Transfers:** Patients sent from one hospital to another hospital via private vehicle (non-ambulance) are not considered transfers for the purpose of inclusion. It is expected that patients with serious injuries will be transferred via ambulance, and that private vehicles are used only for patients with minor injuries.

**Admitted to your facility:** Patients moved from the emergency department to any bed in the hospital are considered admitted to the facility.

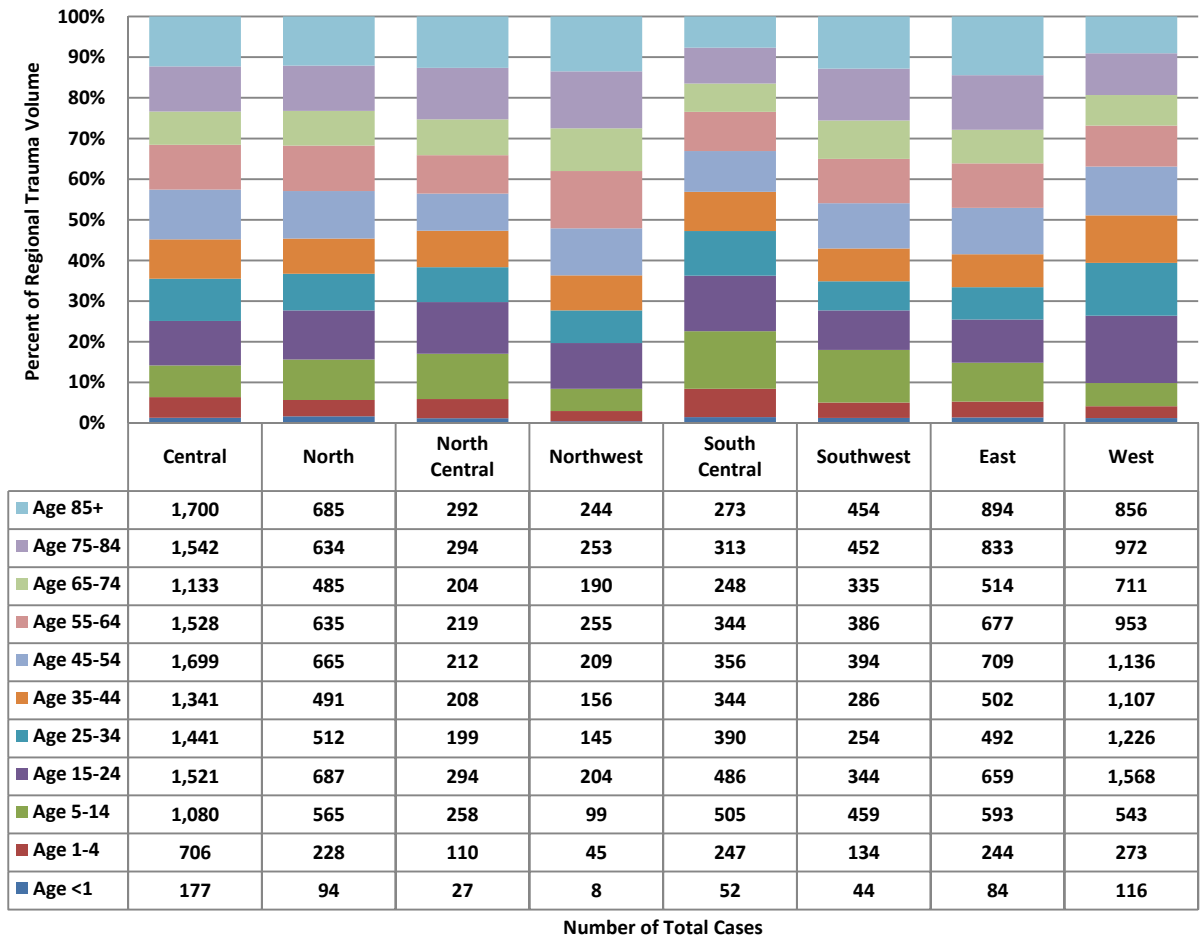
**Readmissions:** The Trauma Registry does not require readmission records for the same injury. Only the initial episode of care (first admission) is required. Exception: If a patient is discharged home from the emergency department and is subsequently admitted for a missed diagnosis of the same injury, both records should be included.

Trauma services may include additional patients that do not meet the state inclusion criteria. However, hospital comparative reports, regional quality improvement reports, and other state-prepared reports will only reflect records that meet the state criteria. This helps assure comparability across facilities and regions.

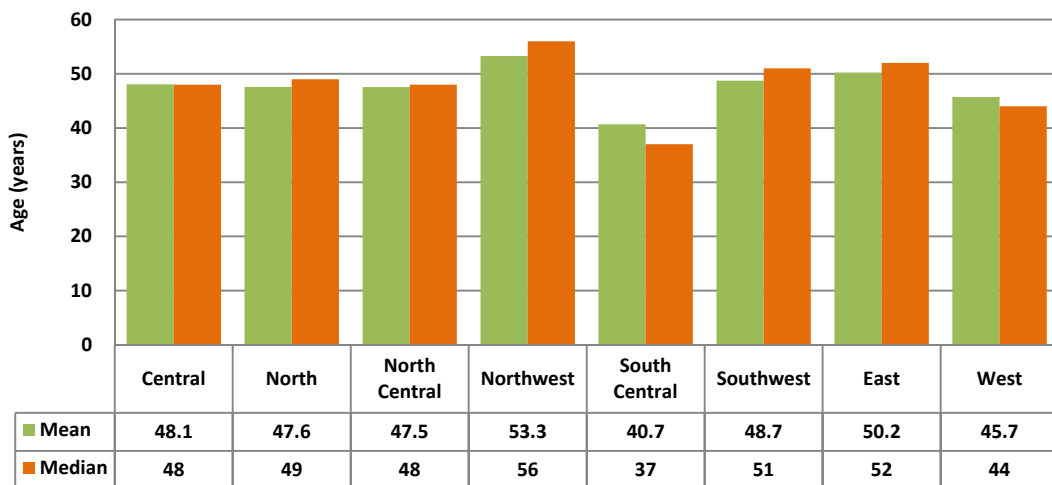


## Appendix II: Regional Comparisons

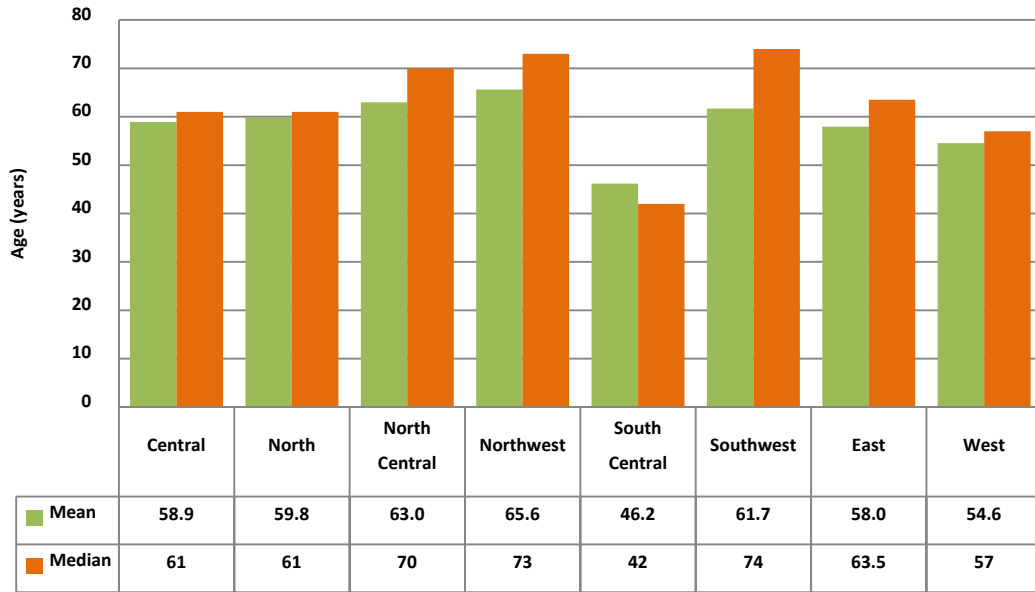
**Figure 2b: Trauma Volume by Age Groups and Region, 2007-2009**



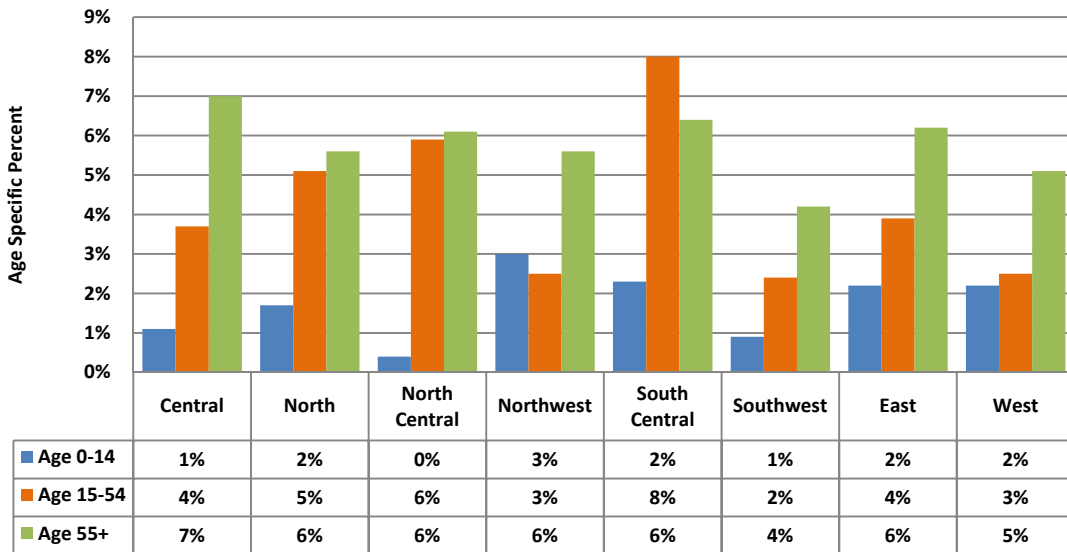
**Figure 2b: Mean and Median Age of Trauma Patients by Region, 2007-2009**



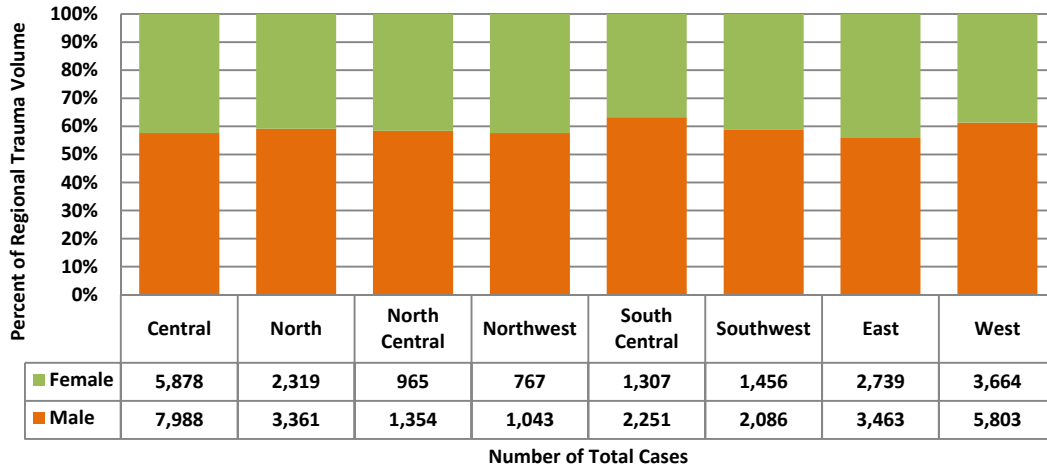
**Figure 3b: Mean and Median Age of Trauma Deaths by Region, 2007-2009**



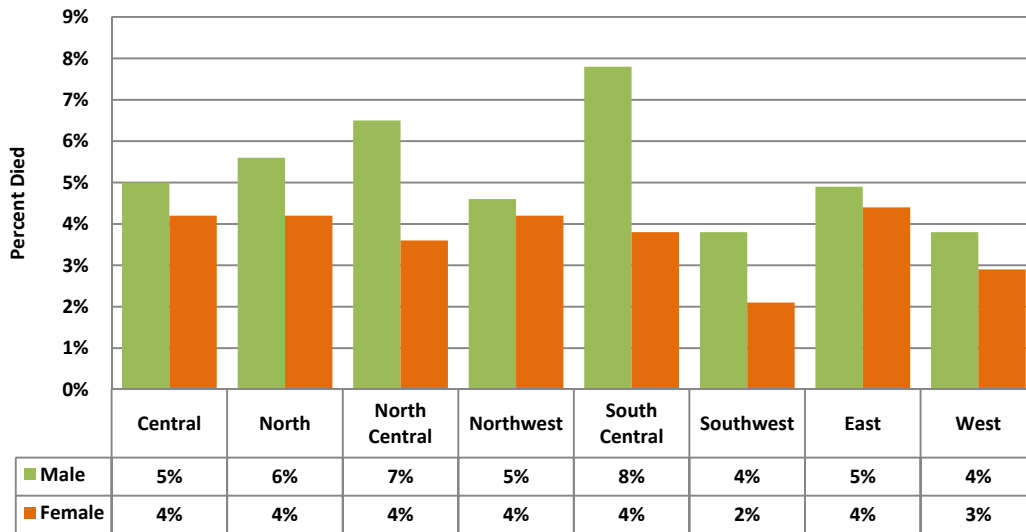
**Figure 4b: Trauma Mortality by Age and Region, 2007-2009**



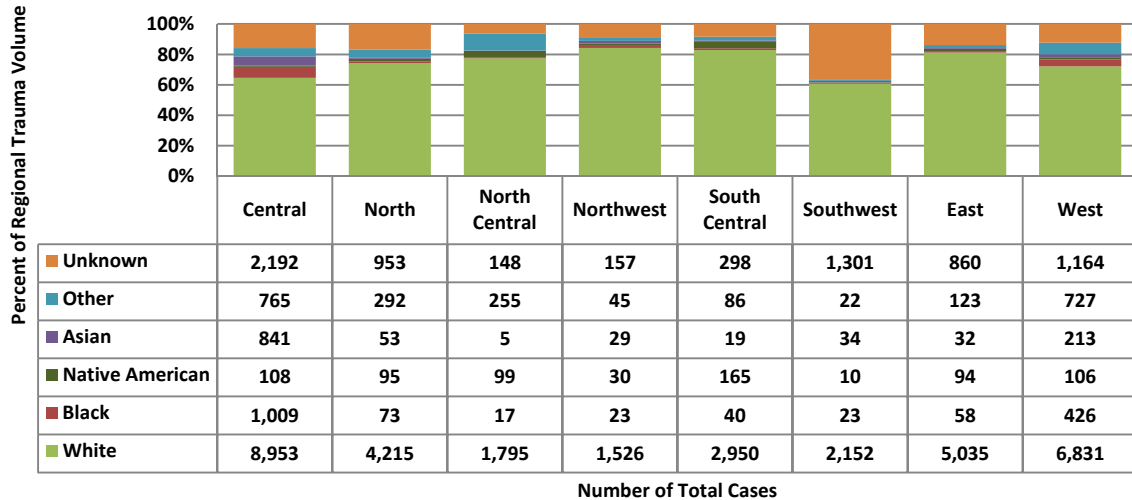
**Figure 9b: Gender by Region, 2007-2009**



