

Trauma Care Advisory Council

Trauma Care in Tennessee

2014 Report to the 109th General Assembly

Tennessee Department of Health

Trauma Care Advisory Council

December 18, 2014

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STATE OF TENNESSEE
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BUREAU HEALTH LICENSURE AND REGULATION
TRAUMA CARE ADVISORY COUNCIL
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December 18, 2014

Dear Members of the General Assembly,

As required by Tenn. Code Ann §68-59-103, we are pleased to submit our Annual Trauma Report. This report reflects activities and accomplishments of the Trauma Care Advisory Council (TCAC) and Tennessee's designated Trauma Hospitals.

The Trauma Care Advisory Council was implemented in 1990 to advise the Board for Licensing Health Care Facilities and the Emergency Medical Services (EMS) Board in regards to regulatory standards to ensure the adequacy of statewide trauma care. Rule promulgation is guided by national standards.

In 2007, the General Assembly enacted the Trauma Fund Law, providing valuable resources to support and maintain Tennessee's vital Trauma System.

The data in this publication give an overview of patients cared for in Tennessee designated Trauma Centers and Comprehensive Regional Pediatric Centers. With your ongoing support, the TCAC hopes to continue to expand access to quality trauma care for injured Tennesseans.

Respectfully Submitted,

Oscar Guillamondegui, MD, MPH, FACS
Associate Professor of Surgery
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2013 EXECUTIVE SUMMARY

Last year, 23,641 Tennesseans were injured with an associated 1026 fatalities (4.3%). This is up slightly from 2012 numbers but remains below the 2009 high of 4.9%. Tennessee fatalities remain approximately twice the rate of the national level. Costs to Tennesseans are high in terms of years of potential life lost and treatment costs. The good news is that injuries and subsequent deaths are largely preventable. Through such measures as outreach to the elderly to educate on fall risks, maintaining the helmet laws and safe driving promotion, we are able to decrease the fatal effects of injury. Most importantly though, is the maintenance of trauma centers to ensure optimal care of the injured. Our trauma centers provided care for Tennesseans from every county in the state, as well as patients from every other state in the continental US, except Montana, Nevada and South Dakota.

The Trauma Care Advisory Council (TCAC) was established in 1988 to advise the Bureau of Health Care Licensing Facilities (BLHCF) regarding trauma care policy and regulation. The Tennessee Trauma System initially boasted 11 trauma hospitals: 4 as Level I (the highest level of care) and 7 as Level II. Several Level III centers were later designated, bringing the total to 13. The last decade has seen an erosion of these services. Currently, Tennessee has 6 Level I trauma centers, 1 Level II center, 1 provisional Level II center, and 2 Level III centers for 10 total adult centers. There are an associated 4 Comprehensive Regional Pediatric Centers (CRPCs) treating those injured under the age of 16. The ongoing attrition in trauma center availability may place the Tennessee trauma system behind some of the care supported by the contiguous states to Tennessee. Tennessee has significant gaps in coverage across the state in terms of trauma center availability, particularly in rural areas. Lack of a state regional access center model for coordination of the trauma system may leave many Tennesseans with suboptimal outcomes following injury due to transport or transfer to inadequate facilities.

Four years ago, the Board for Licensing Health Care Facilities approved demanding higher standards of care with increased requirements for designation of trauma centers in Tennessee, raising the bar for quality care of injured Tennesseans. These new requirements have been used for the renewal of designation of all trauma centers in the state including: a new Level II center gaining provisional status in middle Tennessee. These requirements ensure that trauma centers have the necessary resources available to care for the severely injured. Level I trauma centers are required to have fully staffed operating rooms, lab and radiologic capabilities, intensive care units, and professional personnel in the hospital (including emergency physicians and surgeons) available on a moment's notice – 24 hours a day, 7 days a week, 365 days a year. This service availability provides a safety net for all local communities and regions – by also being available to care for patients with other emergency medical care needs such as ruptured aneurysms, strokes, and cardiac emergencies to name a few, within the same time frame as the injured patient. This value is unquantifiable.

The trauma registry, initiated in 2007, has added over 164,000 trauma patients along with data

available from hospital billing information identified in the last seven years. This year, at least one citizen from every county in Tennessee was treated at a Tennessee trauma center. Falls continue to be the number one cause of trauma in the state. This speaks to the aging population of the state, with a ten year rise in the average age of the patient at time of admission from a decade ago. Although falls has surpassed motor vehicle crashes (MVCs) for trauma admissions, MVCs remain the highest fatality rate in the state

This report provides information on injury patterns across the state, referral patterns, and financial statistics. Other key aspects of this report include Injury Prevention activities and statewide research efforts. It is the goal of the TCAC to target future activities through data from the state registry and to continually strive to improve patient outcomes through an array of performance improvement initiatives, research activities, and outcomes based evidence. Such efforts consist of outreach to nursing homes and specific communities to educate the elderly on fall risk, “Battle of the Belts” for high school student awareness of seatbelt use and motorcycle and ATV safety education.

This report speaks volumes about the hospitals designated as trauma centers and dedicated to caring for the injured patient. It also suggests that there is more work to accomplish. There are areas of the state that are outside the contiguous counties of the major metropolitan areas that are not within easy reach of a designated trauma center. A formal system of designating more centers as Level II, III or IV may be beneficial in maintaining the highest possible level of care for the injured patient.

With your ongoing support we can continue with our mission of providing the highest level of care, injury prevention, education, and research to minimize the death and disability that occurs as a result of injury across the state of Tennessee

Oscar D. Guillamondegui, MD, MPH, FACS
Chair, Trauma Care Advisory Council and
The Tennessee Committee on Trauma

INJURY PREVENTION IN TENNESSEE

Injuries are the leading cause of death among Tennessee residents ages 1-44 and the fourth leading cause of death overall after heart disease, cancer and lower respiratory disease. The majority of injuries are unintentional; however, injuries can be intentional through self-harm or by another individual. In 2012, over 5,105 Tennessee residents were fatally injured, another 37,568 were hospitalized for non-fatal injuries, and 745,475 visited an emergency department due to injury.

The cost of all of these injuries is tremendous. In 2011, the median admission charge in Tennessee for non-fatal injury hospitalizations was \$49,000. The total charges exceeded \$3.4 billion: \$1.6 billion from ED visits and \$1.8 billion from hospitalizations (which do not include rehabilitation, emergency medical services, or physician costs). Many of these injuries were preventable.

The Tennessee Department of Health first received the Core Injury Surveillance, Prevention, and Control Grant from the Centers for Disease Control and Prevention (CDC) in 2005 to address injuries. An objective of this grant was to ensure that injury prevention efforts provided by public health and private agencies were coordinated. This coordination assisted with eliminating redundancy, sharing resources, and increasing support and impact for injury prevention initiatives statewide. As part of this coordinated effort, the Commissioner's Council on Injury Prevention and Control was established as an advisory council for injury prevention efforts in Tennessee. The statewide membership includes injury prevention experts from a variety of public and private agencies with a common goal of reducing injuries among Tennesseans.

The Tennessee Department of Health received a five year continuation of that grant in 2011. Under that new grant, four priority areas were chosen with input from the Commissioner's Council. The priority areas for 2011 – 2016 include: motor vehicle crashes, poisoning, sleep-related deaths and senior adult falls. Many injury prevention efforts are being implemented related to these areas and others throughout Tennessee.

Trauma centers and the comprehensive regional pediatric centers (CRPCs) are integral partners in the implementation of programmatic efforts to reduce the burden of injury in Tennessee. Examples of injury prevention efforts among designated trauma centers and CRPCs include:

- **Safe Kids Coalitions** – The safe kids coalitions provide education to families and advocate for better laws to keep children safe and healthy. In addition, the Safe Kids coalitions often provide safety devices, such as car seats, to families in need.
- **Champ's Corner Store** - Champ's Corner Store is located at Monroe Carell Jr. Children's Hospital at Vanderbilt and is the first of its kind in Tennessee. Open to the public, the store serves families in Middle Tennessee and across the state by providing

low cost safety products for children such as child passenger safety seats, cabinet locks and bicycle helmets.

- **Battle of the Belt** – This competition is a collaborative effort between trauma centers and high schools to increase seat belt usage among teens. Each trauma center chose one or more schools and is working with them to conduct two seat belt checks and education for students throughout the year. The school with the most increase in seat belt use and the school with best educational campaign both win a trophy. In addition, an overall winning school is chosen at the end of the school year based on increased percentage of seat belt usage and quality of educational campaign.
- **“BE IN THE ZONE”** – This program, supported by the Trauma Center’s Injury Programs, was developed to promote teen driver safety in Tennessee with a focus on cell phone use and texting while driving.
- **REDUCETNCRASHES.ORG** – This program is an interactive website unique to Tennessee that was developed using the National Highway Transportation and Safety (NHTSA) best practices known to reduce crashes. High schools and colleges can join an annual contest to promote safe driving in their community.
- **Trauma Nurses Talk Tough** – This program teaches parents, teenagers and children about safety topics and injury prevention. Topics include: seatbelt safety, dangers of speeding and driving impaired, and the importance of wearing helmets when bicycling and skating.
- **Tennessee Coalition for ATV Safety** – This coalition, supported by the Trauma Center’s Injury Prevention Programs, was developed to promote ATV safety among youth and adults.
- **Safe Sleep Education** – The Tennessee Department of Health has provided educational materials and encouraged hospitals to educate staff and parents about safe sleep practices. Most of the trauma centers and comprehensive regional pediatric centers have developed safe sleep policies which require training for their staff, education for parents and modeling of safe sleep practices in the hospital.
- **Tennessee Falls Prevention Coalition** – The Tennessee Department of Health has partnered with Trauma Center staff, universities, physical therapists, private industry, senior centers, and other stakeholders to develop a statewide coalition to reduce falls among older adults. Falls prevention conferences, instructional webinars, assessment tools, and other resources have been provided to professionals and the public. Evidence-based falls prevention educational programs have also been promoted and conducted throughout the state, including “Matter of Balance”, “Stepping On”, “Staying Active and Independent for Life”, and Tai Chi.

TRAUMA CENTER FUNDING

With the passage of the Tennessee Trauma Center Funding Law of 2007, the Trauma Care Advisory Council was charged with developing recommendations on how to distribute Trauma System Fund reserves. In keeping with the intent of the statute, three broad categories for disbursement were identified:

- Money to support the **trauma system infrastructure** at the state level.
- **Readiness costs** to designated trauma centers and comprehensive regional pediatric centers.
- Money for **uncompensated care**.

Trauma System Infrastructure:

Robert Seesholtz is the State Trauma System Manager as of August 2010 and is responsible for providing general oversight for Tennessee's Trauma Care System. Responsibilities include oversight of the trauma fund, the trauma registry, administrative support to the Trauma Care Advisory Council, and the coordination of site visits for new and existing trauma centers.

Readiness Costs:

Tennessee trauma centers and CRPC's are ready at a moment's notice to treat those suffering from traumatic injury and are required to maintain life critical services 24 hours a day, 7 days a week, 365 days a year. While readiness costs disbursed from the trauma fund cannot realistically compensate centers for all of their costs, readiness funds help to ensure that these necessary life critical services are maintained. Readiness cost amounts for those state designated trauma centers and comprehensive regional pediatric centers may be found in **appendix III**.

Uncompensated Care Methodology:

The trauma funding law provides for uncompensated care funding to be distributed to: 1) designated trauma centers 2) comprehensive regional pediatric centers and 3) other acute care hospitals functioning as a part of the trauma system. Actual hospital claims data was selected by the committee to determine the levels of trauma care provided by each center/hospital and the uncompensated costs related to that care.

While designated trauma centers and comprehensive regional pediatric centers are automatically eligible for participation in this portion of the fund, not all acute care hospitals are. Criteria used to determine which hospitals "function as a part of the trauma system", include: 1) Utilization - the percentage of all claims that are trauma related and 2) Acuity – the acuity of the trauma injuries seen by a hospital. Acute care hospitals which prove to have a utilization rate and acuity equal to or greater than the minimum utilization and acuity rates of the designated centers are eligible for participation in the pool.