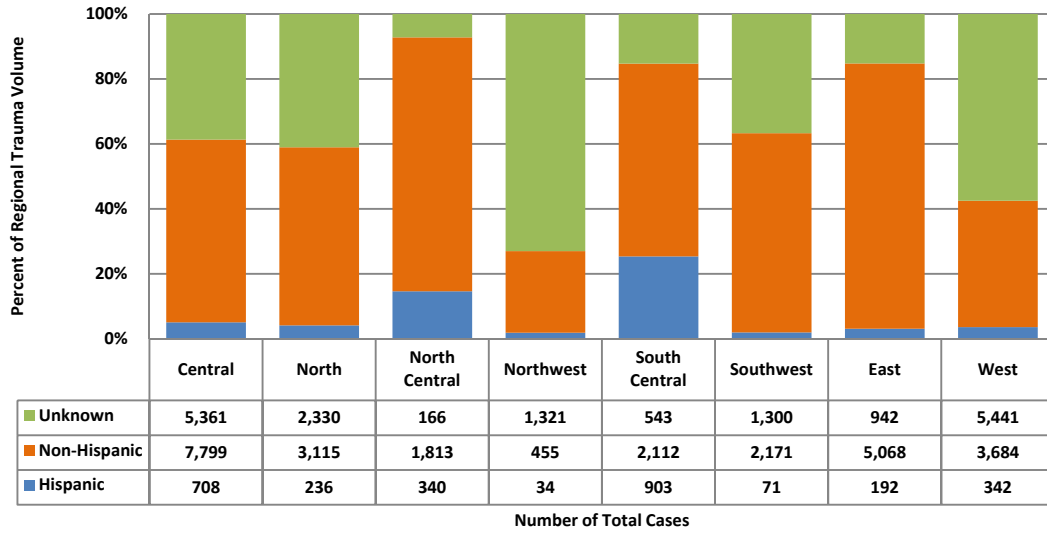
**Figure 10b: In-Hospital Mortality by Gender and Region, 2007-2009**



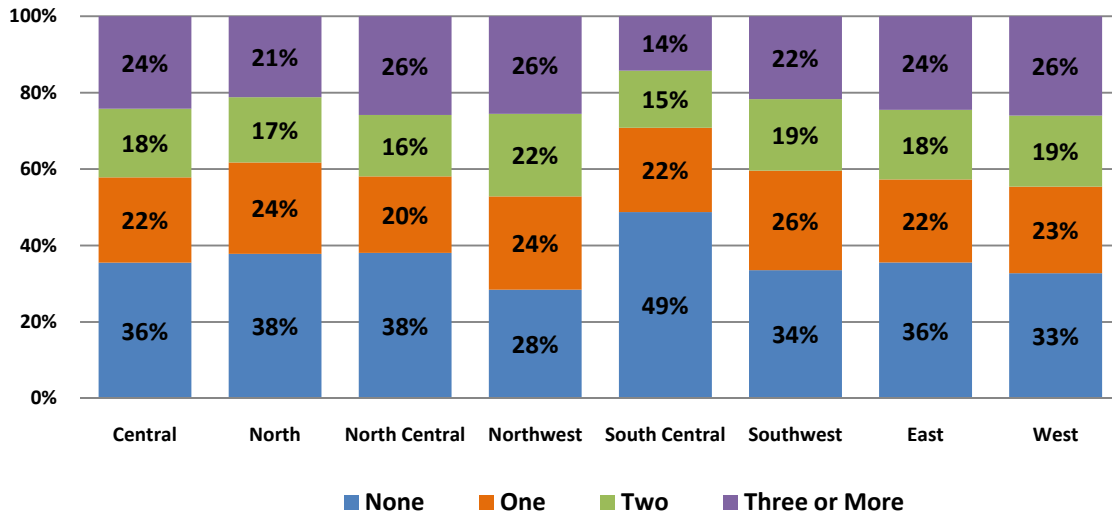
**Figure 11b: Race of Trauma Patients by Region, 2007-2009**



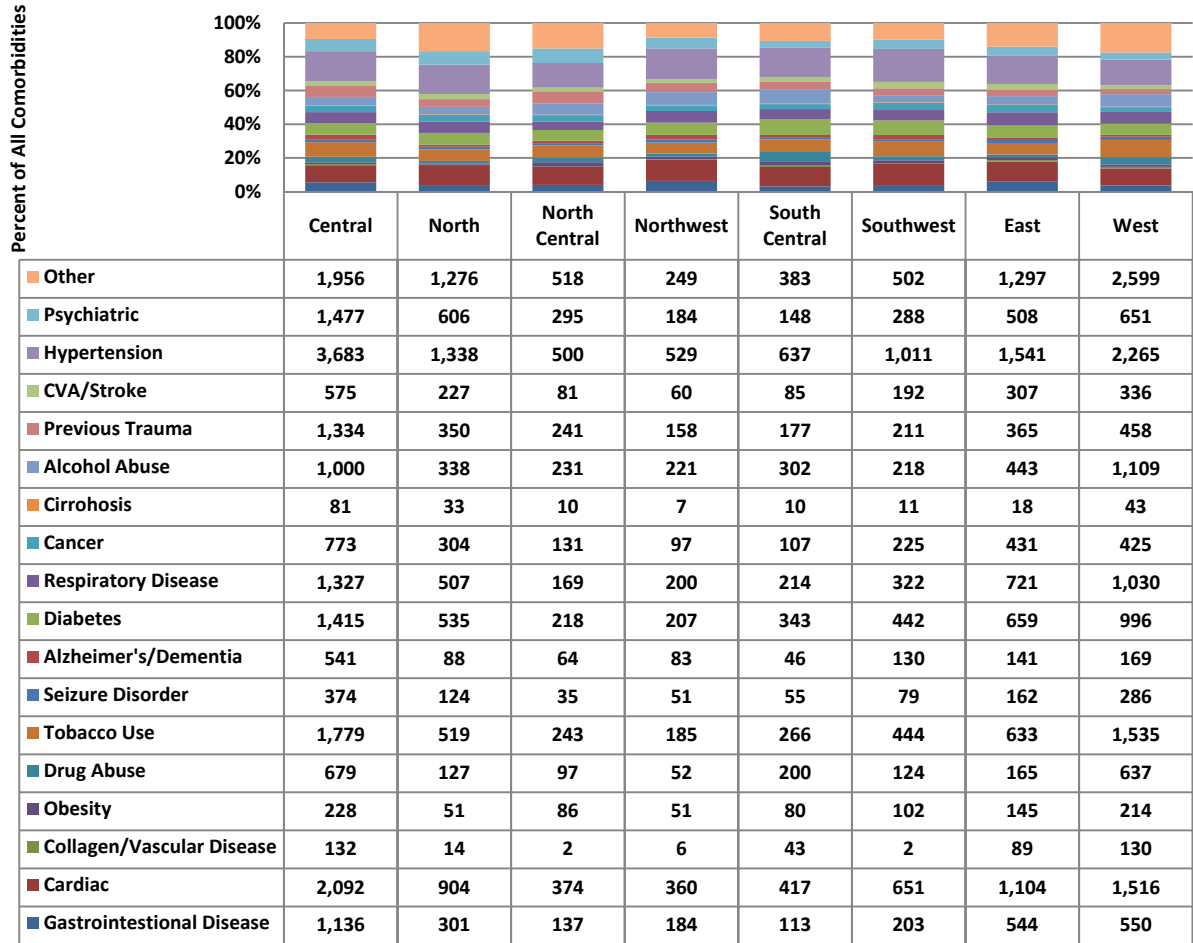
**Figure13b: Ethnicity of Trauma Patients by Region, 2007-2009**



**Figure 15b: Percentage of Pre-existing Conditions per Patient by Region, 2007-2009**

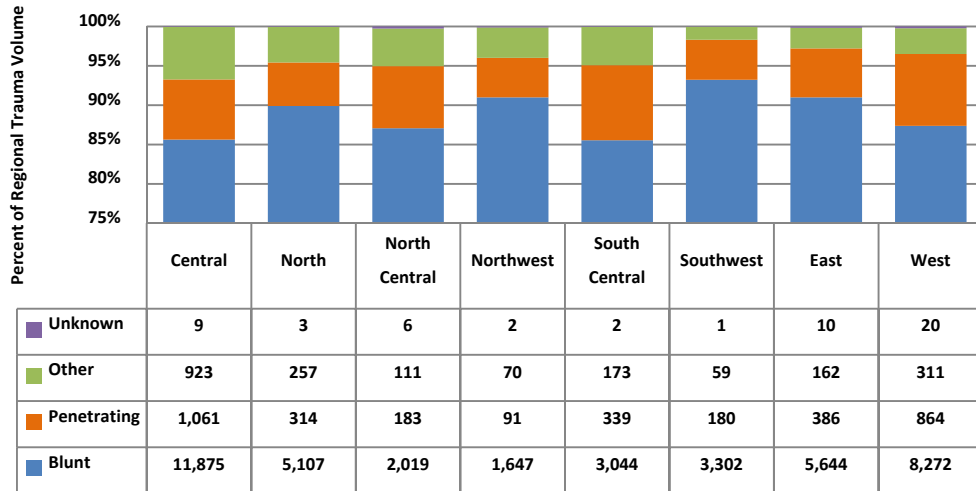


**Figure 16b: Number and Percentage of Pre-existing Conditions, 2007-2009**



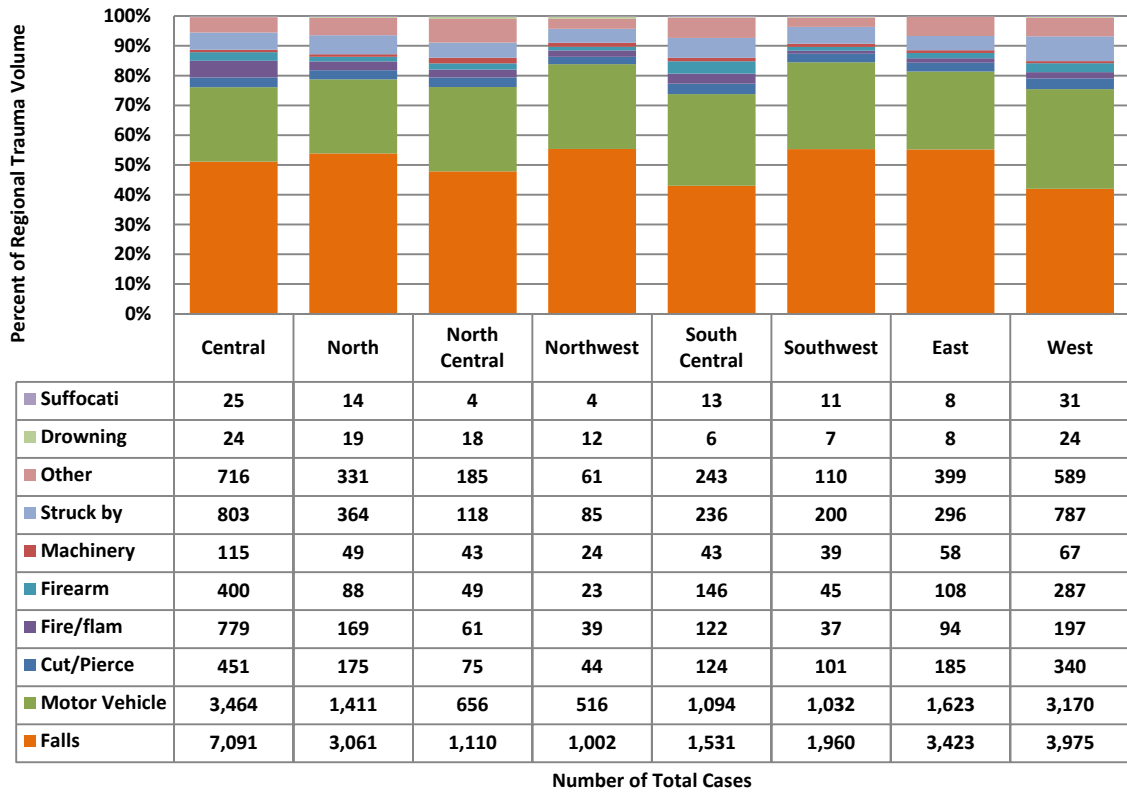
Number of Total Cases

**Figure 17b: Injury Type by Region, 2007-2009**

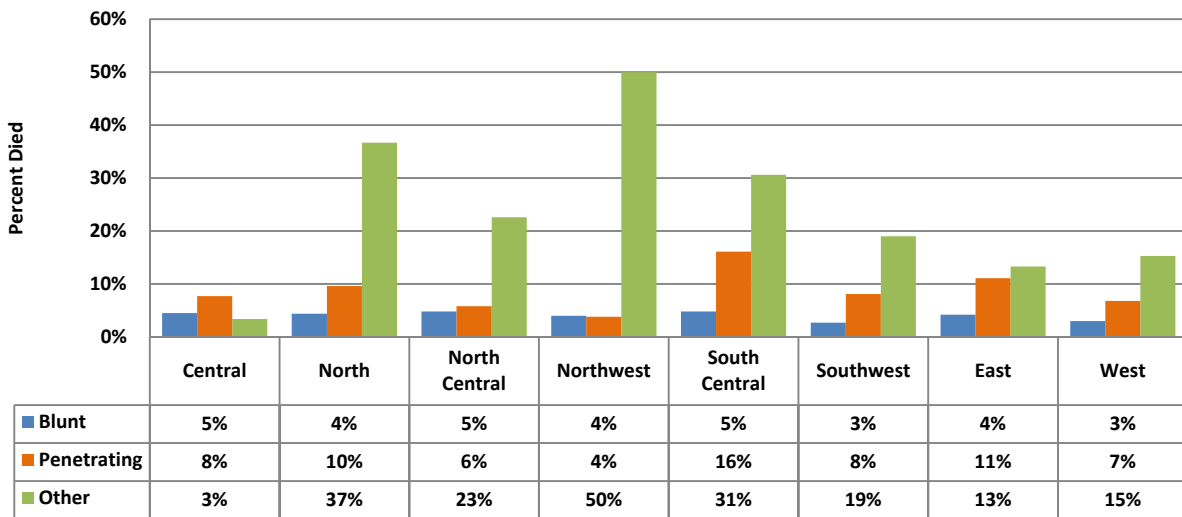


Number of Total Cases

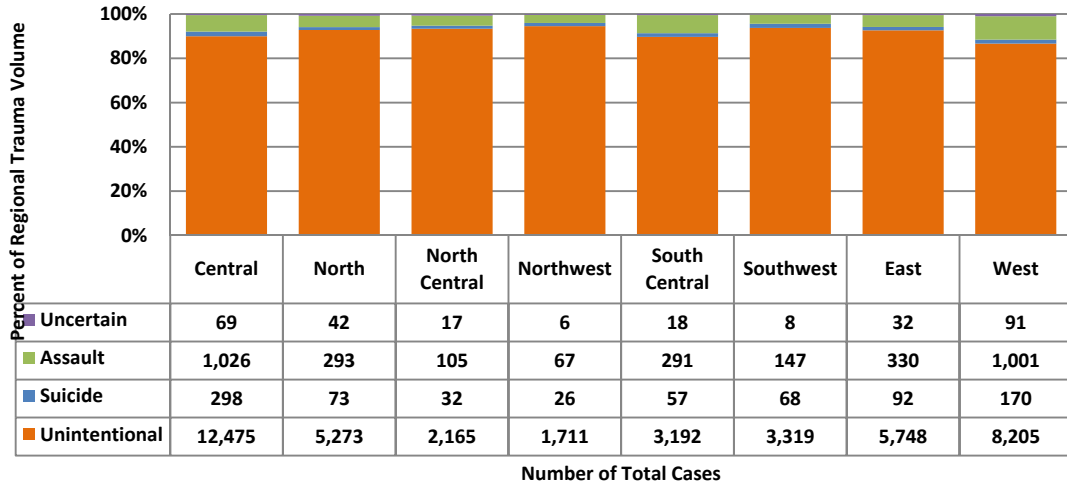
**Figure 18b: Mechanism of Injury by Region, 2007-2009**



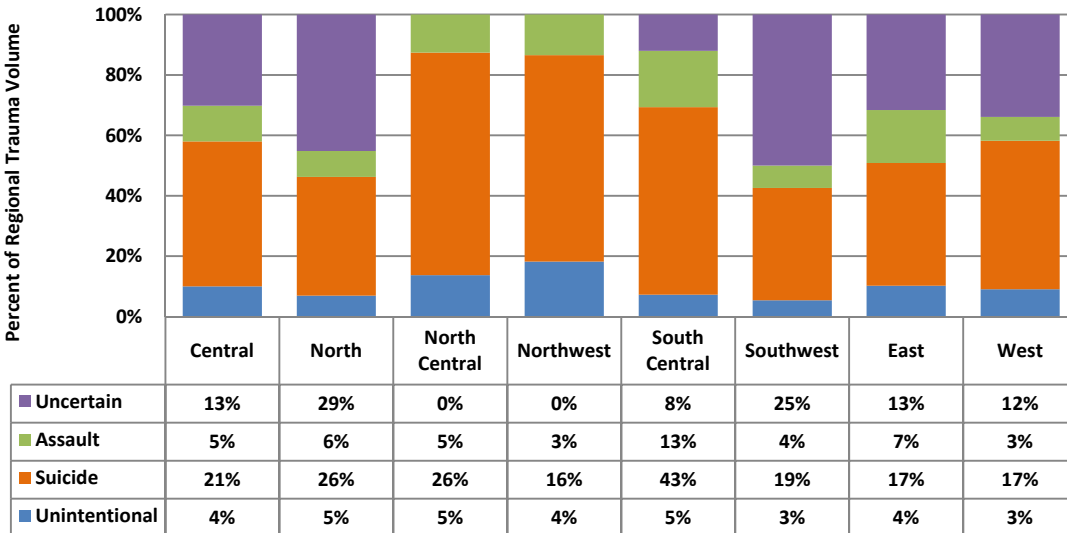
**Figure 19b: Trauma Mortality by Injury Type and Region, 2007-2009**



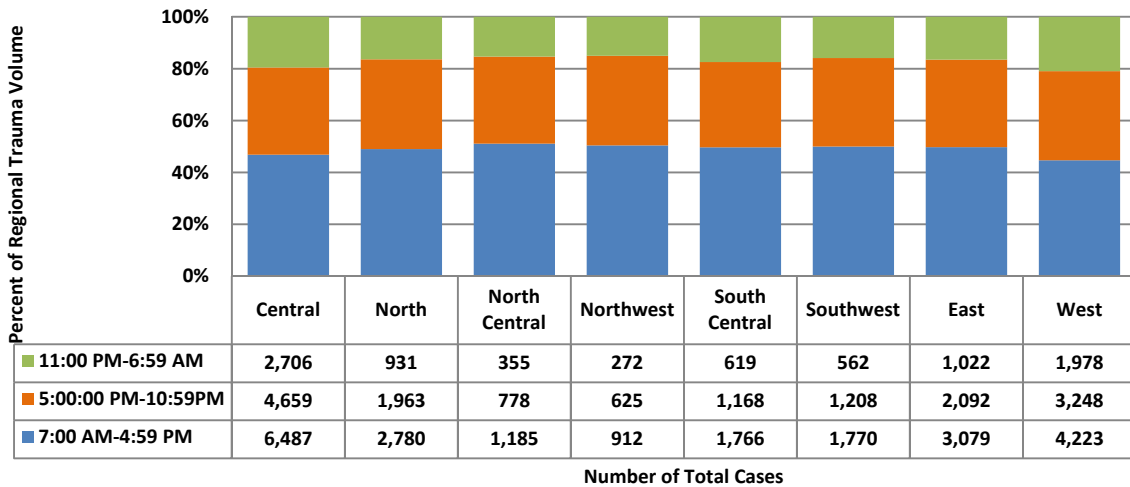
**Figure 20b: Intent of Injury by Region, 2007-2009**



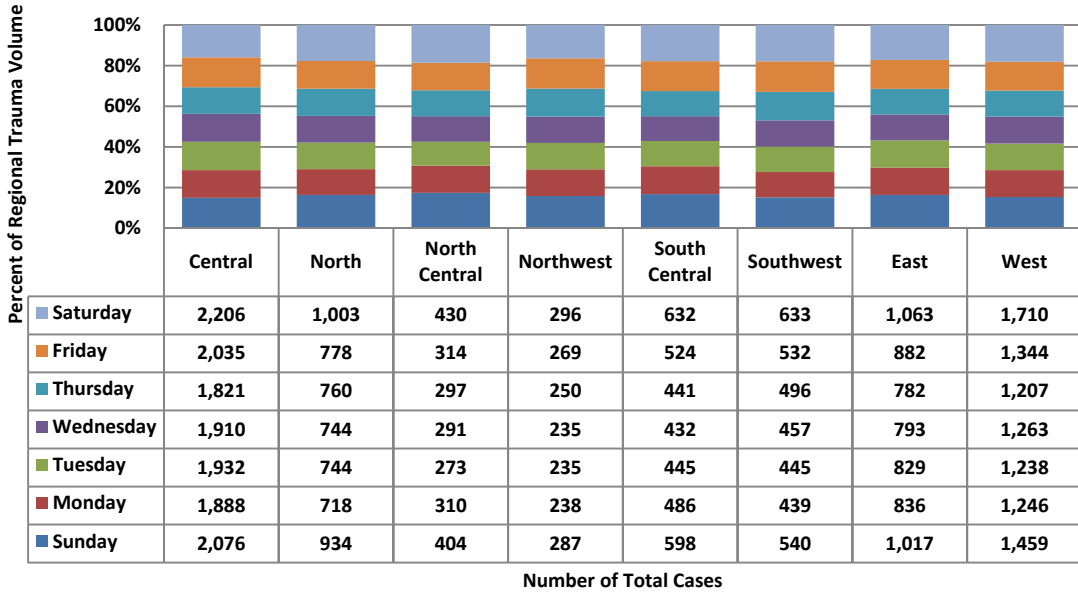
**Figure 21b: Trauma Mortality by Intent and Region, 2007-2009**



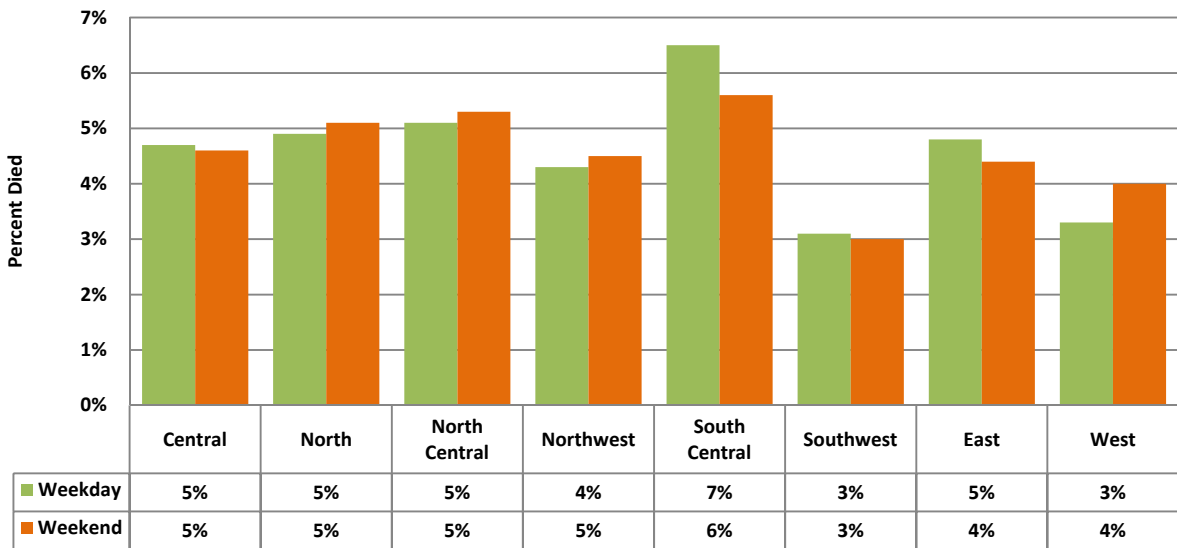
**Figure 22b: Time of Trauma Patient Arrival at Hospital by Region, 2007-2009**



**Figure 23b: Trauma Volume by Day of Week and Region, 2007-2009**

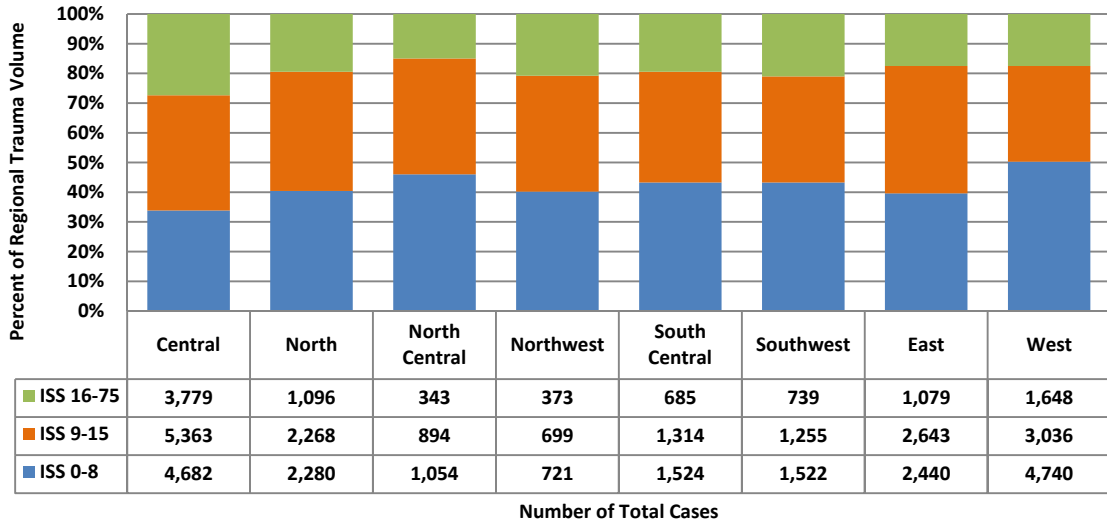


**Figure 24b: Trauma Mortality by Day of Week and Region, 2007-2009**

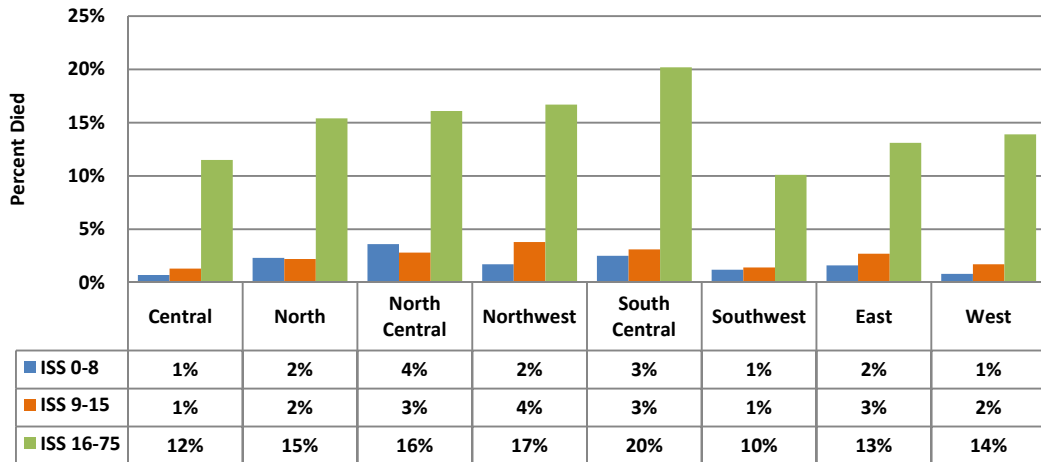




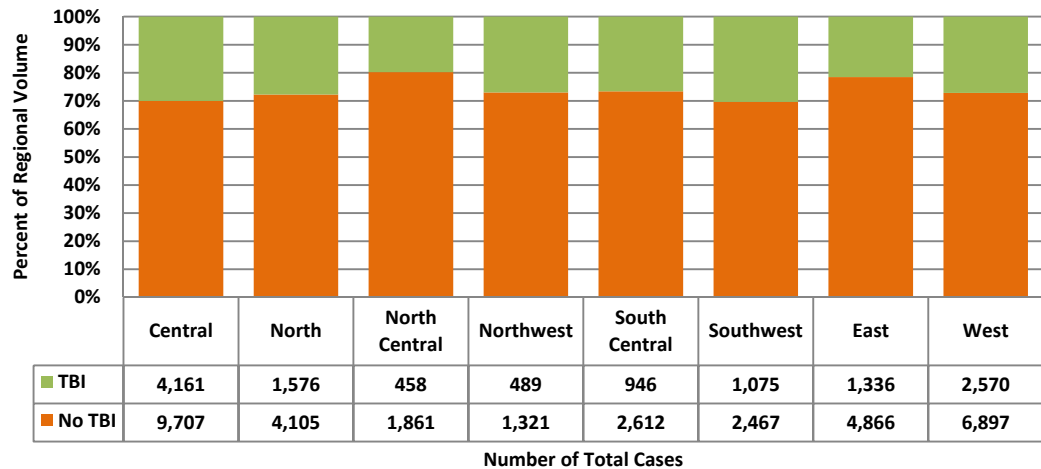
**Figure 25b: Trauma Severity by Injury Severity Score and Region, 2007-2009**