Distribution to eligible hospitals is based on: 1) the level of funding within the reserve account following infrastructure and readiness costs and 2) the documented level of each hospital's uncompensated trauma cost. Though this amount will vary from year to year, at the end of 2014 this portion of the fund was approximately \$7,768,758.15. **Appendix III** shows quarterly payments made to eligible hospitals for calendar year 2014.

Trauma Fund disbursement totals have seen a steady decline for the past three years. Fiscal year 2014 saw its biggest reduction in funds with a drop of over \$547,000.00 in reimbursement for those hospitals eligible to receive monies from the trauma fund. Since its inception, the trauma fund has decreased over \$1,300,000.00 dollars making finding alternative sources of funding a priority to ensure the viability of Tennessee's Trauma System.

TRAUMA REGISTRY

The Tennessee Trauma Registry is the data repository for patients treated at Tennessee's 9 participating trauma centers and 4 Comprehensive Regional Pediatric Centers (CRPC). 2007 marked the first full year of data submission. Since that date the Registry shows Tennessee trauma facilities have treated 164,656 patients (including 11,299 for the first 6 months of 2014). The cumulative annual average through 2013 is 21,908 patients. In 2013 the number of patients treated (23,641) dropped slightly (3%) from the 2012 Registry high (24,394).

Reporting for the current Registry assessment is primarily based on patient abstractions completed at the 13 trauma facilities through 2013. The registry reports represent cross-sectional views of the injuries sustained in 2013 with additional trend reporting that includes the 4 years prior.

"Trauma" refers to a body wound or shock produced by sudden physical injury, as from violence or accident. It can also be described as a physical wound or injury, such as a fracture or blow. Serious trauma is defined as having an injury severity score of 15 and above. The weighted average of reported ISS was 11.7 in 2013 (versus 11.5 in 2012)

RESEARCH

Level 1 trauma centers are charged with performing research. These endeavors spur improvements in care on an ongoing basis. In 2013 over 50 peer reviewed manuscripts were published by Level 1 trauma centers and CRPC's. **Appendix IV** represents just a sample of these state wide research publication efforts.

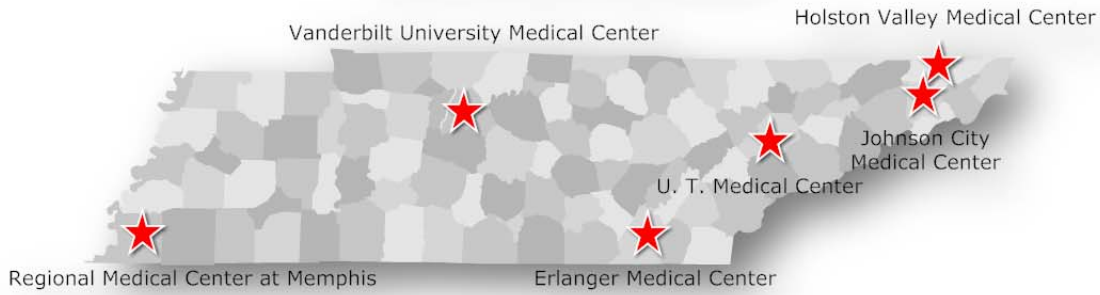
OUTREACH

Tennessee's trauma centers and CRPC's provide many different outreach opportunities for both the public and for those who are responsible for the specialized care of injured Tennesseans and visitors in our state. The outreach activities listed below represent just a sample of the opportunities that are being provided the public and health care providers.

- Advanced Trauma Life Support
- Trauma Nurse Core Course
- Advanced Trauma Care for Nurses
- Emergency Nursing Pediatric Course
- AARP Smart Driver for elderly drivers
- Helicopter scene safety
- Senior Falls Education and Training
- Community Health Leaders Program
- Transport Ventilator Management course
- Prom Promise
- Wilderness First Aid
- Rural Trauma Team Development Course
- Pre-hospital Trauma Life Support
- Trauma Nurses Talk Tough
- Paramedic and EMT Refresher Courses
- Trauma Symposiums
- Bike Helmet Fittings
- Car Seat Inspections
- Health Fairs
- Distracted Driving Simulator
- Sports Safety
- Advanced Burn Life Support

**Appendix I:
Trauma Center Location & Level Designation**

Level I Tennessee Trauma Centers



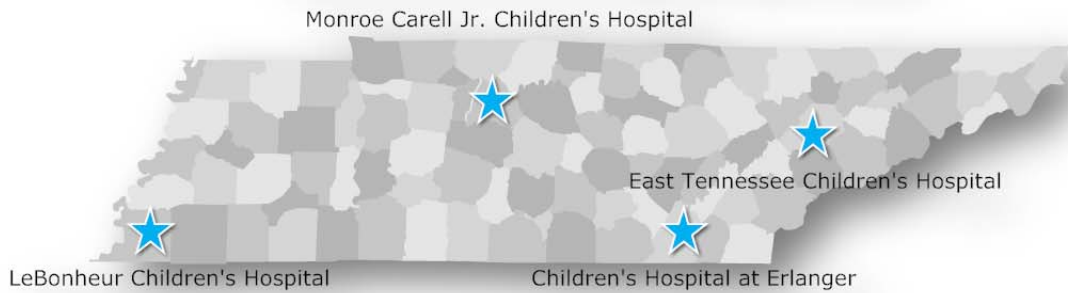
Level II Tennessee Trauma Centers



Level III Tennessee Trauma Centers



Tennessee Comprehensive Regional Pediatric Centers



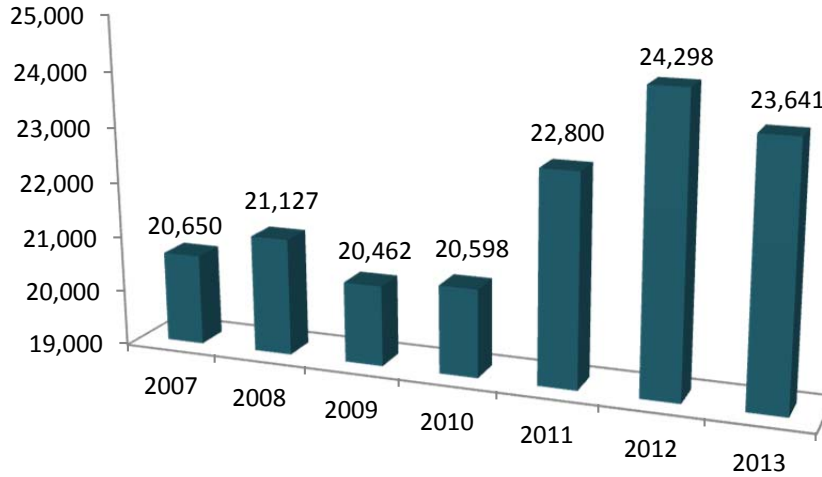
Appendix II:

Trauma Registry Reports

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Figure 1a:

Total Trauma Patients 2007 - 2013



In 2013 23,641 patients were treated in Tennessee trauma facilities. The overall growth pattern of patient totals recorded in the registry since 2007 is shown above in figure 1a. The age distribution of patients treated in Tennessee trauma facilities was 43.1 and the maximum age for a trauma patient was 108 as shown in figure 1b below.

Figure 1b:

Cummulative Distribution of 2013 Patients by Age

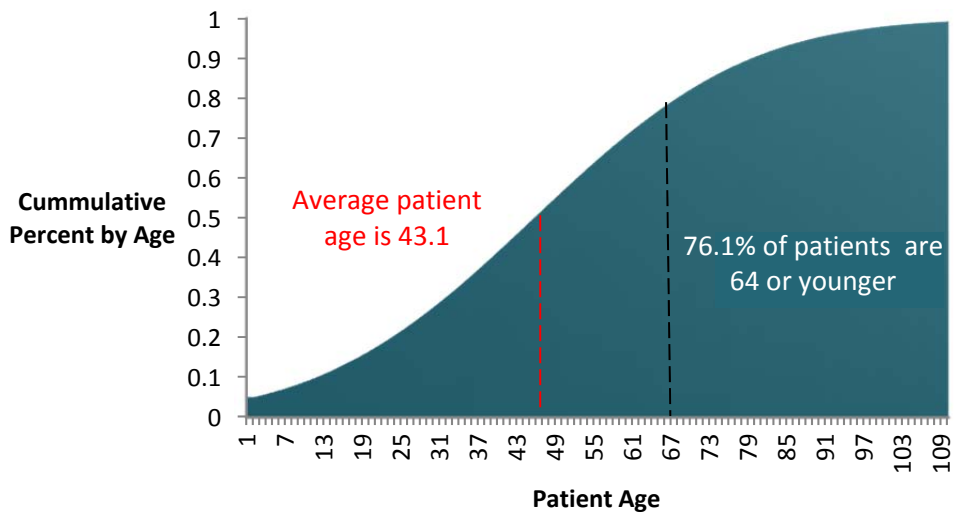
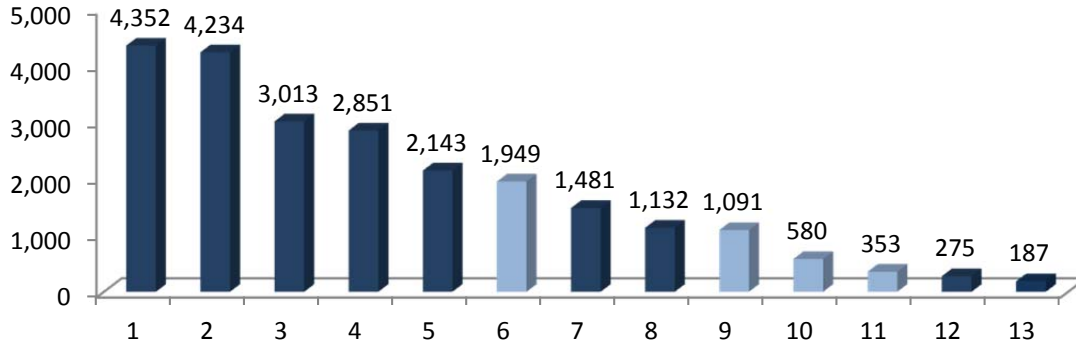


Figure 2a:

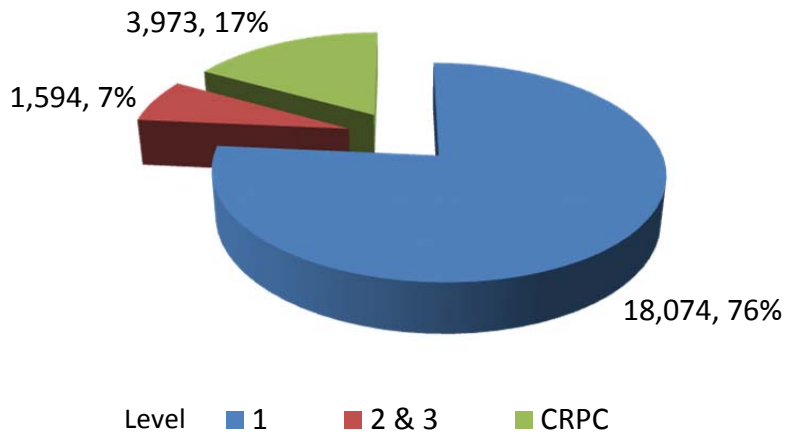
2013 Facility Rank by Patient Counts



Patient count is shown above in order of maximum patient counts to minimum. Comprehensive Regional Pediatric Centers are indicated by .