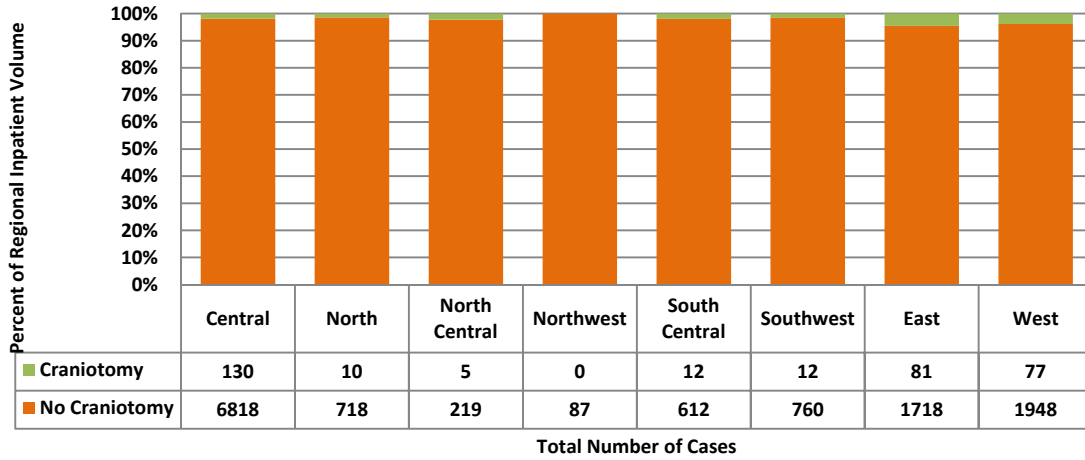
**Figure 26b: Trauma Mortality by Injury Severity Score and Region, 2007-2009**



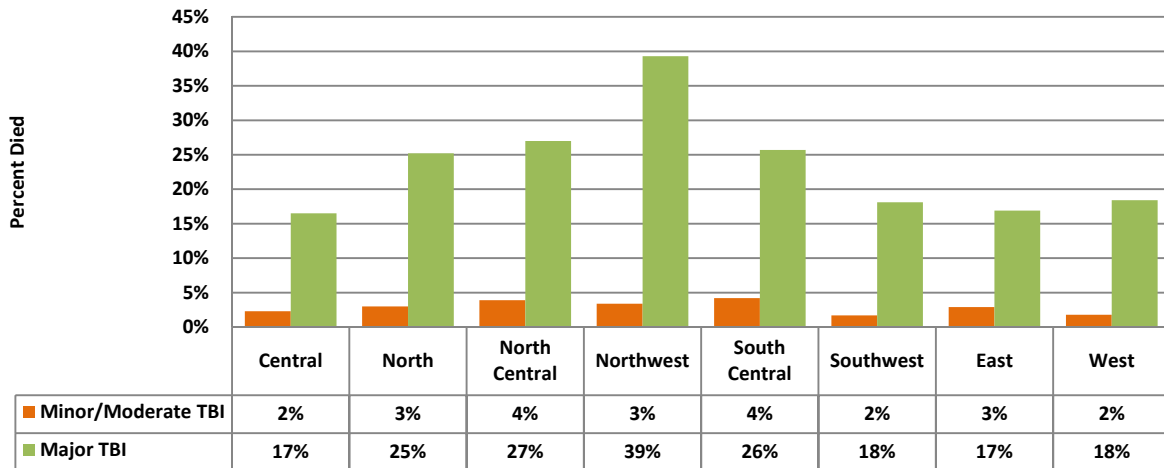
**Figure 27b: Traumatic Brain Injury (TBI) Patients by Region, 2007-2009**



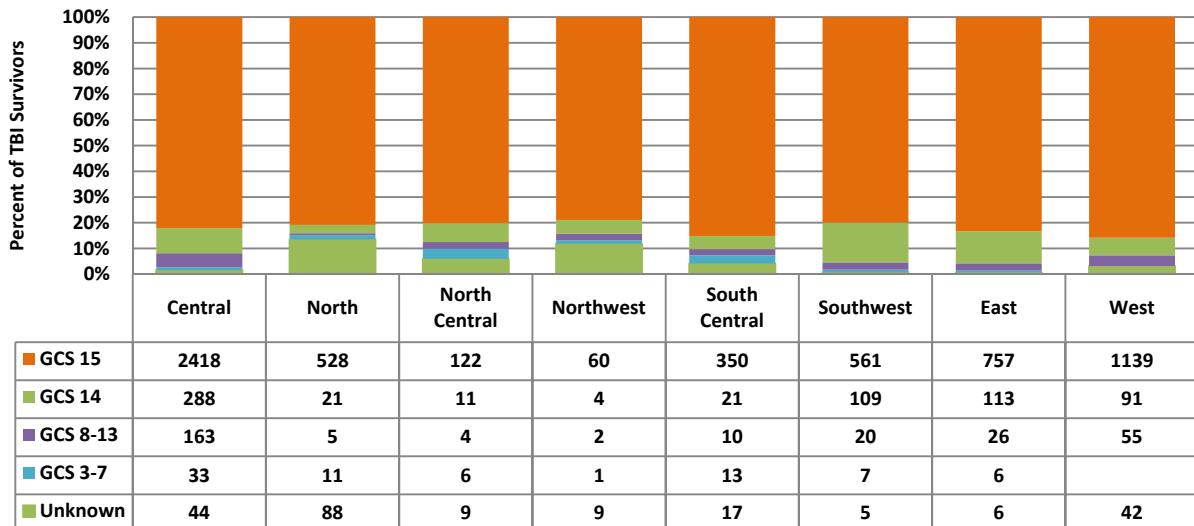
**Figure 29b: Admitted TBI Patients Receiving Craniotomy by Region, 2007-2009**



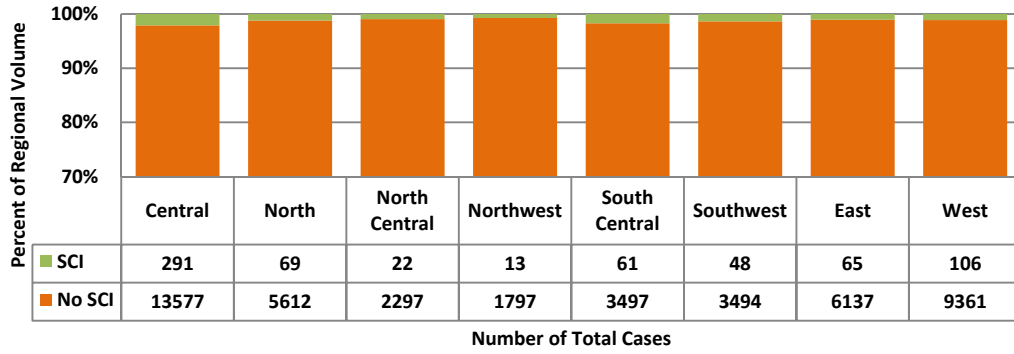
**Figure 30b: Mortality of TBI Patients by Regions, 2007-2009**



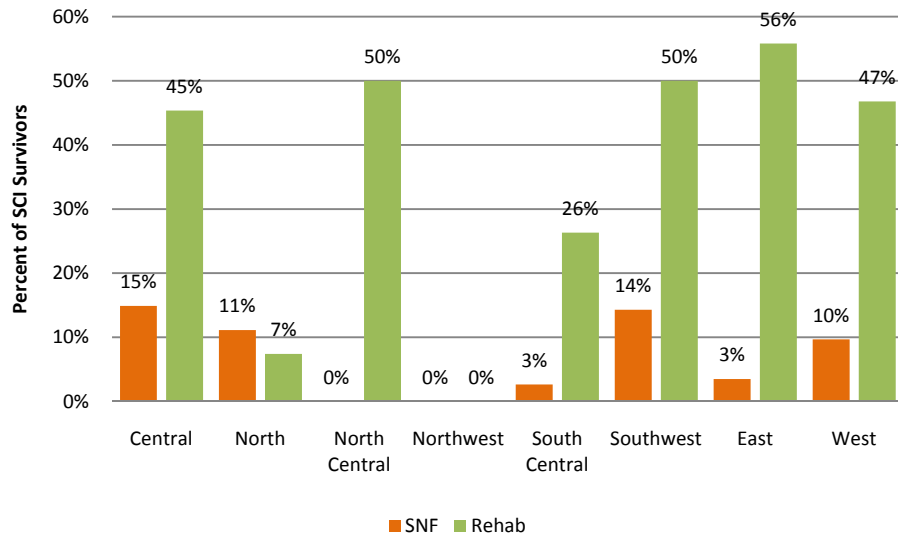
**Figure 31b: TBI Survivors by Glasgow Coma Score at Discharge, 2007-2009**



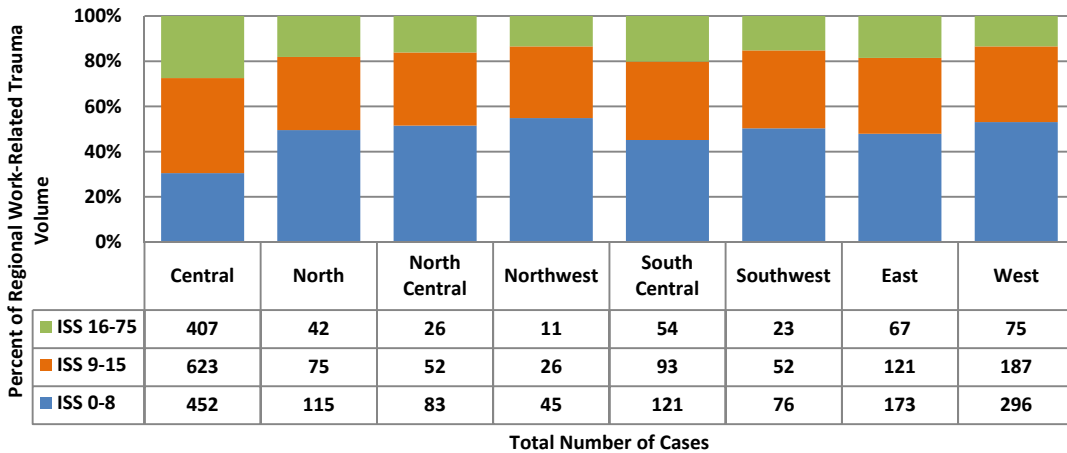
**Figure 32b: Admitted Patients with Spinal Cord Injury (SCI) by Region, 2007-2009**



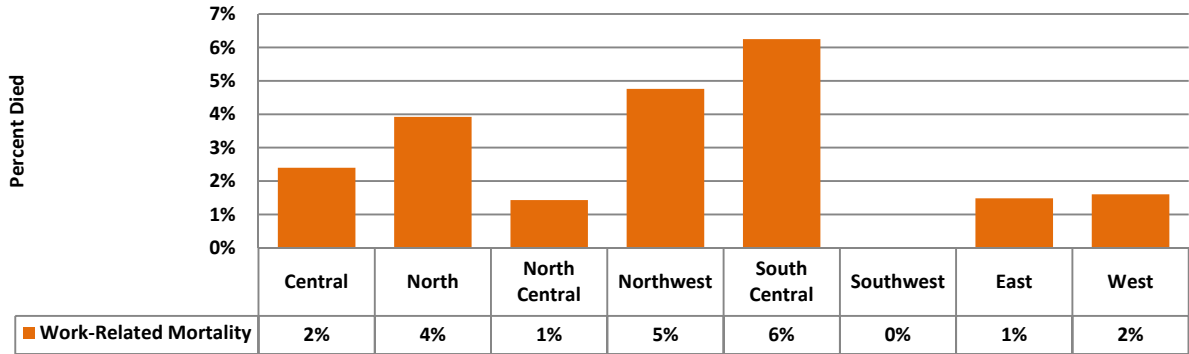
**Figure 34b: SCI Survivors Discharged to a Rehabilitation Service by Region, 2007-2009**



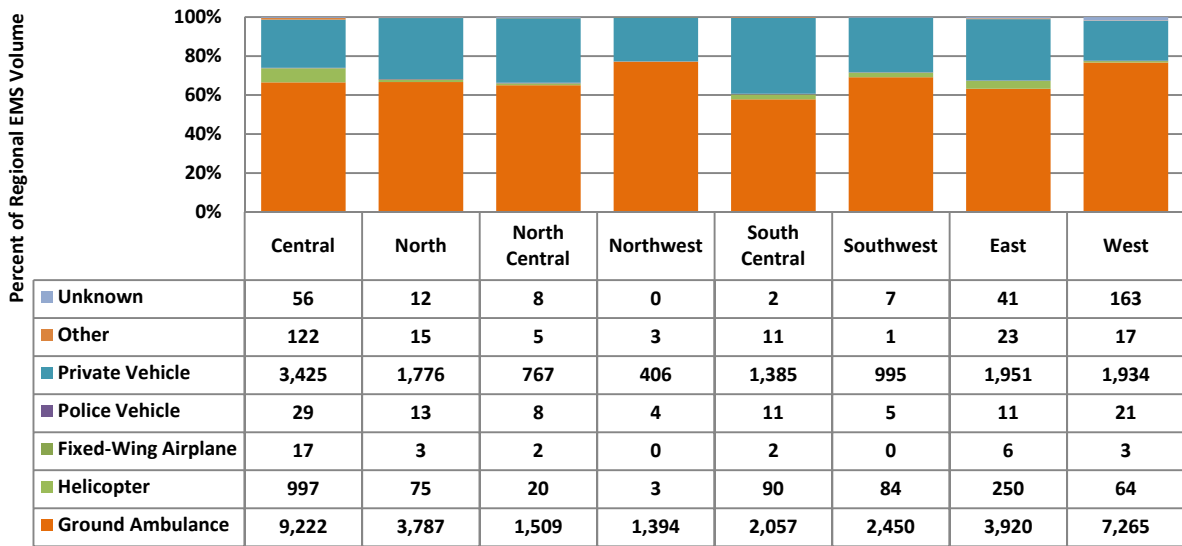
**Figure 35b: Work-Related Trauma by Injury Severity Score (ISS) and Region, 2007-2009**



**Figure 36b: Work Related Trauma Mortality by Region, 2007-2009**

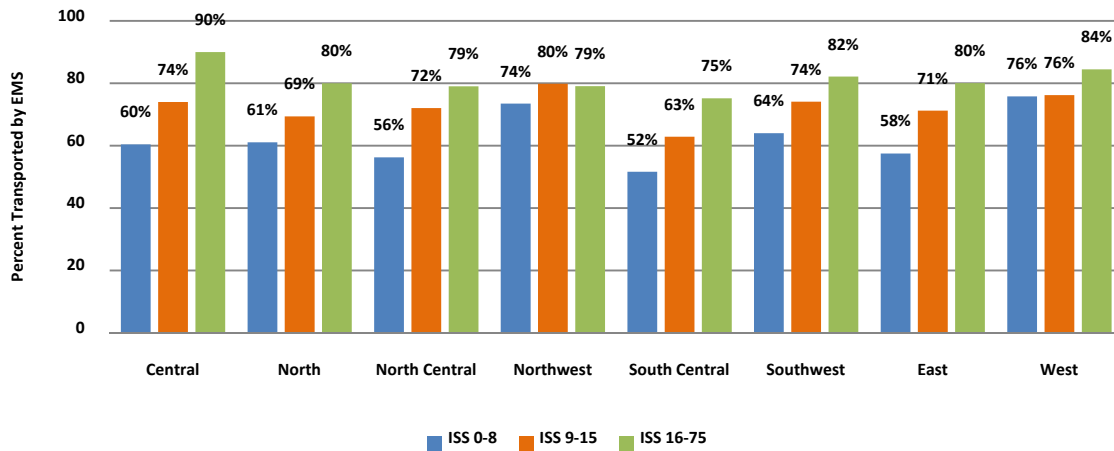


**Figure 37b: Transport Mode from the Scene by Region, 2007-2009**

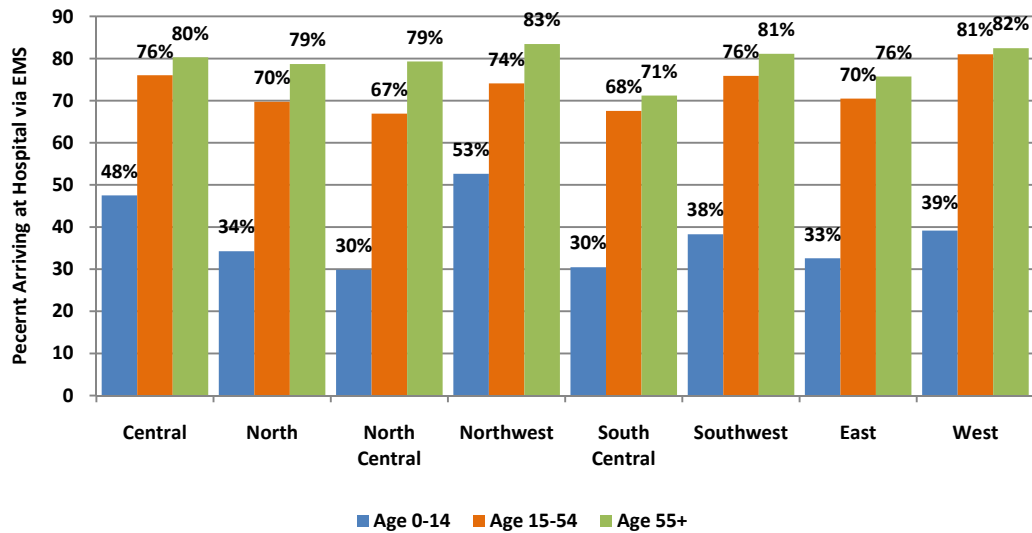


Total Number of Cases

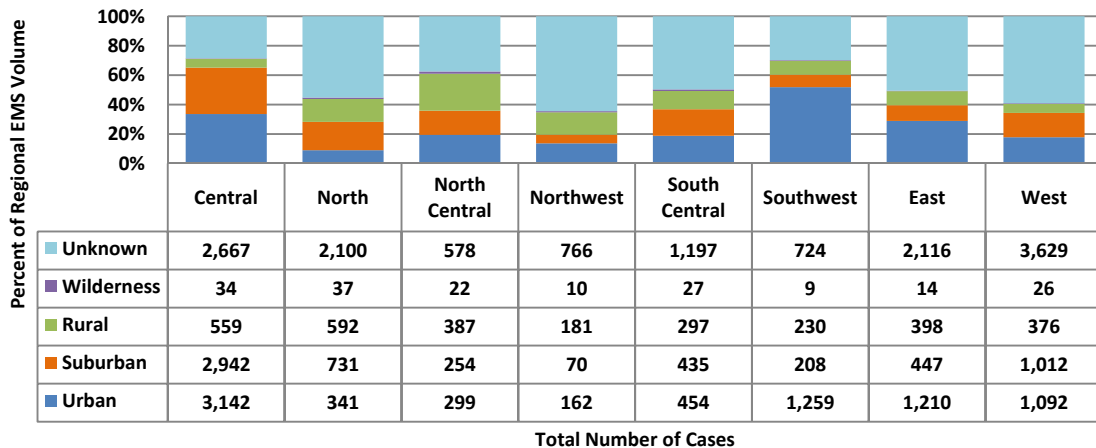
**Figure 38b: Trauma Patients Arriving at Hospital via EMS by Injury Severity Score and Region, 2007-2009**



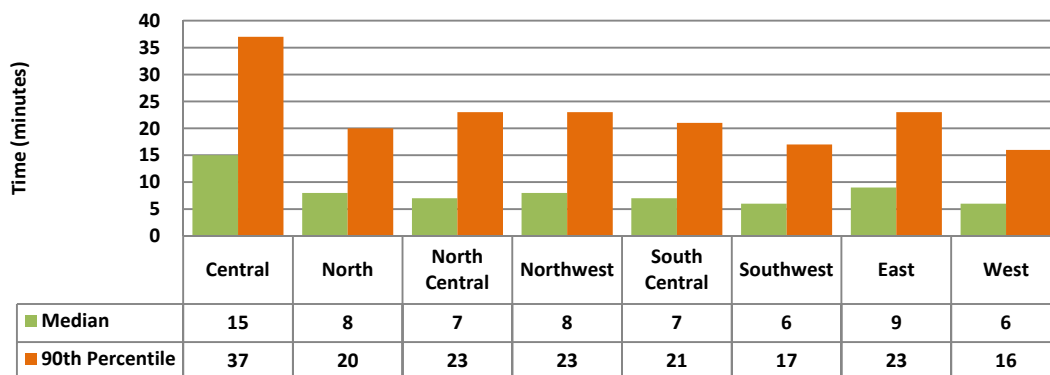
**Figure 39b: Percentage of Trauma Patients Arriving at Hospital via EMS by children vs. Adults and Region, 2007-2009**



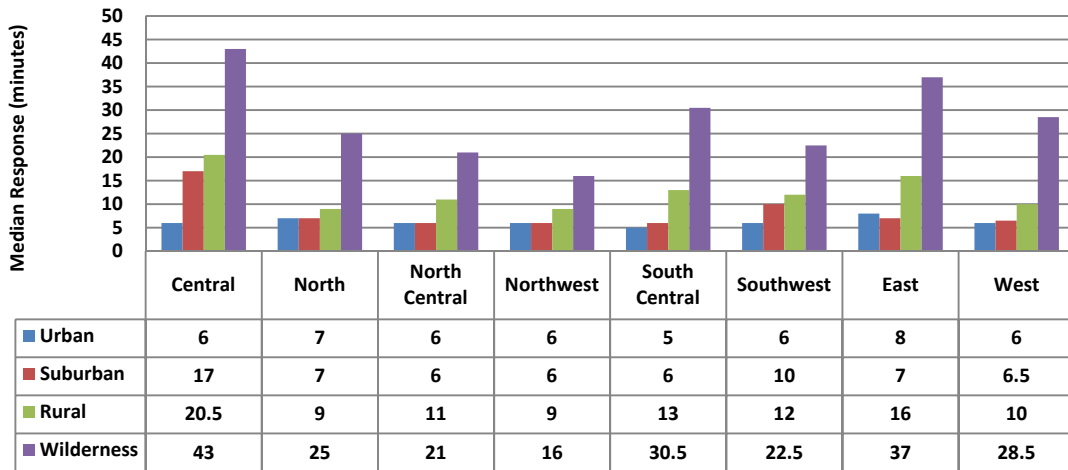
**Figure 40b: EMS Scene Responses by Area and Region, 2007-2009**



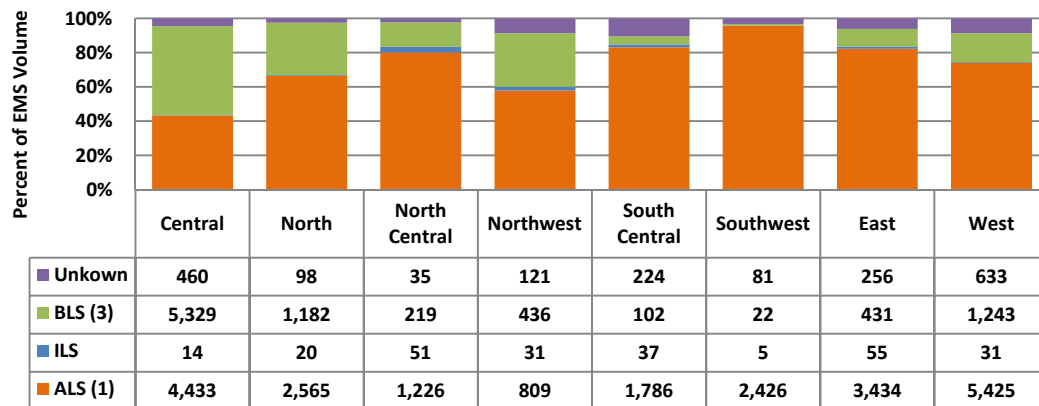
**Figure 42b: EMS Response Times by Region, 2007-2009**



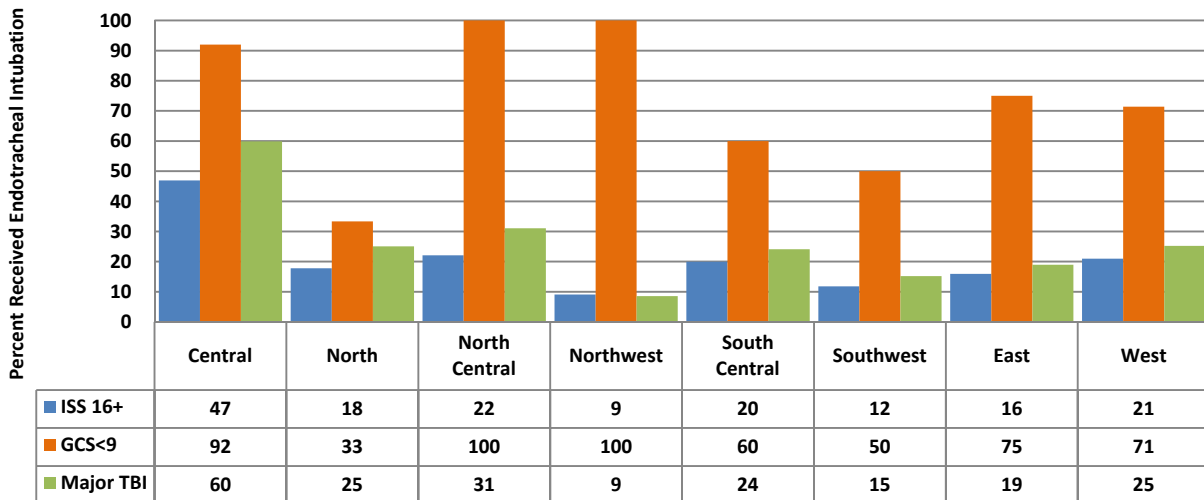
**Figure 43b: Response Time to Scene by Area Type and Region, 2007-2009**



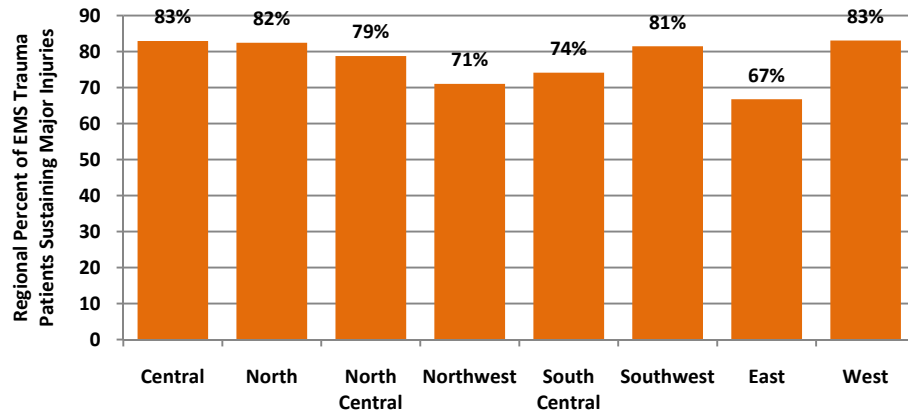
**Figure 44b: Level of EMS Service from Scene by Region, 2007-2009**



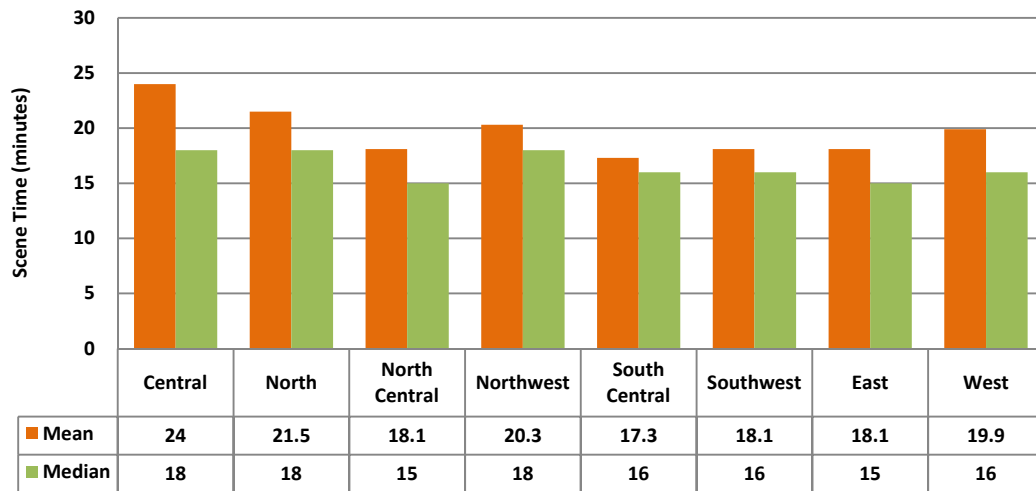
**Figure 46b: Percentage of Selected Patient Groups Receiving Intubation in the Field by Region, 2007-2009 (ALS Transports Only)**



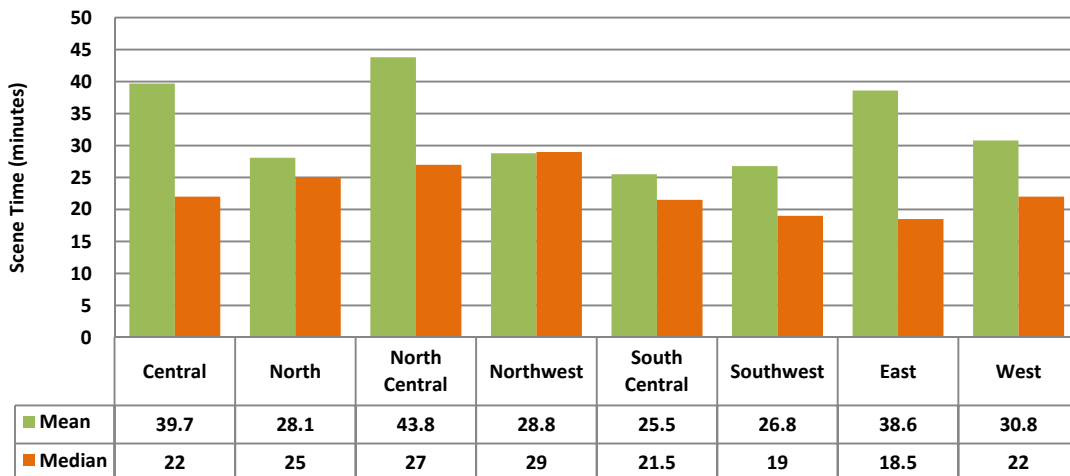
**Figure 48b: Percentage of Major Trauma Patients (ISS 16+) Received Intravenous (IV) Therapy by Region, 2007-2009**