Figure 2b:

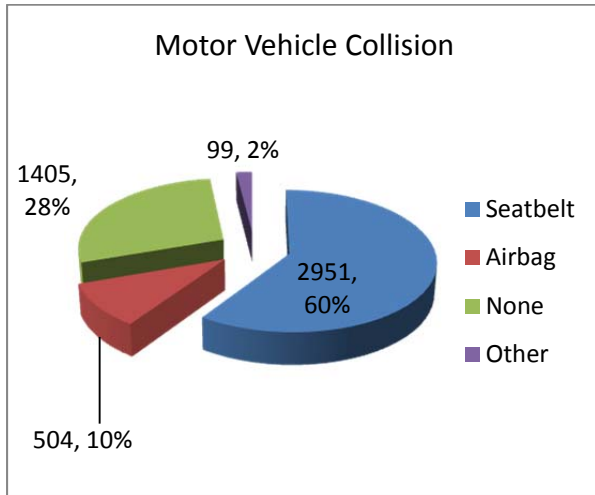
2013 Injury Distribution by Trauma Facility Level



As might be expected more than 3 quarters of all trauma patients were treated at a Level 1 trauma facility. Slightly more than 1 in 6 trauma patients were treated at Comprehensive Regional Pediatric Centers (CRPCs). Nearly 1 in 14 was treated in either a Level 2 or Level 3 facility.

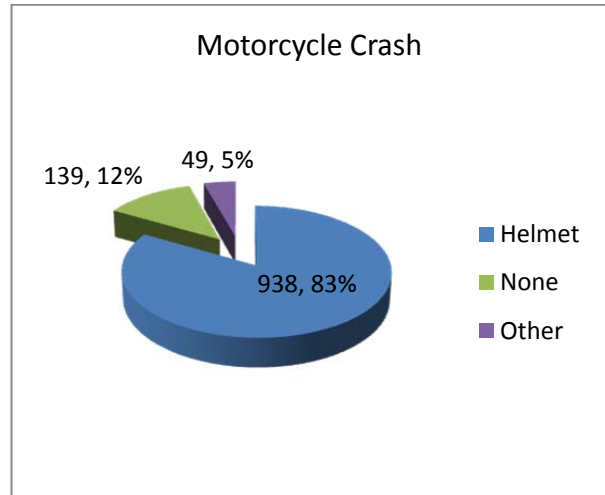
2013 Motor Vehicle, Motorcycle, and ATV Primary Safety Equipment Reported

Figure 3a:



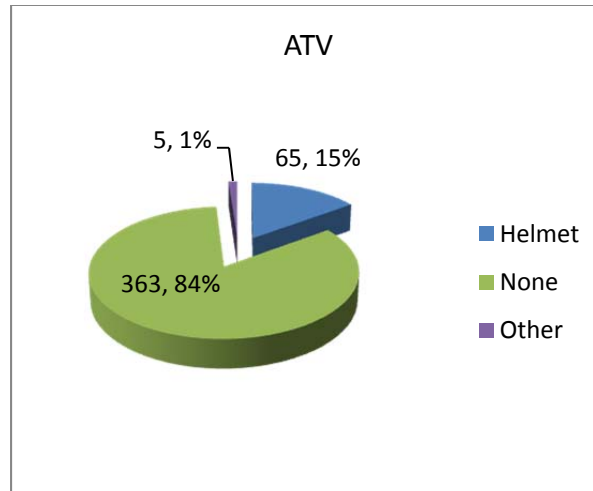
Total Injuries = 5,747; Primary safety measure not available = 788

Figure 3b:



Total injuries = 1,253; Primary safety measure not available = 127

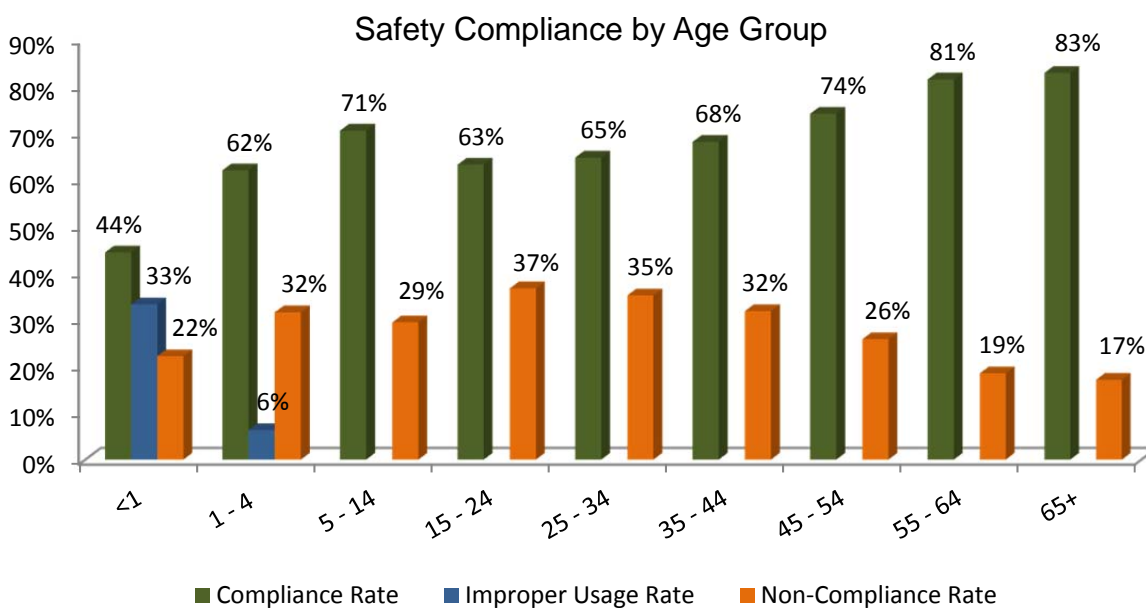
Figure 3c:



Total Injuries = 629; Primary safety measure not available = 196

Primary Safety Equipment measurements reflect the first piece of safety equipment listed during the record abstraction. In some cases, multiple equipment measures may have been utilized; however, the more critical result is an indication that no safety measure was applied. The least compliance was seen for ATV injuries in which 84% of patients treated show equipment use of “None”. The percent is not applicable to the entire 2013 trauma population (23,641), but instead to the total injuries for that MVC group. The injuries total for Motor Vehicle Collision was 5,747; Motorcycle crash was 1,253 and ATV was 629.

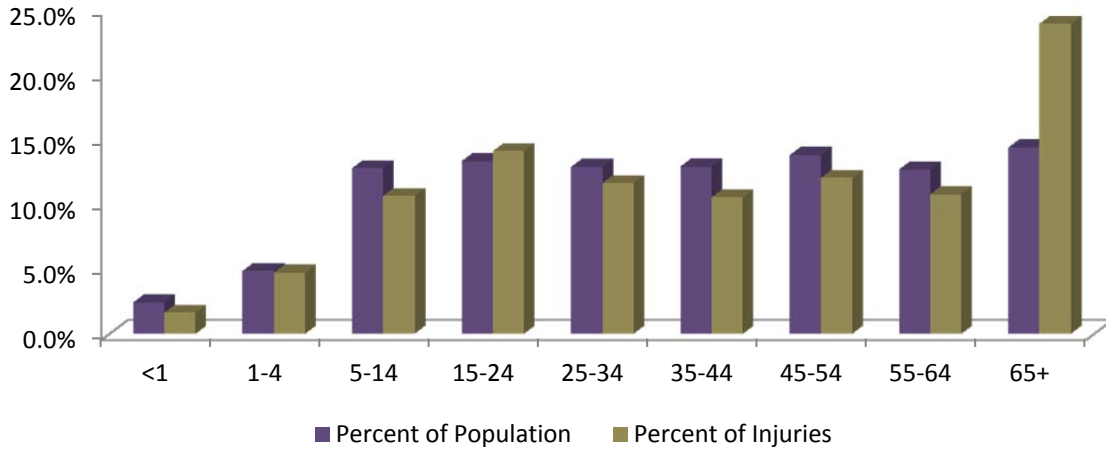
Figure 4:



The age group 65+ has the largest number of major trauma (1,554) which represents 25% of all traumas with ISS greater than 15. This group is also the most compliant for safety equipment as 83% of those MVC injuries had safety equipment engaged. The lowest rate was shown for children under 1 year old. In 33% of the injuries to these children, improper use of equipment rates was noted, i.e. improperly secured car seat. The pre-teens (5 – 14) are among the more compliant groups (71%); however for persons between age 15 and 34, compliance drops to 65% or less. With each subsequent age group the compliance rate increases an overall average of 6%. Between the 55 and 65+ groups, there is less change (2% increase).

Figure 5:

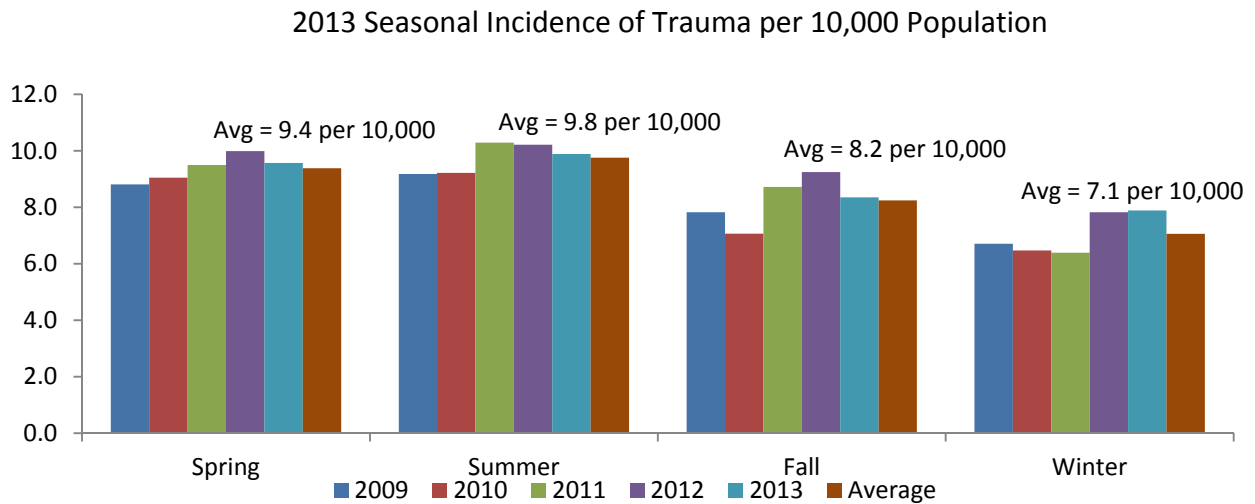
2013 Injury Proportion versus Population Percent (by Age Group)



Sources:
Tennessee Department of Health, Division of Policy, Planning and Assessment, Office of Health Statistics.
Tennessee Department of Health, BHLR, Office of Emergency Medical Services, 2013.

In 2013 the balance between the proportion of injuries experienced by age group relative to its Tennessee population percent is generally even with the exception of the age group over 65. Persons 65 and older disproportionately show a percentage of injuries 1.66 times the percentage of persons of this age group in the total population. Slightly fewer than 1 in 4 (23.9%) injuries were sustained by persons of this age group while only around 1 in 7 (14.4%) persons in Tennessee are 65 or older. (It should be noted that the 65+ age group represents the largest age demographic in Tennessee at 14.4%). The only similar anomaly of injuries percentage exceeding its population rate is the 15 – 24 age group where its injury rate is slightly more than its population rate for a 1.06 ratio.

Figure 6:



The chart above shows a regular pattern of seasonal trauma incidence per 10,000 population in each of the 5 years displayed. Each year the lowest number of injuries were treated during winter months and peaked during the summer. Average statewide Patient counts range from approximately 4,700 in the winter to 6,490 during the summer (38.1% difference).