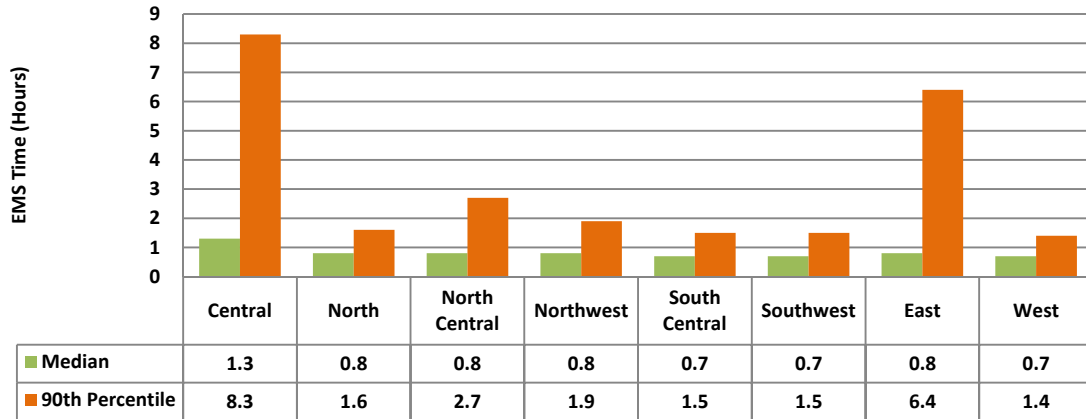
**Figure 49b: Scene Time by Region, 2007-2009 (No Extrication)**



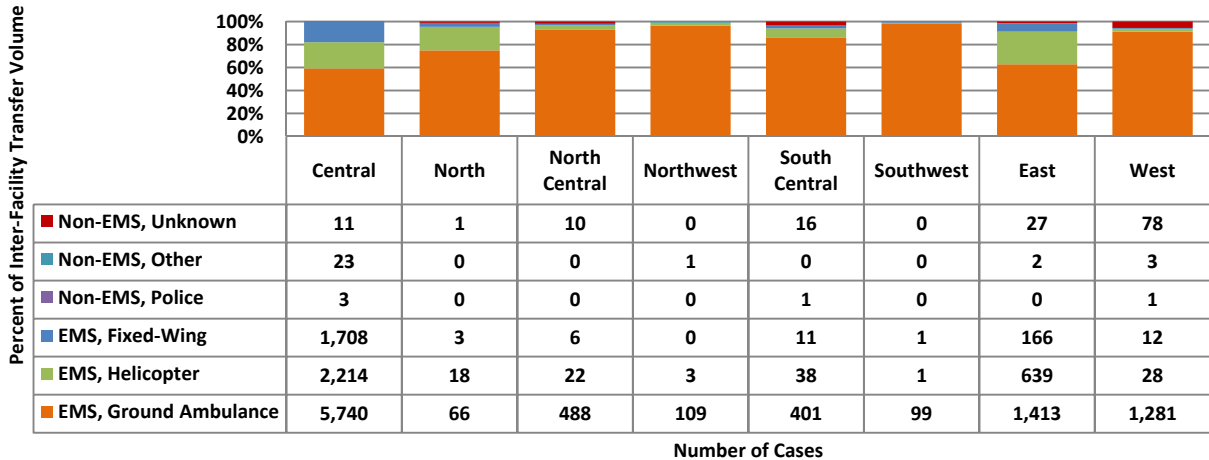
**Figure 50b: Scene Time by Region, 2007-2009 (With Extrication)**



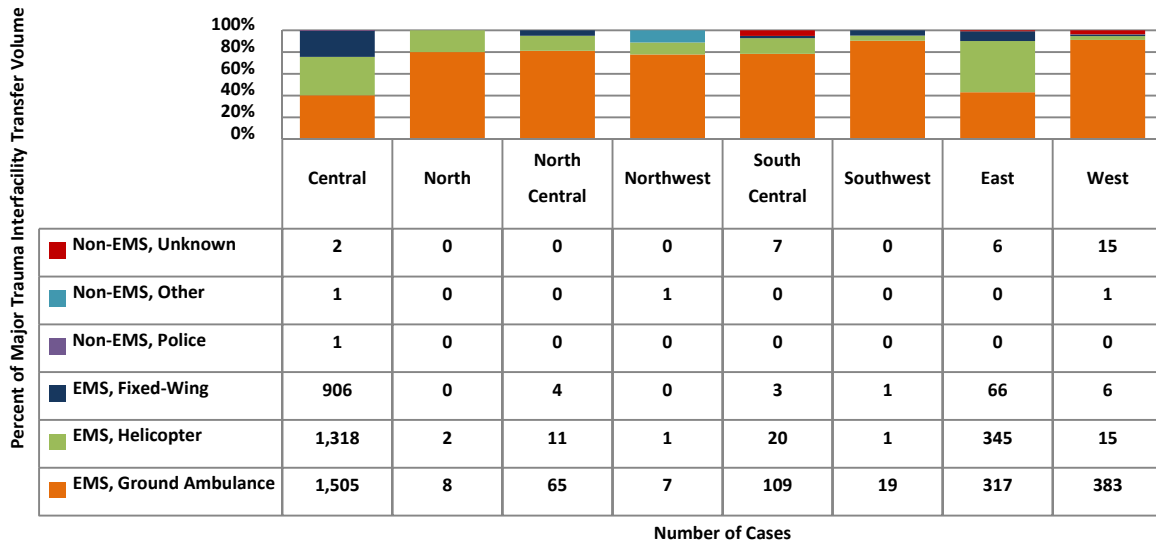
**Figure 51b: Time from EMS Dispatch to Arrival with Patient at Hospital by Region, 2007-2009**



**Figure 52b: Transport Mode Inter-facility Transfers by Region, 2007-2009**

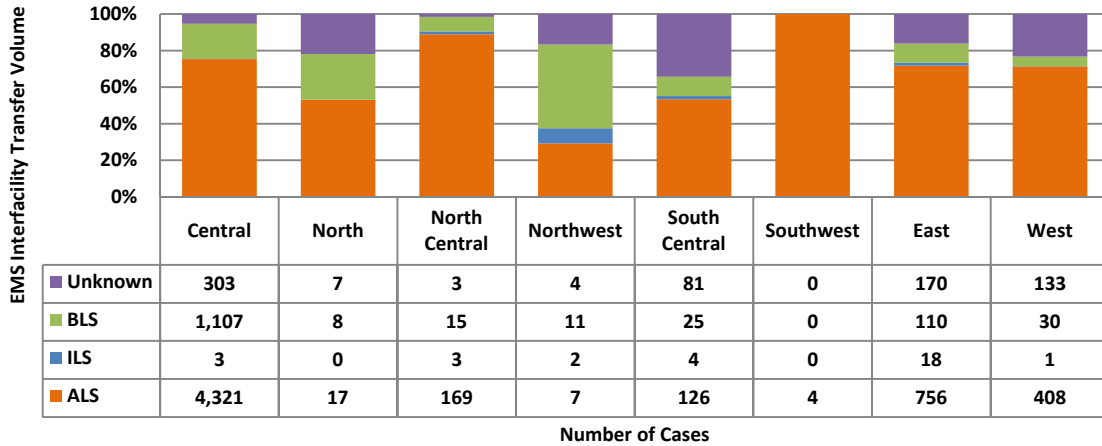


**Figure 53b: Transport Mode for Inter-facility Transfers of Seriously Injured (ISS 16+) Trauma Patients by Region, 2007-2009**

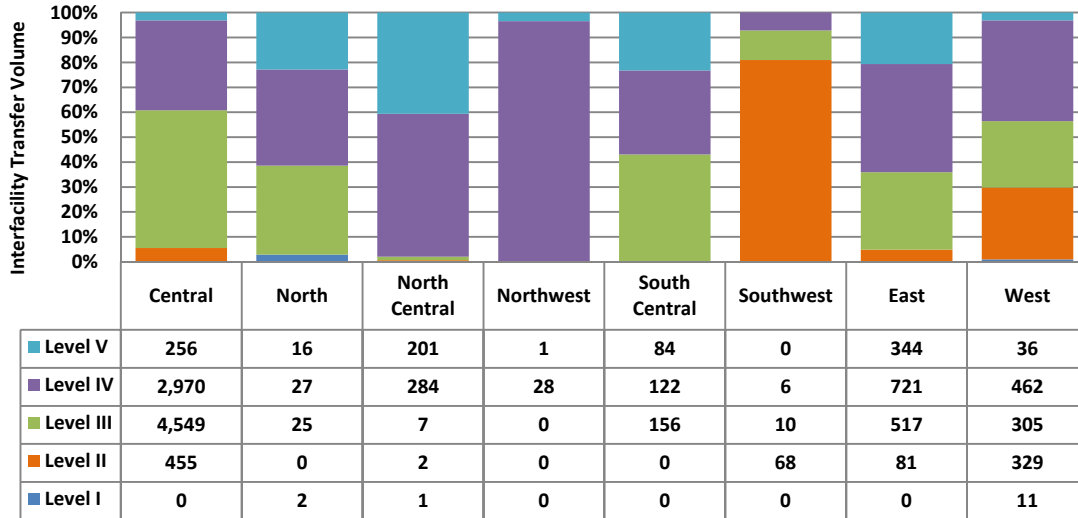




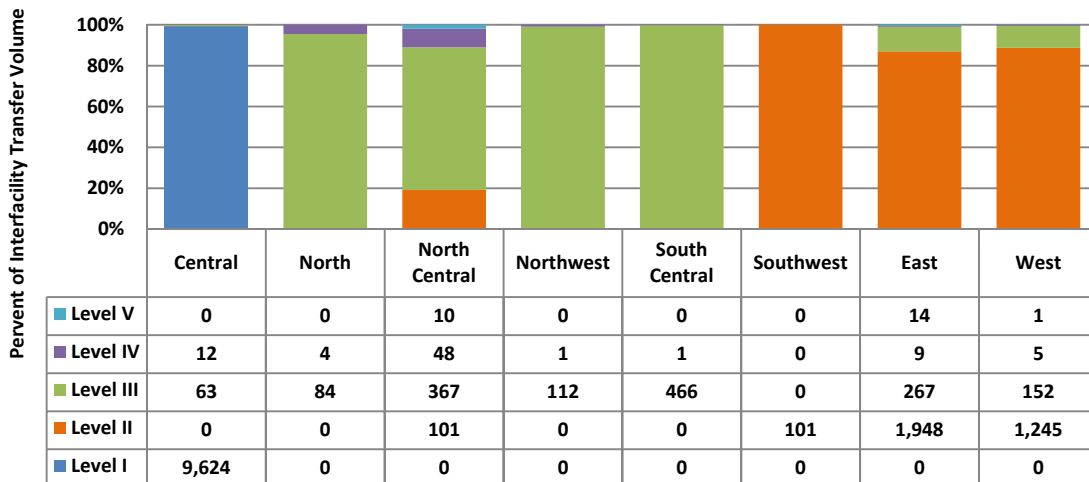
**Figure 54b: Level of EMS Service of Inter-facility Transfers by Region, 2007-2008**



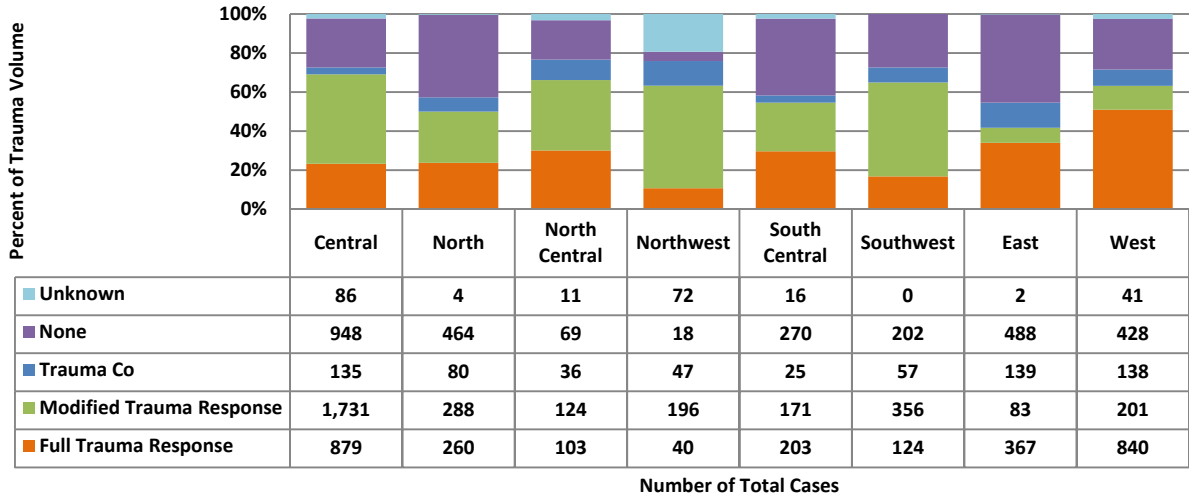
**Figure 55b: Transfers to another Acute Care Facility by Sending Hospital Designation Level and Region, 2007-2009**



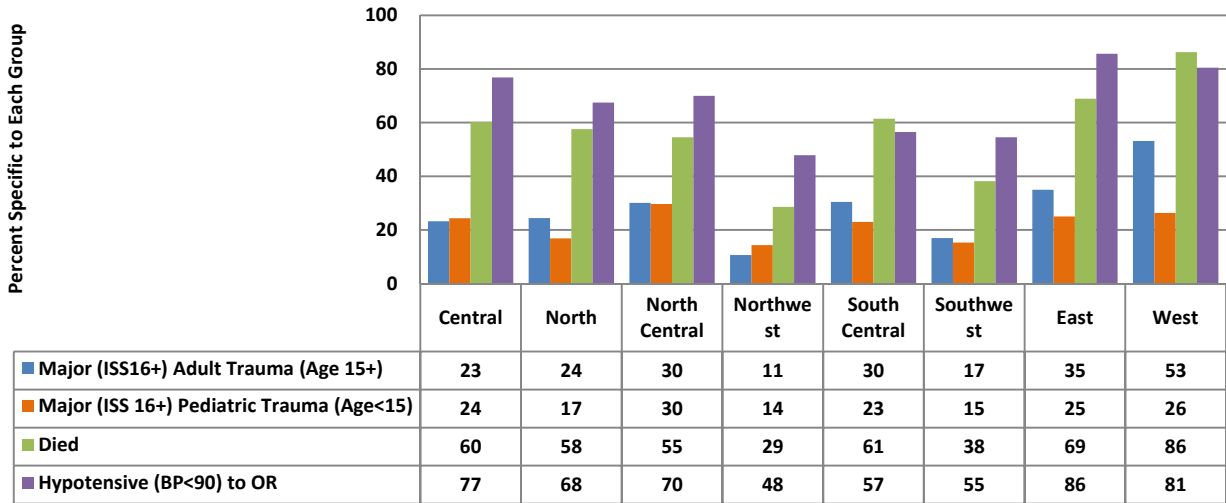
**Figure 57b: Transfers to another Acute Care Facility by Receiving Hospital Designation Level and Region, 2007-2009**