Seasonal Incidence Rate per 10,000				
Year	Spring	Summer	Fall	Winter
2009	8.8	9.2	7.8	6.7
2010	9.0	9.2	7.1	6.5
2011	9.5	10.3	8.7	6.4
2012	10.0	10.2	9.3	7.8
2013	9.6	9.9	8.4	7.9
Average	9.4	9.8	8.2	7.1

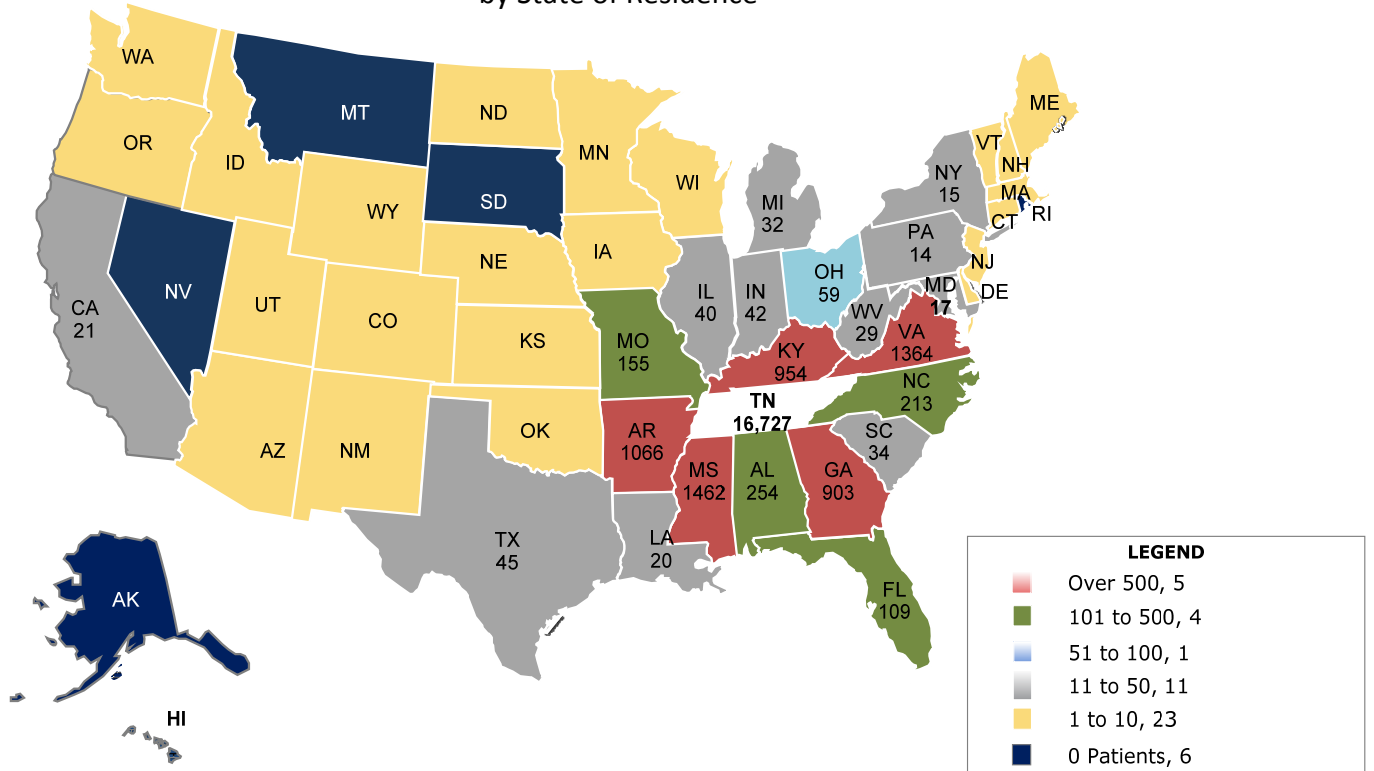
2013 Tennessee Trauma population = 6,621,214

Sources:

Tennessee Department of Health, Division of Policy, Planning and Assessment, Office of Health Statistics.
Tennessee Department of Health, BHLR, Office of Emergency Medical Services, 2013.

Figure 7:

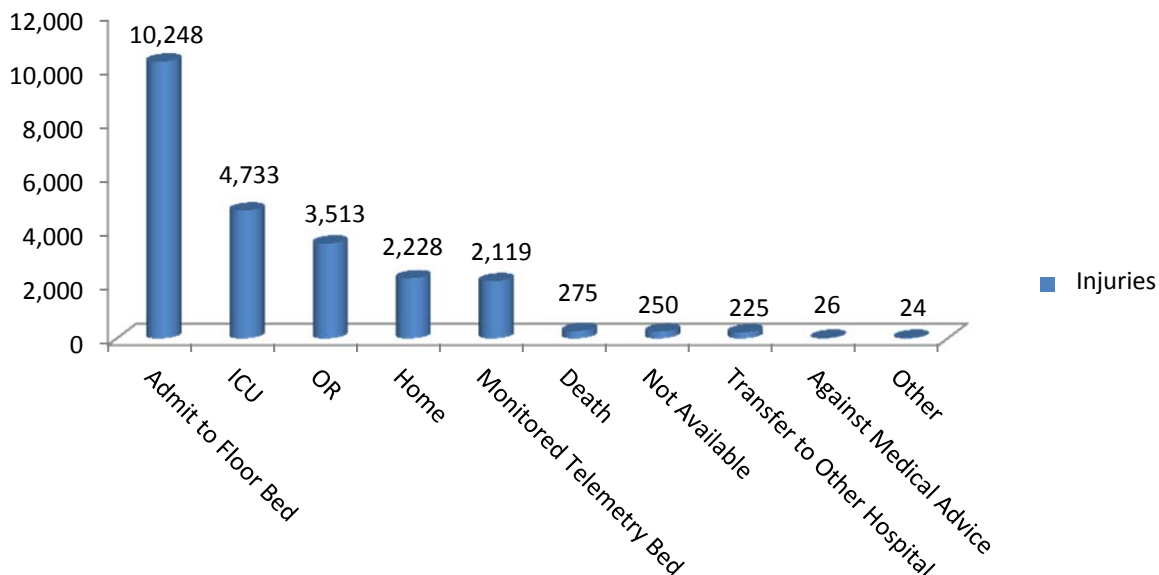
**2013 Trauma Patients Treated in Tennessee Trauma Facilities
by State of Residence**



70.8% of all trauma cases treated in Tennessee trauma facilities were Tennesseans (16,727); 29.2% of all cases (23,641) were residents of other states (6,914). Unlike 2012, when all but 4 states had residents treated in Tennessee trauma facilities, 6 of the 50 states had none of its residents treated in a Tennessee trauma facility in 2013. (State residence was not reported for 66 patients.)

Figure 8:

Top Ten 2013 Patient Counts by ED Disposition

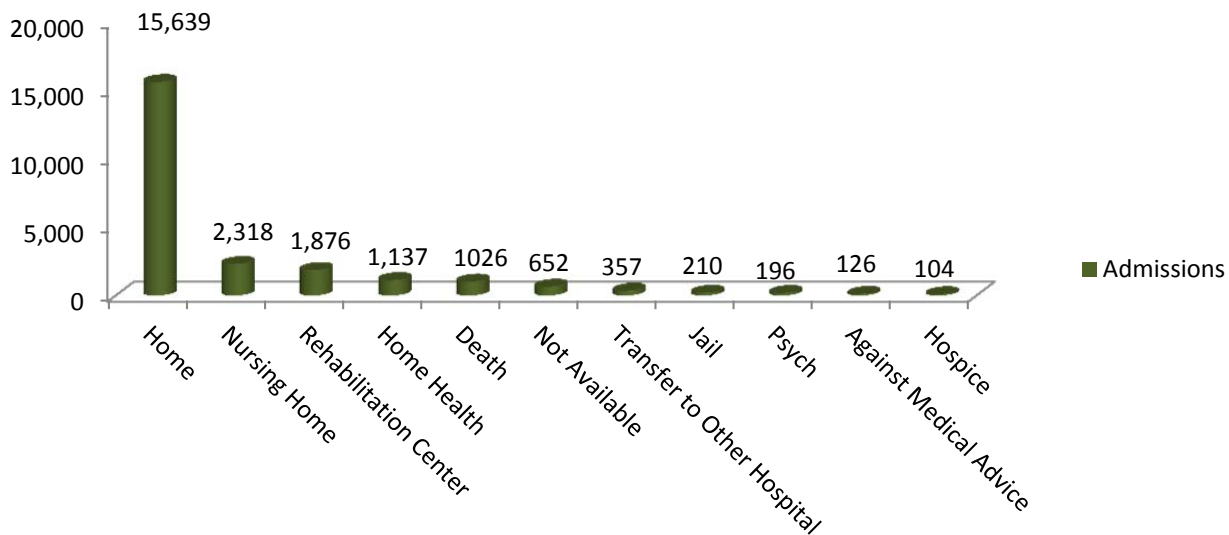


The majority of persons (approximately 9 in 10) who arrived at a trauma care facility emergency department for care were admitted to that facility. 9.5% were discharged home from the Emergency Department or left against medical advice.

ED Disposition	Patients	Percent
Admit to Floor Bed	10,248	43.3%
ICU	4,733	20.0%
OR	3,513	14.9%
Home	2,228	9.4%
Monitored Telemetry Bed	2,119	9.0%
Death	275	1.2%
Not Available	250	1.1%
Transfer to Other Hospital	225	1.0%
Against Medical Advice	26	0.1%
Other	24	0.1%
Total	23,641	100.0%

Figure 9:

Top Ten 2013 Patient Counts by Hospital Disposition

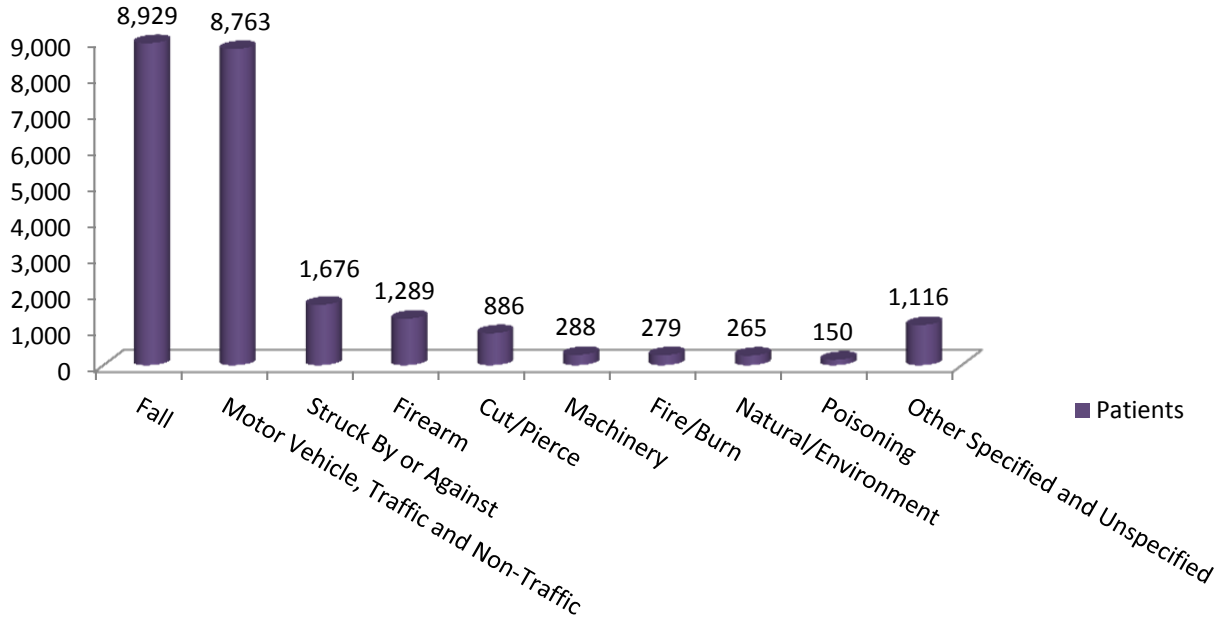


Three out of every four patients seeking care from a trauma facility were released back to their home or other facility upon treatment completion. A little more than 4% had an outcome of death.