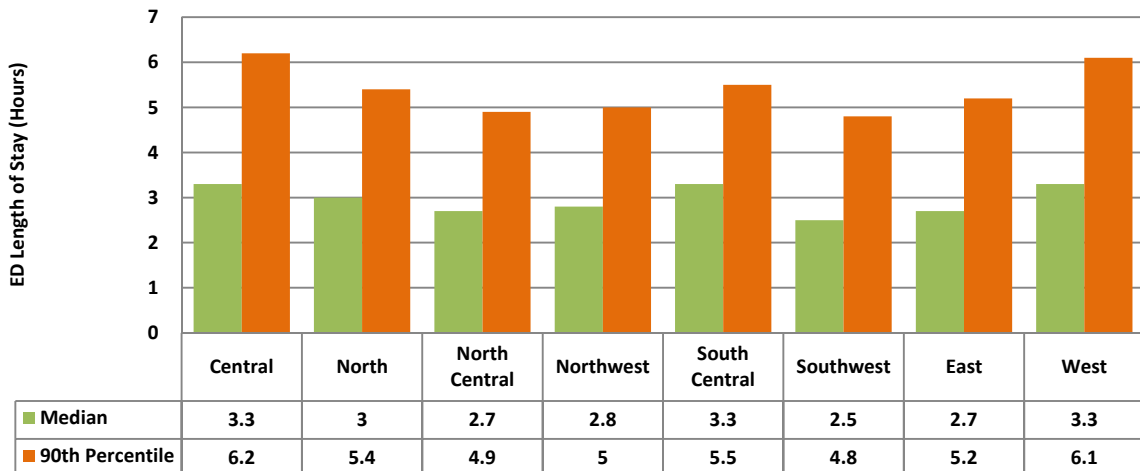
**Figure 58b: Trauma Team Activation Level for Major Trauma Patients (ISS>16) by Region, 2007-2009**



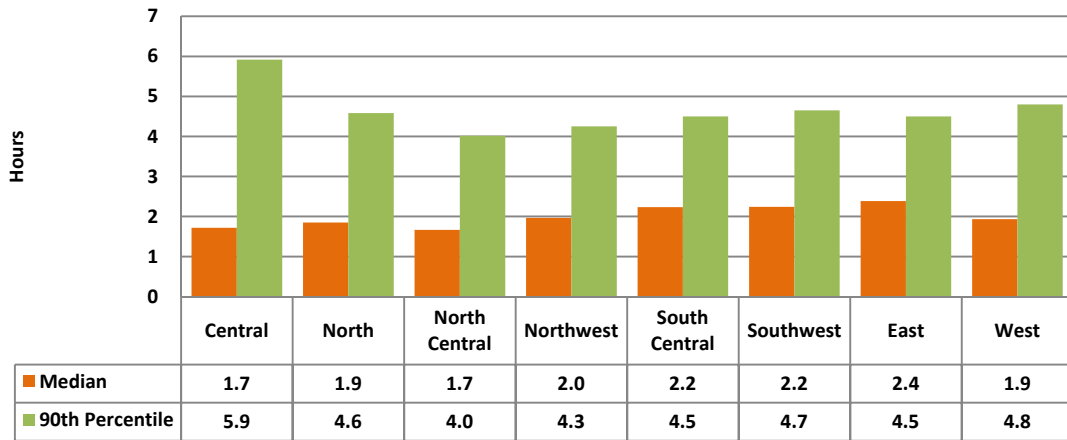
**Figure 59b: Percentage of Selected Groups Receiving Full Trauma Team Activation by Region, 2007-2009**



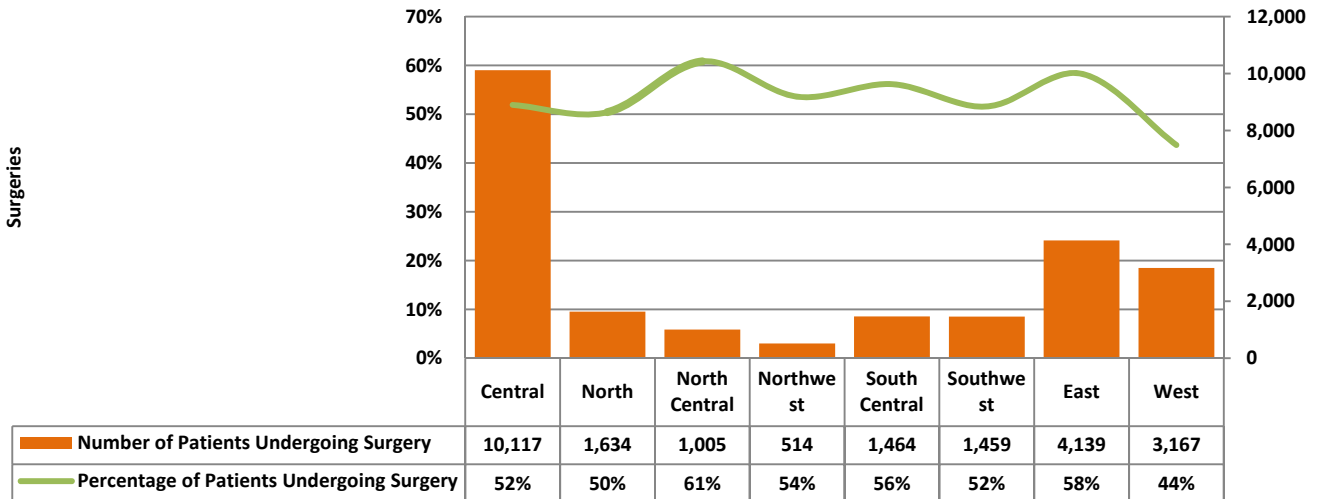
**Figure 60b: Emergency Department Length of Stay Prior to Transfer by Region, 2007-2009**



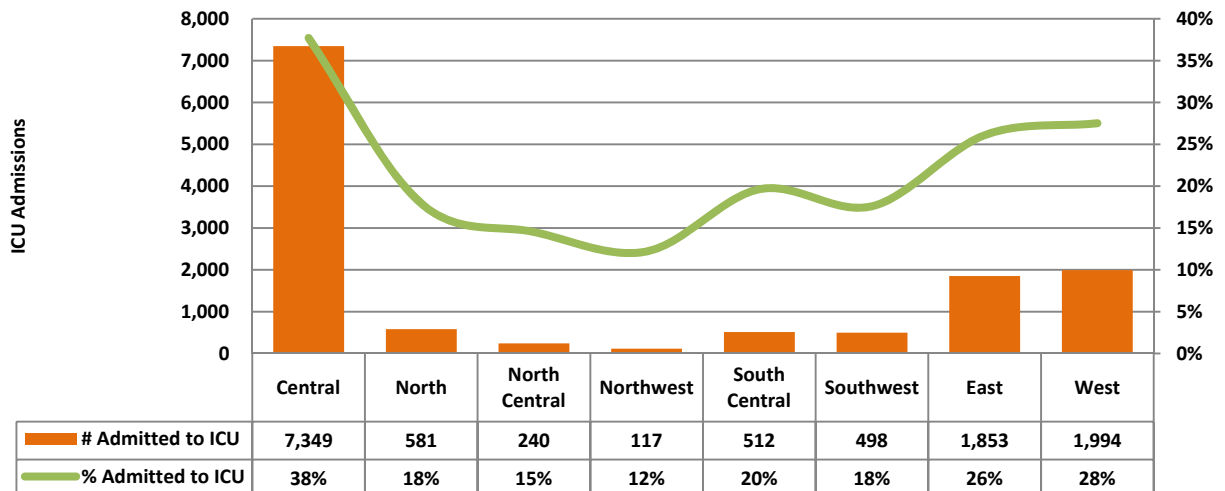
**Figure 62b: Time from Arrival to Operating Room for Major Trauma (ISS16+) Patients Sent Directly from the Emergency Department to Operating Room by Region, 2007-2009**



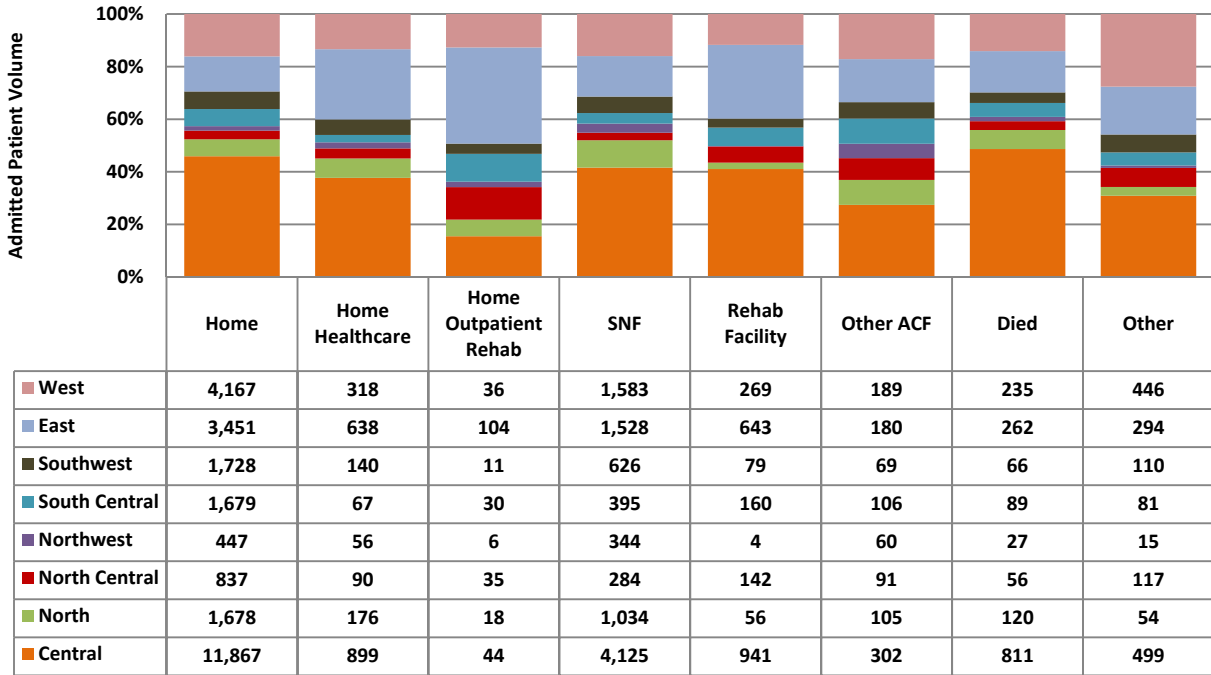
**Figure 63b: Surgery Performed on Admitted Patients by Region, 2007-2009**



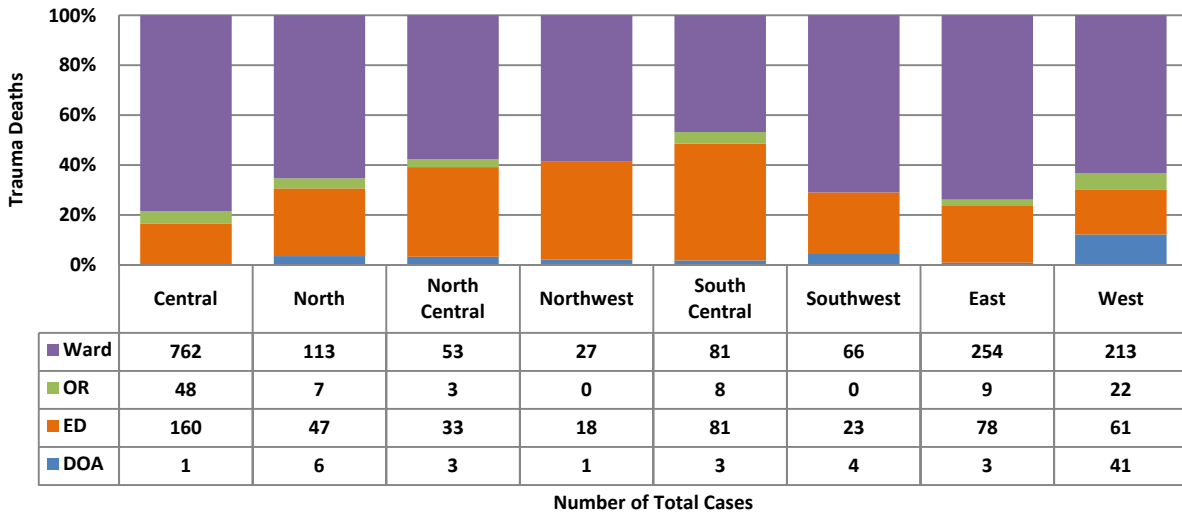
**Figure 65b: Intensive Care Unit Admissions by Region, 2007-2009**



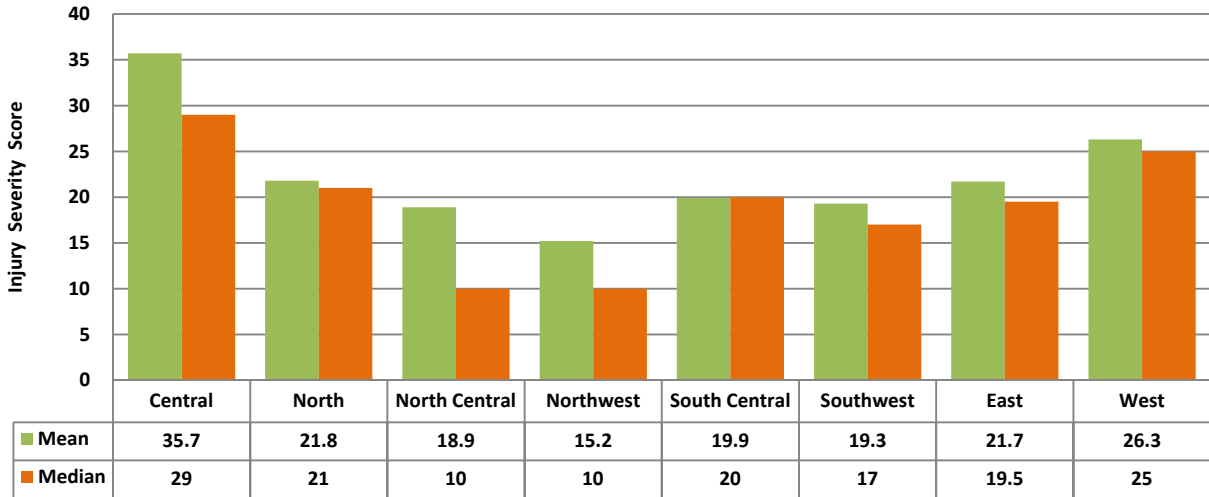
**Figure 66b: Hospital Disposition for Admitted Patients by Region, 2007-2009**