Hospital Disposition	Patients	Percent
Home	15,639	66.15%
Nursing Home	2,318	9.80%
Rehabilitation Center	1,876	7.94%
Home Health	1,137	4.81%
Death	1,026	4.16%
Not Available	652	2.76%
Transfer to Other Hospital	357	1.51%
Jail	210	0.89%
Psych	196	0.83%
Against Medical Advice	126	0.53%
Other	104	0.25%
Total	23,641	100%

Figure 10:

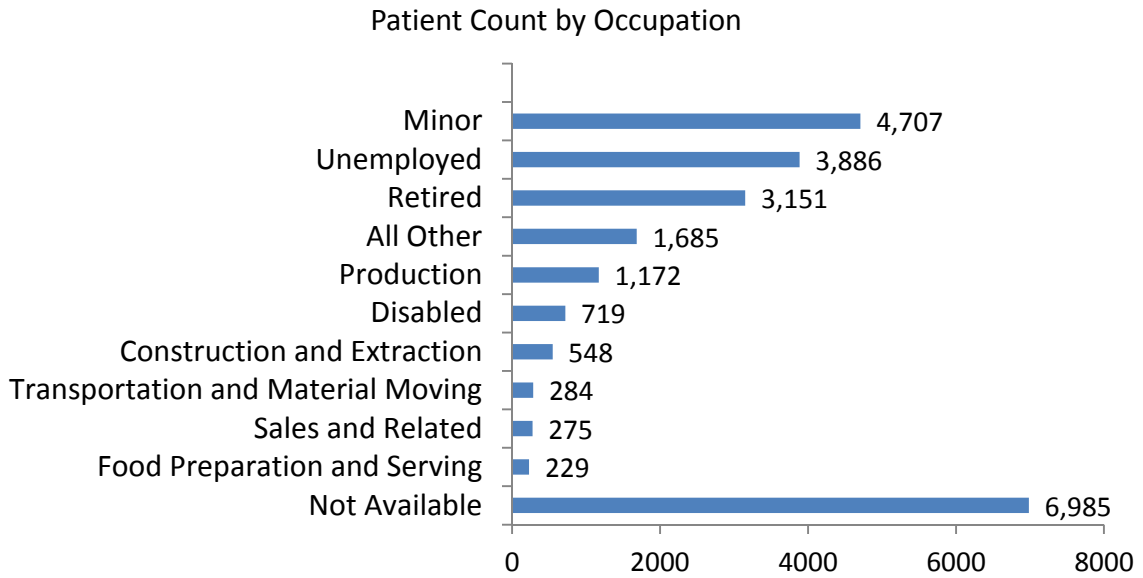
**Top Ten 2013 Patient Counts by Mechanism of Injury
(ECODES)**



Falls and Motor Vehicle, Traffic and Non-Traffic continue to be the top two injury causes for those presenting to a trauma center or CRPC.

Injury Cause (Mechanism)	Patient Counts	Percent
Fall	8,929	37.77 %
Motor Vehicle, Traffic and Non-Traffic	8,763	37.07 %
Struck By or Against	1,676	7.09 %
Firearm	1,289	5.45 %
Cut/Pierce	886	3.75 %
Machinery	288	1.22 %
Fire/Burn	279	1.18 %
Natural/Environment	265	1.12 %
Poisoning	150	0.63 %
Other Specified and Unspecified	1,116	4.72 %
Total	23,641	100.00 %

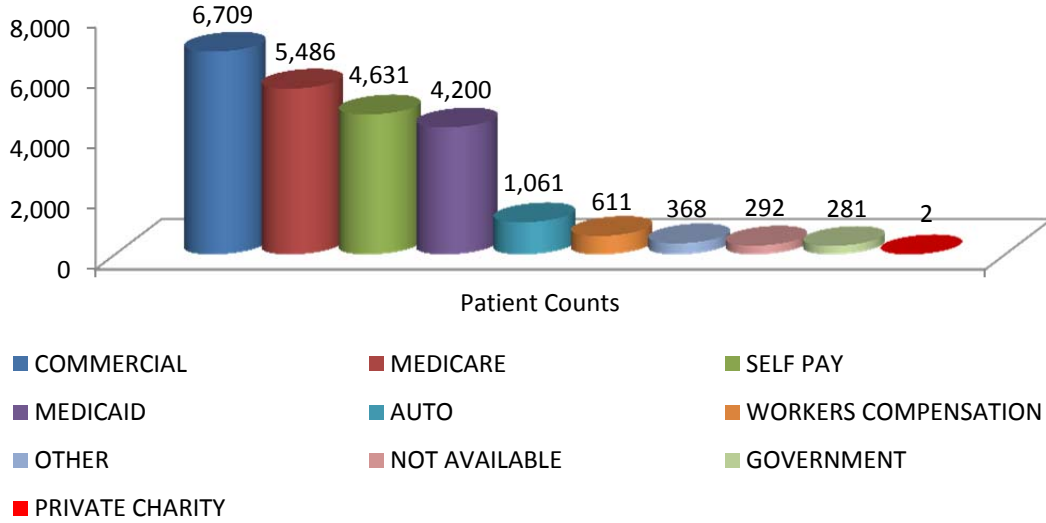
Figure 11:



Occupation	Patient Count	Percentage
Minor	4,707	20%
Unemployed	3,886	16%
Retired	3,151	13%
All Other	1,685	7%
Production	1,172	5%
Disabled	719	3%
Construction and Extraction	548	2%
Transportation and Material Moving	284	1%
Sales and Related	275	1%
Food Preparation and Serving	229	1%
Not Available	6,985	30%
Total	23,641	100%

Figure 12:

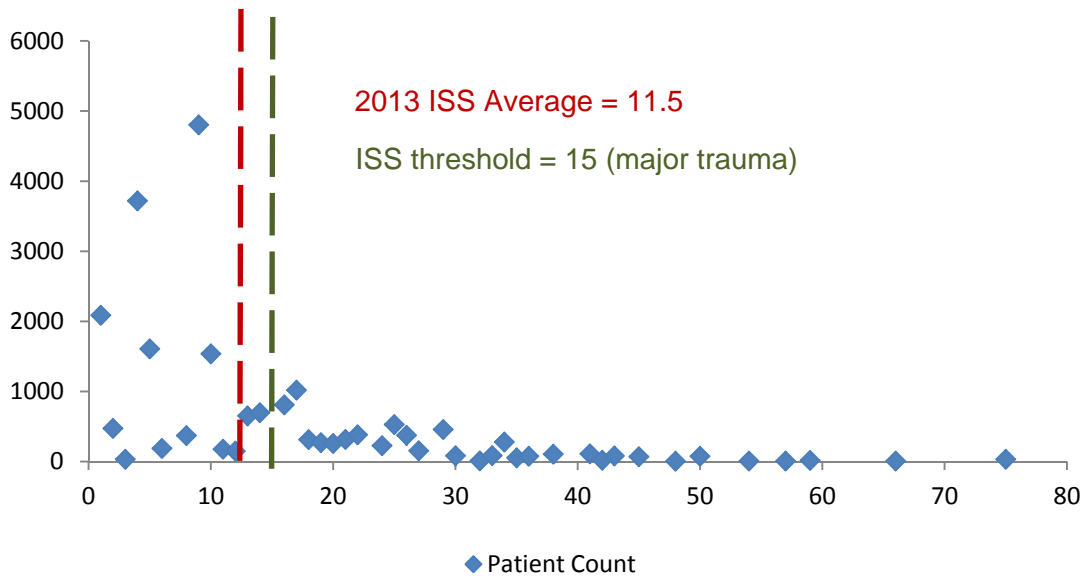
2013 Patient Counts by Payor Grouping



Payor	Patient Counts	Percentage
COMMERCIAL	6,709	28.38 %
MEDICARE	5,486	23.21 %
SELF PAY	4,631	19.59 %
MEDICAID	4,200	17.77 %
AUTO	1,061	4.49 %
WORKERS COMPENSATION	611	2.58 %
OTHER	368	1.56 %
NOT AVAILABLE	292	1.24 %
GOVERNMENT	281	1.19 %
PRIVATE CHARITY	2	0.01 %
Total	23,641	100.00%

Figure 13:

2013 Patient Counts by Injury Severity Score (ISS) and Age



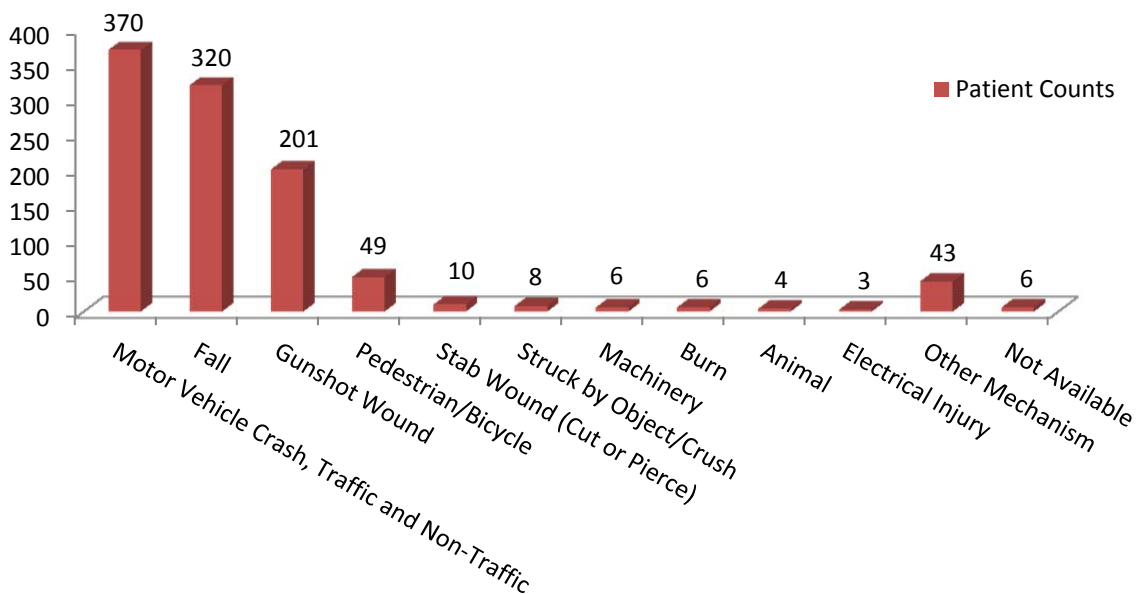
Major trauma is commonly defined using an Injury Severity Score (ISS) of 15. In 2013 the weighted average of reported ISS was 11.5. (The most frequently occurring ISS was 9.) Slightly more than 1 in 4 patients (27.4%) had scores 15 or higher, indicating major trauma. This represents a 2.8% reduction in the number of patients with ISS of 15 or higher in 2012 (28.2%). The threshold note was retrieved from PMC U.S. National Library of Medicine, National Institute of Health. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3217501/>

ISS range	2012 Patient Counts	2013 Patient Counts
1 to 14	16,393	16,489
15 to 30	5,317	5,185
31 to 45	925	889
46 to 60	146	114
61 to 75	38	40
Not Reported	1,575	924
TOTAL:	24,394	23,641
Weighted Average	11.7	11.5

Figure 14:

2013 Fatalities by Mechanism of Injury

ECODE

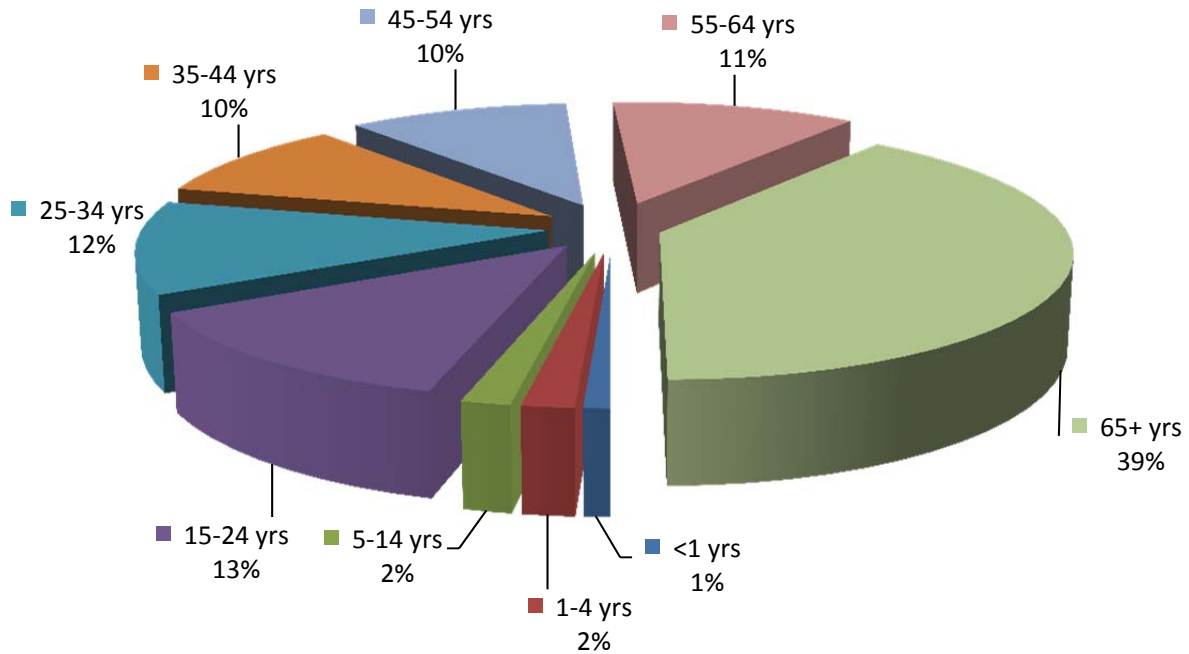


Motor vehicle crashes continue to be the leading cause of death for patients brought to trauma facilities. Deaths due to falls follow closely with only 50 fewer fatalities.

Mechanism of Injury	Patient Counts	Percent
Motor Vehicle Crash, Traffic and Non-Traffic	370	36.1%
Fall	320	31.2%
Gunshot Wound	201	19.6%
Pedestrian/Bicycle	49	4.8%
Stab Wound (Cut or Pierce)	10	1.0%
Struck by Object/Crush	8	0.8%
Machinery	6	0.6%
Burn	6	0.6%
Animal	4	0.4%
Electrical Injury	3	0.3%
Other Mechanism	43	4.2%
Not Available	6	0.6%
TOTAL:	1,026	100.0%

Figure 15:

Fatalities by Age Group

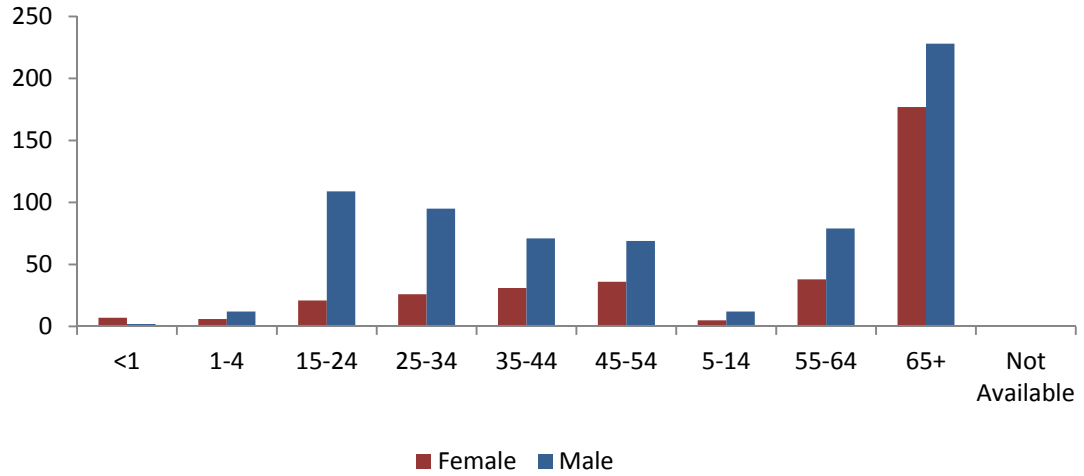


As the 65+ age group shows the largest percentage of injuries (23%), it similarly experiences the largest percentage of fatal outcomes (39%). This comparison shows a relative disproportion of percentages – 1.7 injuries rate to death rate.

Total	<1 yrs.	1-4 yrs.	5-14 yrs.	15-24 yrs.	25-34 yrs.	35-44 yrs.	45-54 yrs.	55-64 yrs.	65+ yrs.	Not Available
1026	9	18	17	130	121	102	105	117	405	2

Figure 16:

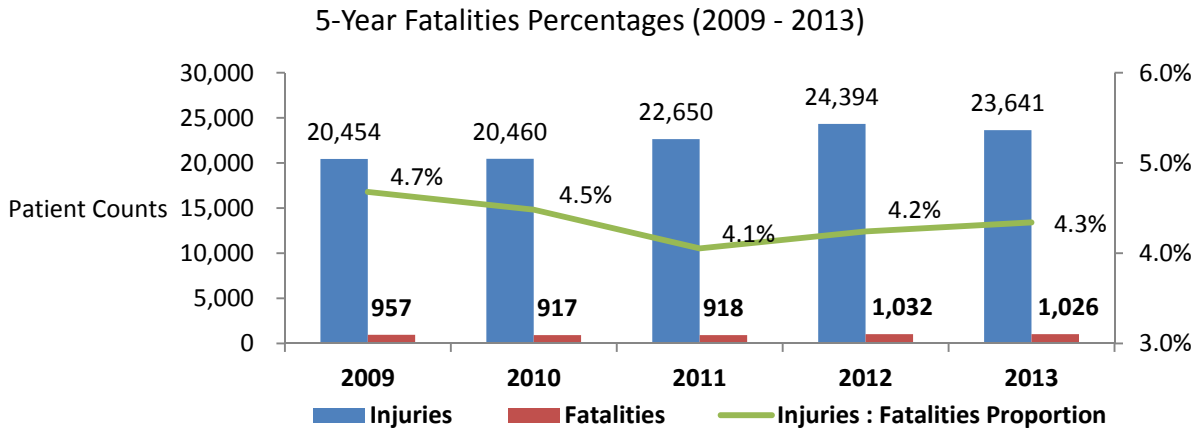
Case Fatalities by Age and Gender



Although the overall fatality rate by gender is just under 2, the most disparate frequency occurs in males age 15 to 24, when the death rate for male patients is nearly 5 times that of females.

Age Group	Female	Male	Male:Female Ratio
<1	7	2	0.29
1-4	6	12	2.00
15-24	21	109	5.19
25-34	26	95	3.65
35-44	31	71	2.29
45-54	36	69	1.92
5-14	5	12	2.40
55-64	38	79	2.08
65+	177	228	1.29
N/A	1	1	1.00
Total	348	678	1.95

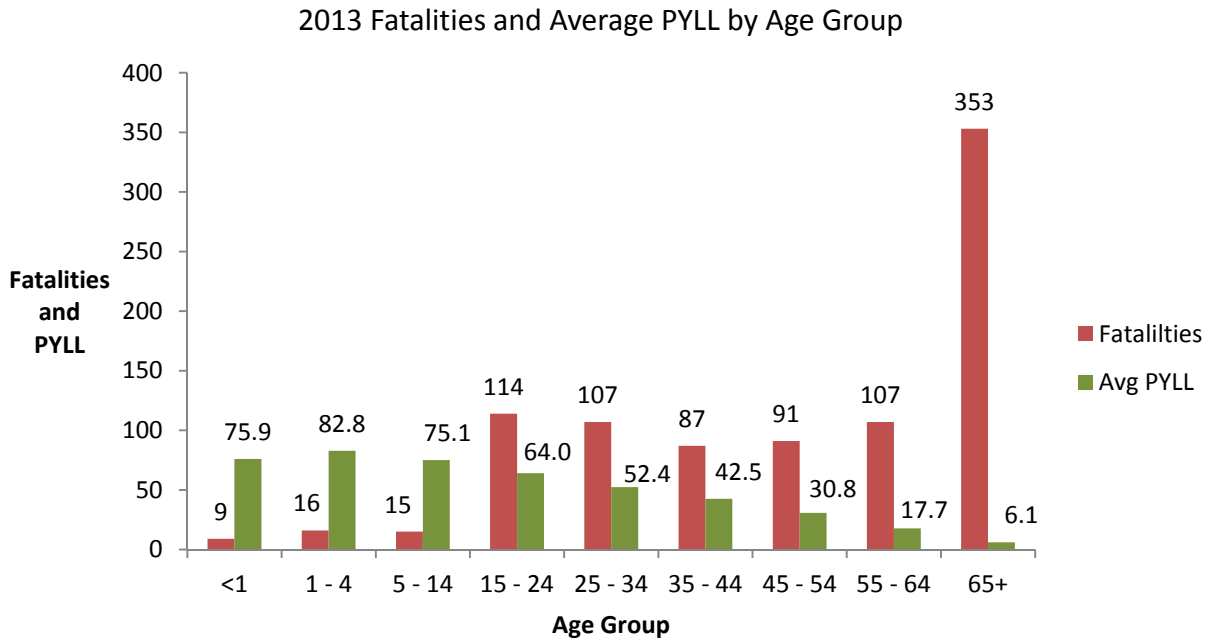
Figure 17:



Mortality rate for 2013 was 15.5 fatalities per 100,000 population. Tennessee Trauma Population for the state (6,621,214) was derived by upwardly adjusting the Tennessee resident population to 6,614,298 to account for the 6,914 out of state patients treated in the state trauma facilities. Of the 6,914 patients treated, 3.7% had fatal outcomes (256).

	2009	2010	2011	2012	2013
Injuries	20,454	20,460	22,650	24,394	23,641
Fatalities	957	917	918	1032	1026
Fatalities Percentage	4.7%	4.5%	4.1%	4.2%	4.3%

Figure 18:



Potential Years of Life Lost (PYLL)

At 65 years of age, average life expectancy is 81.3¹ while life expectancy beginning at birth is 76.4 years. The table below indicates the average age at death for this group is 76.9². Persons younger than 65 were on average 36.9 years old at death.

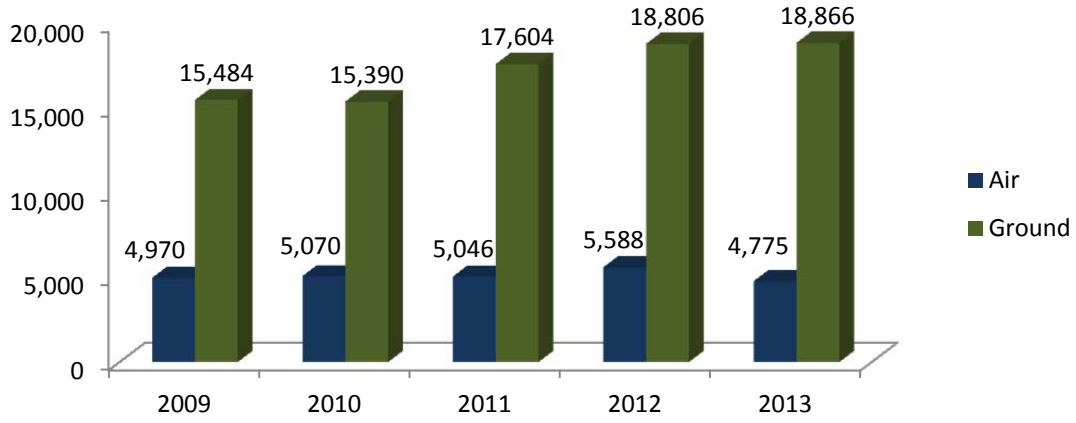
Age Group	Fatalities	Average Age at Death
Under 65	353	36.9
65+	673	79.9

Sources:

- (1) Tennessee Department of Health, Division of Policy, Planning and Assessment, 2011.
- (2) Tennessee Department of Health, BHLR, Emergency Medical Services, 2013.