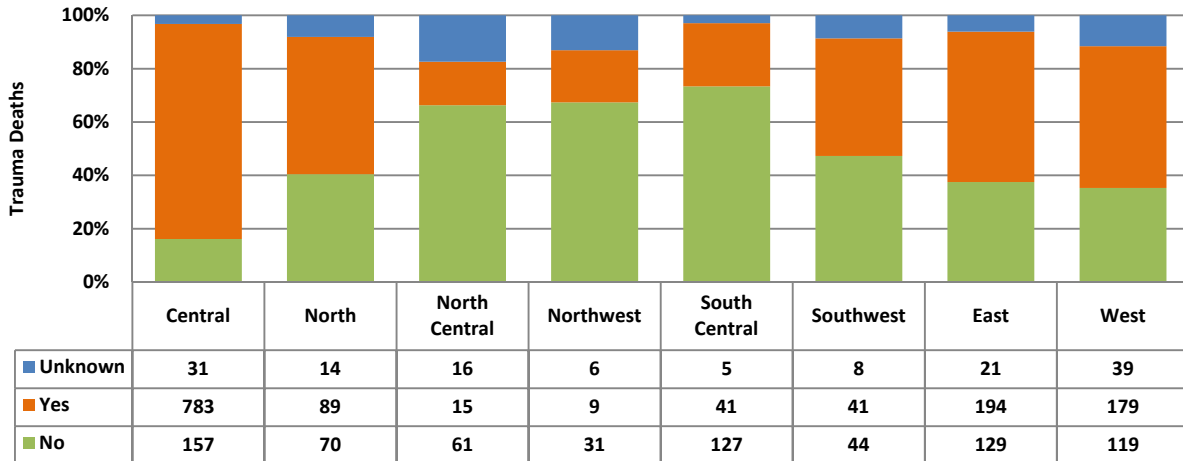
**Figure 68b: Location of Death by Region, 2007-2009**



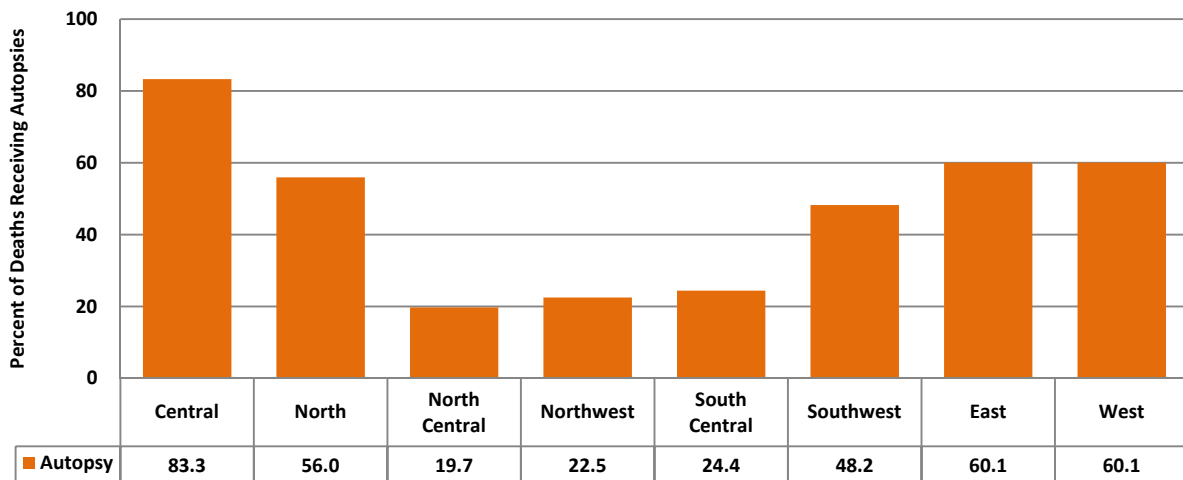
**Figure 69b: Injury Severity Score of Deaths by Region, 2007-2009**



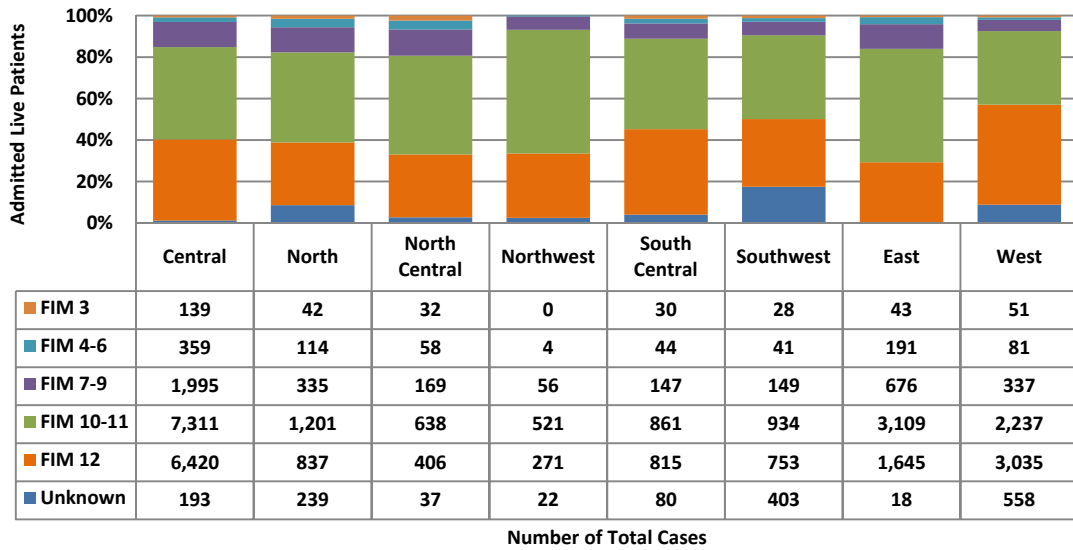
**Figure 70b: Autopsies Performed by Region, 2007-2009**



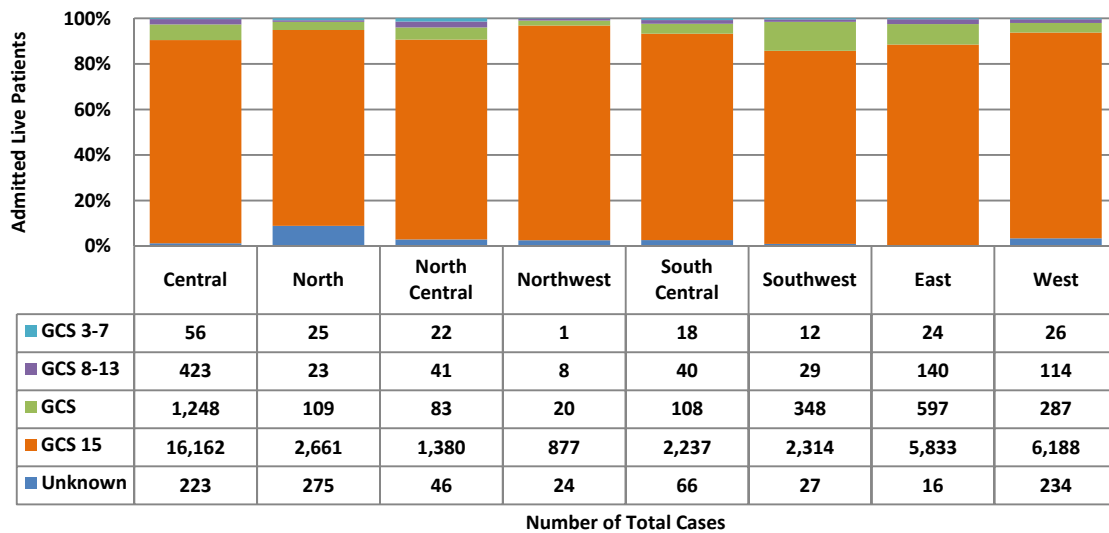
**Figure 71b: Percentage of Trauma Deaths Receiving Autopsies by Region, 2007-2009**



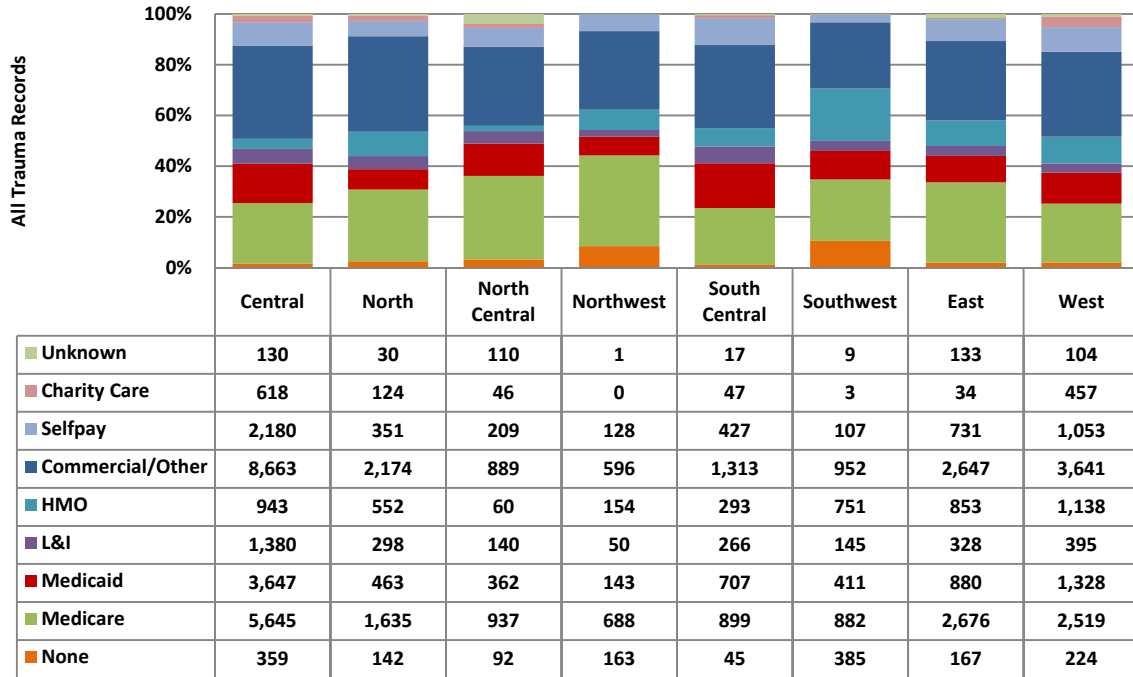
**Figure 72b: Functional Independence Measure (FIM) at Discharge for Survivors (Age >=15) by Region, 2007-2009**



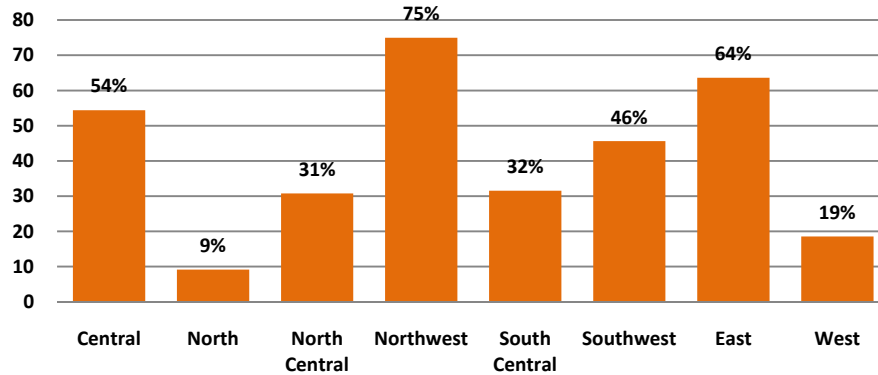
**Figure 73b: Glasgow Coma Score at Discharge by Region, 2007-2009 (Survivors, Age 2+)**



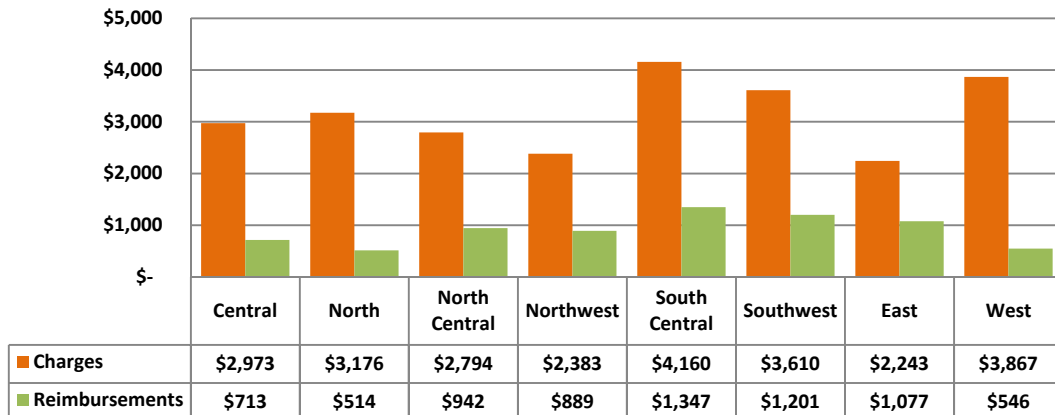
**Figure 74b: Primary Payer by Trauma Records by Region, 2007-2009**



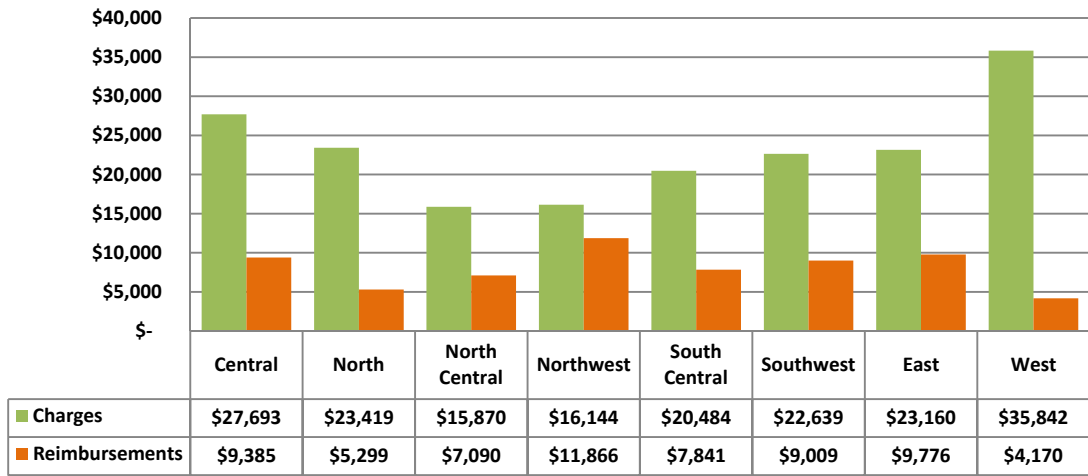
**Figure 75b: Percentage of Trauma Registry Records with Hospital Charges Available by Region, 2007-2009**



**Figure 76b: Median Charges and Reimbursement by Year for Patients Transferred from ED to another Acute Care Facility by Region, 2007-2009**



**Figure 77b: Median Charges and Reimbursement by Region for Patients Admitted to the Hospital, 2007-2009**



**Figure 78b: Percentage of Patients with Medicaid as Primary Payer by Region, 2007-2009**