Figure 19:

**Patient Distribution by Transport Category
2009 - 2013**

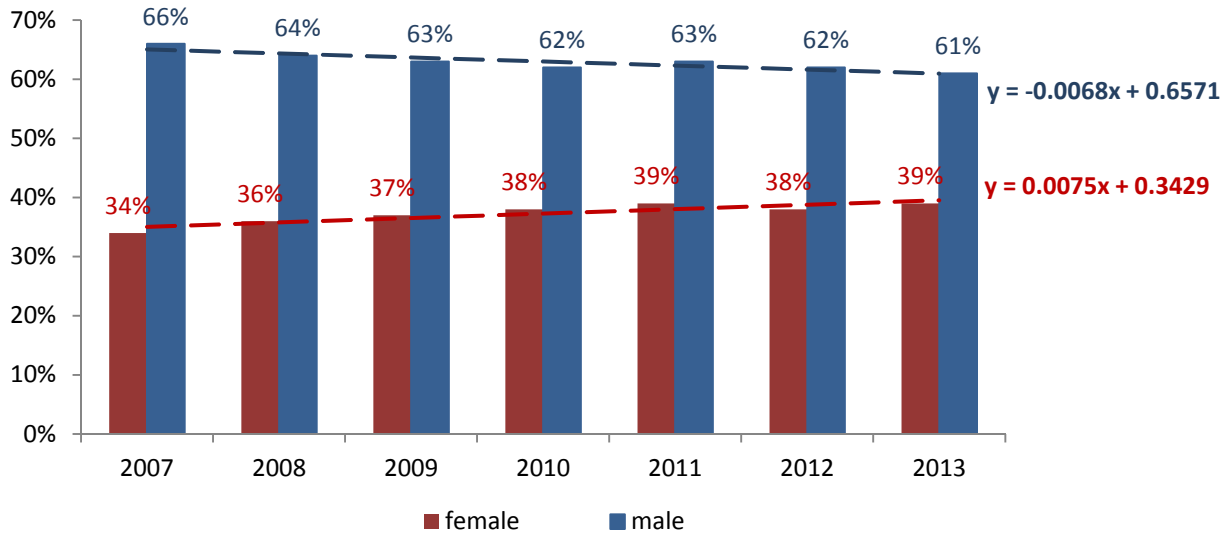


Patient transport by ground travel has shown on an upward trend for the past 5 years. Since 2007 patients are increasingly arriving to the trauma facilities using ground transportation.

Year	2009	2010	2011	2012	2013
Air	4,970	5,070	5,046	5,588	4,775
Air Percent	24.3%	24.8%	22.3%	22.9%	20.2%
Ground	15,484	15,390	17,604	18,806	18,866
Ground Percent	75.7%	75.2%	77.7%	77.1%	79.8%
Total	20,454	20,460	22,650	24,394	23,641

Figure 21:

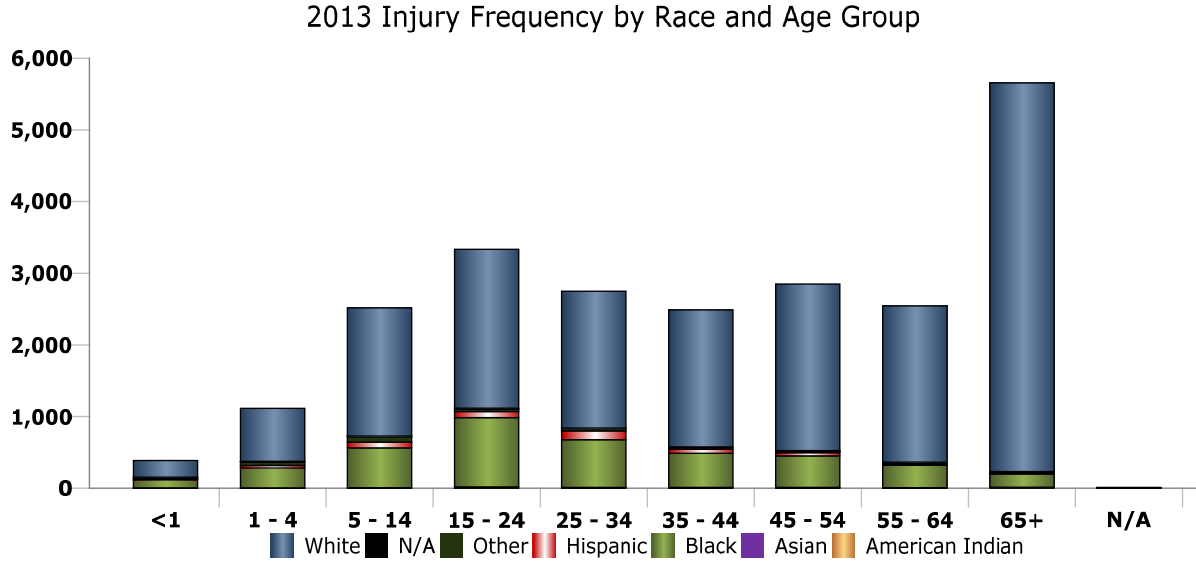
**Injury Ratios by Gender
2007 - 2013**



The distribution of trauma injuries by gender has shown an inverted shift toward females. Since 2007 injury rate changed from approximately 4 male injuries for every 2 females to a rate of around 3 males for every 2 females. Total annual injuries increased by 14.5% during this same period from 20,649 in 2007 to 23,641 in 2013. Falls and Motor Vehicle Collision are consistently the leading cause of injury. Females suffer only about 1% more falls than males while males are injured 1½ more times than females in motor vehicle crashes and all other injury causes where there were 2 or more trauma cases reported.

Trauma Patient Counts by Gender							
	2007	2008	2009	2010	2011	2012	2013
Female Pct	34%	36%	37%	38%	39%	38%	39%
Male Pct	66%	64%	63%	62%	63%	62%	61%
Female Count	7,080	7,597	7,492	7,692	8,505	9,231	9,124
Male Count	13,545	13,507	12,971	12,765	14,143	15,161	14,515

Figure 22:



Considering injuries by age category and race, the age group experiencing the most injuries varies from one race to another. In the White demographic, injuries sustained by the 65+ age group is 3.3 times the average of the other 8 reported age groups (5,424 versus 1,663). Similarly, the 15 – 24 age group in the Black demographic experienced 2.6 times the average of its other 8 age groups (969 versus 378), and the 25 – 34 age group in the Hispanic race had 2.8 times as many injuries as its other 8 age groups (122 versus 43). Comparing the high injury age group to the same age in other races shows the 65+ White demographic experienced nearly 122 times the average for all other races 65 and older (5,424 versus 44). Black persons 15-24 years old experienced slightly more than double the average of all other races (969 versus 470). Although the Hispanic demographic had its highest incidence of injuries between ages 25 and 34, this injury count was slightly under 25% of the average of all other races. This is largely due to the overall higher number of injuries sustained in the White (1,911) and Black (477) demographics.

	<1	1-4	5-14	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65+	N/A	Total	Percent of Total
American Indian	0	1	1	0	1	1	0	1	0	0	5	0.02%
Asian	2	4	8	16	10	12	9	7	14	0	82	0.35%
Black	111	277	556	969	667	477	439	312	185	0	3,993	16.89%
Hispanic	18	36	80	82	122	57	44	18	10	0	467	1.98%
White	232	739	1,786	2,218	1,908	1,911	2,326	2,181	5,424	2	18,727	79.21%
Other	18	49	76	34	34	24	18	16	13	0	282	1.19%
N/A	4	10	9	13	6	9	10	11	11	2	85	0.36%
Total	385	1,116	2,516	3,332	2,748	2,491	2,846	2,546	5,657	4	23,641	100

Appendix III:

2014 Trauma Fund Distribution

FUNDS DISTRIBUTED TO TRAUMA CENTERS AND NON-TRAUMA CENTERS FROM TENNESSEE TRAUMA FUND - FY2014 – 1st QUARTER DISTRIBUTION				
Level	Hospital Name	Hospital Specific Pool Payment	Readiness Costs	Total Hospital Distribution Payment
	TOTAL	\$1,190,441.02	\$835,000.00	\$2,025,441.02
Lev I	Regional Medical Center at Memphis	\$452,551.06	\$97,250.00	\$549,801.06
Lev I	Vanderbilt University Hospital	\$329,557.95	\$153,250.00	\$482,807.95
Lev I	Erlanger Health Center	\$93,479.15	\$153,250.00	\$246,729.15
Lev I	University of Tennessee Medical Center	\$99,840.56	\$102,250.00	\$202,090.56
Lev I	Johnson City Medical Center	\$44,671.92	\$72,500.00	\$117,171.92
Lev I	Wellmont Holston Valley Medical Center	\$35,299.67	\$72,500.00	\$107,799.67
PED	LeBonheur Children's Hospital	\$3,576.22	\$64,250.00	\$67,826.22
Lev II	Wellmont Bristol Regional Medical Center	\$16,066.15	\$37,750.00	\$53,816.15
PED	East Tennessee Children's Hospital	\$0.00	\$51,000.00	\$51,000.00
Lev III	Blount Memorial Hospital	\$2,364.28	\$15,500.00	\$17,864.28
Lev III	Athens Regional Medical Center	\$1,776.79	\$15,500.00	\$17,276.79
	Jackson-Madison County General Hospital	\$17,276.79	.	\$17,276.79
	Methodist University Hospital	\$17,276.79	.	\$17,276.79
	TriStar Skyline Medical Center	\$13,421.02	.	\$13,421.02
	Saint Thomas West Hospital	\$11,168.47	.	\$11,168.47
	Saint Francis Hospital	\$8,573.37	.	\$8,573.37
	Methodist Medical Center of Oak Ridge	\$6,516.74	.	\$6,516.74
	Methodist North Hospital	\$5,573.32	.	\$5,573.32
	Baptist Memorial Hospital-Memphis	\$5,544.38	.	\$5,544.38
	Cookeville Regional Medical Center	\$3,465.84	.	\$3,465.84
	Cumberland Medical Center	\$2,526.57	.	\$2,526.57
	Henry County Medical Center	\$2,348.14	.	\$2,348.14
	Maury Regional Medical Center	\$2,065.41	.	\$2,065.41
	River Park Hospital	\$1,688.98	.	\$1,688.98
	Memorial Health Care System	\$1,480.94	.	\$1,480.94
	Williamson Medical Center	\$1,477.72	.	\$1,477.72
	Physicians Regional Medical Center	\$1,418.78	.	\$1,418.78
	Parkwest Medical Center	\$1,370.09	.	\$1,370.09
	Sumner Regional Medical Center	\$1,296.81	.	\$1,296.81
	Laughlin Memorial Hospital	\$1,284.49	.	\$1,284.49
	Morristown-Hamblen Healthcare System	\$1,169.61	.	\$1,169.61
	TriStar Horizon Medical Center	\$833.57	.	\$833.57
	Roane Medical Center	\$805.84	.	\$805.84

	Southern Tennessee Medical Center	\$748.04	.	\$748.04
	Harton Regional Medical Center	\$526.80	.	\$526.80
	Baptist Memorial Hospital-Collierville	\$481.39	.	\$481.39
	Baptist Memorial Hospital-Union City	\$415.75	.	\$415.75
	Memorial Hospital Hixon	\$293.78	.	\$293.78
	Sweetwater Hospital Association	\$207.84	.	\$207.84

**FUNDS DISTRIBUTED TO TRAUMA CENTERS AND NON-TRAUMA CENTERS
FROM TENNESSEE TRAUMA FUND - FY2014 – 2nd QUARTER DISTRIBUTION**

Level	Hospital Name	Hospital Specific Pool Payment	Readiness Costs	Total Hospital Distribution Payment
	TOTAL	\$997,727.35	\$835,000.00	\$1,832,727.35
Lev I	Regional Medical Center at Memphis	\$363,747.43	\$97,250.00	\$460,997.43
Lev I	Vanderbilt University Hospital	\$277,722.12	\$153,250.00	\$430,972.12
Lev I	Erlanger Health Center	\$73,736.87	\$153,250.00	\$226,986.87
Lev I	University of Tennessee Medical Center	\$96,262.28	\$102,250.00	\$198,512.28
Lev I	Johnson City Medical Center	\$50,961.49	\$72,500.00	\$123,461.49
Lev I	Wellmont Holston Valley Medical Center	\$29,278.53	\$72,500.00	\$101,778.53
PED	LeBonheur Children's Hospital	\$12,359.17	\$64,250.00	\$76,609.17
Lev II	Wellmont Bristol Regional Medical Center	\$19,441.28	\$37,750.00	\$57,191.28
PED	East Tennessee Children's Hospital	.	\$51,000.00	\$51,000.00
Lev III	Blount Memorial Hospital	\$2,170.54	\$15,500.00	\$17,670.54
Lev III	Athens Regional Medical Center	\$459.48	\$15,500.00	\$15,959.48
	Methodist University Hospital	\$14,746.42	.	\$14,746.42
	Baptist Memorial Hospital-Memphis	\$11,109.23	.	\$11,109.23
	Jackson-Madison Cnty. General Hospital	\$7,373.54	.	\$7,373.54
	TriStar Skyline Medical Center	\$6,886.94	.	\$6,886.94
	Cookeville Regional Medical Center	\$3,821.71	.	\$3,821.71
	Henry County Medical Center	\$3,438.25	.	\$3,438.25
	Saint Thomas West Hospital	\$3,402.88	.	\$3,402.88
	Methodist Medical Center of Oak Ridge	\$2,422.70	.	\$2,422.70
	Maury Regional Medical Center	\$2,146.27	.	\$2,146.27
	Physicians Regional Medical Center	\$2,142.57	.	\$2,142.57
	TriStar Horizon Medical Center	\$2,049.44	.	\$2,049.44
	TriStar Southern Hills Medical Center	\$1,421.66	.	\$1,421.66
	Hendersonville Medical Center	\$1,162.42	.	\$1,162.42
	NorthCrest Medical Center	\$1,086.08	.	\$1,086.08
	Morristown-Hamblen Healthcare System	\$1,028.44	.	\$1,028.44
	LeConte Medical Center	\$1,022.95	.	\$1,022.95
	Parkwest Medical Center	\$969.57	.	\$969.57
	Laughlin Memorial Hospital	\$929.41	.	\$929.41

	River Park Hospital	\$876.44	.	\$876.44
	Baptist Memorial Hospital-Collierville	\$857.54	.	\$857.54
	Williamson Medical Center	\$685.02	.	\$685.02
	Cumberland Medical Center	\$642.82	.	\$642.82
	Southern Tennessee Medical Center	\$573.59	.	\$573.59
	Memorial Hospital Hixon	\$444.85	.	\$444.85
	Jefferson Memorial Hospital	\$243.58	.	\$243.58
	Claiborne County Hospital	\$103.86	.	\$103.86

**FUNDS DISTRIBUTED TO TRAUMA CENTERS AND NON-TRAUMA CENTERS
FROM TENNESSEE TRAUMA FUND - FY2014 – 3rd QUARTER DISTRIBUTION**

Level	Hospital Name	Hospital Specific Pool Payment	Readiness Costs	Total Hospital Distribution Payment
	TOTAL	\$1,101,771.80	\$835,000.00	\$1,936,771.80
Lev I	Regional Medical Center at Memphis	\$437,391.86	\$97,250.00	\$534,641.86
Lev I	Vanderbilt University Hospital	\$345,253.61	\$153,250.00	\$498,503.61
Lev I	Erlanger Health Center	\$69,153.53	\$153,250.00	\$222,403.53
Lev I	University of Tennessee Medical Center	\$77,083.34	\$102,250.00	\$179,333.34
Lev I	Johnson City Medical Center	\$52,542.52	\$72,500.00	\$125,042.52
Lev I	Wellmont Holston Valley Medical Center	\$39,246.10	\$72,500.00	\$111,746.10
PED	LeBonheur Children's Hospital	\$5,544.59	\$64,250.00	\$69,794.59
PED	East Tennessee Children's Hospital	\$0.00	\$51,000.00	\$51,000.00
Lev II	Wellmont Bristol Regional Medical Center	\$10,281.21	\$37,750.00	\$48,031.21
Lev III	Blount Memorial Hospital	\$1,654.65	\$15,500.00	\$17,154.65
Lev III	Athens Regional Medical Center	\$1,555.33	\$15,500.00	\$17,055.33
	Methodist University Hospital	\$17,055.33	.	\$17,055.33
	Jackson-Madison County General Hospital	\$14,208.02	.	\$14,208.02
	Maury Regional Medical Center	\$5,431.71	.	\$5,431.71
	Baptist Memorial Hospital-Memphis	\$5,304.96	.	\$5,304.96
	Physicians Regional Medical Center	\$4,001.52	.	\$4,001.52
	TriStar Skyline Medical Center	\$3,577.84	.	\$3,577.84
	Cookeville Regional Medical Center	\$2,576.35	.	\$2,576.35
	Williamson Medical Center	\$1,993.51	.	\$1,993.51
	TriStar Summit Medical Center	\$1,797.21	.	\$1,797.21
	Henry County Medical Center	\$1,447.08	.	\$1,447.08
	Cumberland Medical Center	\$1,030.54	.	\$1,030.54
	Harton Regional Medical Center	\$925.21	.	\$925.21
	University Medical Center	\$800.16	.	\$800.16
	Methodist Medical Center of Oak Ridge	\$609.38	.	\$609.38
	Southern Tennessee Medical Center	\$369.26	.	\$369.26
	Laughlin Memorial Hospital	\$337.02	.	\$337.02

	Sweetwater Hospital Association	\$336.08	.	\$336.08
	Memorial Hospital Hixon	\$263.88	.	\$263.88

**FUNDS DISTRIBUTED TO TRAUMA CENTERS AND NON-TRAUMA CENTERS
FROM TENNESSEE TRAUMA FUND - FY2014 – 4th QUARTER DISTRIBUTION**

Level	Hospital Name	Hospital Specific Pool Payment	Readiness Costs	Total Hospital Distribution Payment
	TOTAL	\$1,138,817.98	\$835,000.00	\$1,973,817.98
Lev I	Vanderbilt University Hospital	\$329,905.73	\$153,250.00	\$483,155.73
Lev I	Regional Medical Center at Memphis	\$383,787.21	\$97,250.00	\$481,037.21
Lev I	Erlanger Health Center	\$94,596.64	\$153,250.00	\$247,846.64
Lev I	University of Tennessee Medical Center	\$108,789.05	\$102,250.00	\$211,039.05
Lev I	Johnson City Medical Center	\$68,139.74	\$72,500.00	\$140,639.74
Lev I	Wellmont Holston Valley Medical Center	\$43,144.35	\$72,500.00	\$115,644.35
PED	LeBonheur Children's Hospital	\$5,655.59	\$64,250.00	\$69,905.59
Lev II	Wellmont Bristol Regional Medical Center	\$14,561.57	\$37,750.00	\$52,311.57
PED	East Tennessee Children's Hospital	\$0.00	\$51,000.00	\$51,000.00
Lev III	Blount Memorial Hospital	\$3,532.35	\$15,500.00	\$19,032.35
Lev III	Athens Regional Medical Center	\$29.78	\$15,500.00	\$15,529.78
	Jackson-Madison County General Hospital	\$15,529.78	.	\$15,529.78
	Methodist University Hospital	\$15,529.78	.	\$15,529.78
	TriStar Southern Hills Medical Center	\$7,841.96	.	\$7,841.96
	Baptist Memorial Hospital-Memphis	\$4,688.88	.	\$4,688.88
	TriStar Summit Medical Center	\$4,394.88	.	\$4,394.88
	Cookeville Regional Medical Center	\$3,531.68	.	\$3,531.68
	Saint Thomas West Hospital	\$3,251.23	.	\$3,251.23
	TriStar Skyline Medical Center	\$3,199.20	.	\$3,199.20
	Mauzy Regional Medical Center	\$2,925.83	.	\$2,925.83
	Harton Regional Medical Center	\$2,867.84	.	\$2,867.84
	Memorial Health Care System	\$2,551.81	.	\$2,551.81
	Parkwest Medical Center	\$2,362.37	.	\$2,362.37
	Dyersburg Regional Medical Center	\$1,948.98	.	\$1,948.98
	Methodist North Hospital	\$1,834.93	.	\$1,834.93
	Henry County Medical Center	\$1,724.85	.	\$1,724.85
	Williamson Medical Center	\$1,388.75	.	\$1,388.75
	River Park Hospital	\$1,218.05	.	\$1,218.05
	Physicians Regional Medical Center	\$1,215.09	.	\$1,215.09
	LeConte Medical Center	\$1,159.05	.	\$1,159.05
	Unicoi County Memorial Hospital, Inc.	\$1,122.80	.	\$1,122.80
	TriStar Horizon Medical Center	\$1,119.34	.	\$1,119.34
	University Medical Center	\$1,040.88	.	\$1,040.88

	Regional Hospital of Jackson	\$869.01	.	\$869.01
	Cumberland Medical Center	\$805.49	.	\$805.49
	Hendersonville Medical Center	\$749.05	.	\$749.05
	Memorial Hospital Hixon	\$615.83	.	\$615.83
	Methodist Medical Center of Oak Ridge	\$509.03	.	\$509.03
	Sumner Regional Medical Center	\$466.99	.	\$466.99
	Southern Tennessee Medical Center	\$208.34	.	\$208.34
	Jefferson Memorial Hospital	\$4.29	.	\$4.29

Trauma Fund Disbursement Totals Since Inception

	Fiscal Year	Trauma Fund Disbursement Totals
*Start of Trauma Fund	FY2008	\$9,086,822.57
	FY2009	\$9,192,013.69
	FY2010	\$8,973,548.13
	FY2011	\$8,762,345.31
	FY2012	\$8,328,132.57
	FY2013	\$8,316,610.13
	FY2014	\$7,768,758.15

\$1,318,063.98 below initial disbursement when trauma fund started

Appendix IV:

Research Publications

1. Airway pressure release ventilation in morbidly obese surgical patients with acute lung injury and acute respiratory distress syndrome. Testerman, GM, Breitman, I, Hensley, S. *Am Surg.* 2013 Mar; 79(3): 242-6
2. Alshadwi AA, Nadersach MM, Carlson ER, Young LS, Burke PA and Daley BJ. "Nutritional Considerations in Head and Neck Cancer Patients: A Review of the Literature." *J Oral Maxillofac Surg* 2013 X:1-8. Epub 7/15/13 – www.joms.org/inpress DOI:10.1016/j.joms.2013.04.028
3. Burke SJ, Goff MR, Lu D, Proud D, Karlstad MD, and Collier JJ. Synergistic Expression of the CXCL10 Gene in Response to IL-1 β and γ -IFN requires NF- κ B, Phosphorylation of STAT1 at Tyr701, and Acetylation of Histones H3 and H4. *J Immunol.* 2013 Jul 1;191(1):323-36.
4. Burke SJ, Goff MR, Updegraff BL, Lu D, Brown PL, Minkin SC Jr, Biggerstaff JP, Zhao L, Karlstad MD, Collier JJ. Regulation of the CCL2 gene in pancreatic β -cells by IL-1 β and glucocorticoids: role of MKP-1. *PLoS One.* 2012;7(10)
5. Croce MA, Brasel KJ, Coimbra R, Adams CA, et. al., A national trauma institute prospective evaluation of the ventilator bundle in trauma patients: Does it really work? *J Trauma & Acute Care Surgery* (74)2: 354 – 362, February 2013.
6. Daley BJ. Peritonitis and Abdominal Sepsis. Medscape Reference. Updated April 18, 2013. Available at: <http://emedicine.medscape.com/article/180234-overview>.
7. Daley BJ, Bhimji S, Bascom R, Benninghoff MG, Alam S. Pneumothorax. Medscape Reference. Updated June 17, 2013. Available at:
8. Daley BJ, Long C. Mesenteric Artery Ischemia. Medscape Reference. Updated October 03, 2013. Available at: <http://emedicine.medscape.com/article/191451-overview>.
9. Dennis BM, Eckert MJ, Gunter OL et al. Safety of Bedside Percutaneous Tracheostomy in the Critically Ill: Evaluation of More than 3,000 Procedures. *J Am Coll Surg* 2013.
10. Dennis BM, Long EL, Zamperini KM et al. The effect of the 16-hour intern workday restriction on surgical residents' in-hospital activities. *J Surg Educ* 2013; 70(6):800-805.
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