Oregon Health Authority

Oregon Trauma Registry Report, 2010-11

Oregon Trauma Registry Report, 2010-11

Oregon Health Authority

Public Health Division

Emergency Medical Services and Trauma Systems Program

Technical Contact: Lisa Millet, Lisa.M.Millet@state.or.us

Trauma Program Contact: Mike Harryman, Mike.Harryman@state.or.us

May, 2012

PUBLIC HEALTH DIVISION
DIRECTOR'S OFFICE
John A. Kitzhaber, MD, Governor

Oregon Health Authority
800 NE OREGON STREET
Portland, Oregon 97232
Voice: 971-673-1300
FAX: 971-673-1361
TTY: 971-673-0372

May 29, 2012

Dear Colleague:

I'm pleased to be sending you this report from Oregon's Trauma Registry. Oregon's Emergency Medical Services (EMS) and Trauma program, including a Trauma Registry, was established by landmark legislation more than 25 years ago. My thanks go to the stakeholders in this program in hospitals and emergency medical services across the state who send us data and make this Registry possible, and also serve on our Trauma Advisory Boards.

The data in this report tell an important story about the critical services provided by our EMS and Trauma Systems to Oregonians every day. Oregon's emergency medical services and trauma centers rapidly provide a high level of care. Of the more than 19,000 people seen in the Trauma System in 2010-2011, 561 died, and more than 4600 were admitted to intensive care units. The vast majority of those hospitalized are discharged to home, and less than 3 percent died while in care. High quality treatment and use of evidence-based best practices in pre-hospital settings and trauma centers help to save lives and reduce long-term disability and the need for rehabilitation. The EMS and Trauma communities are eager to use the data from our Trauma Registry to improve the quality of care they provide. As we move forward producing these reports in the future, we will be working hard to provide the data needed for those quality improvement efforts in a timely way.

But opportunities to improve pre-hospital and hospital care are not the only story told by this report. Particularly as Oregon embarks on efforts to reform our health care system, we need to be mindful of what we can do to prevent the need for EMS and Trauma care by keeping people from being injured in the first place. Injury is one of the leading causes of death in Oregon and across the nation, behind only cancer and heart disease. Overall, injury killed more than 2,732 people in Oregon in 2009. It was the leading cause of death among Oregonians under age 45, and one of the leading causes of hospitalization. Oregon's Emergency Medical Services and Trauma program, with its Trauma Registry, are two important tools to help us monitor and control this epidemic.

Falls and motor vehicle crash injuries, both of which are preventable, caused more than half of all traumatic injuries; you may be surprised to see that falls, many of which are preventable, lead the way. We know that seatbelts save lives, but 16 percent of patients in the trauma system involved in a motor vehicle crash were not wearing a seatbelt or in a child safety seat. Drugs and alcohol were significant contributors to traumatic injuries. Among the patients who were screened for alcohol use, 34 percent were at or above the legal limit of 0.08 blood alcohol content and among those who were screened for drug use, 47 percent tested positive. Some areas of the state have particularly high rates of injury. All of this could be addressed through comprehensive approaches to prevention and partnerships with public health, transportation, businesses, and communities.

This long awaited report marks an important first step in refocusing our collective efforts to take action to prevent injury, reduce health care costs associated with injury, and ensure better health outcomes. Even in these challenging budget times, Public Health and the Oregon Health Authority are working to support your efforts to make Oregon one of the healthiest states by preventing injuries and improving systems of care across the state.

Thank you for the work you do.

Sincerely,

Melvin Kohn, MD, MPH
Director and State Health Officer
Oregon Public Health Division

Table of Contents

Figures

Tables

Executive Summary

To fulfill its legislative mandate, the Oregon Trauma Registry conducts systematic data collection from 44 trauma hospitals in Oregon to: 1) identify the causes of traumatic injury and recommend prevention activities; and 2) assure timely, quality treatment, education, and research. This systematic tracking of trauma care in Oregon is critical for 1) identifying which patients are receiving care in the system, 2) assessing the level of care received; and 3) tracking outcomes of patients in order to ensure high-quality trauma care throughout the state.

During 2010-2011, a total of 18,131 patients entered Oregon's State Trauma System.

Trauma Registry Findings

Demographics

- The highest number of encounters in the trauma registry was in the age group 21-30 years of age followed by the 71+ age group.
- Male trauma system patients outnumber females 66 percent vs. 34 percent.
- The highest rate of trauma system patients was observed in Sherman County (2719.5 per 100,000) and the lowest rate was observed in Malheur County (98.6 per 100,000).

Mechanism of Injury

Unintentional Injuries

- Falls and motor vehicle traffic crashes were the leading mechanisms of injury.
- Almost 16 percent of trauma system patients injured in motor vehicle traffic occupant crashes weren't using a seat belt or child safety seat.
- Pedestrian traffic injuries occurred among 710 trauma system patients. The frequency and rate of pedestrian injury peaks among patients 11-20 years of age.
- Pedalcyclists, also known as bicyclists, are injured twice as often in crashes not involving motor vehicles than in motor vehicle traffic crashes (679 vs. 312).
- A total of 170 (63 percent) adult pedalcyclists were not wearing a helmet when injured.
- Male trauma system patients experienced more traumatic brain injury than females in every age group except adults aged 71 and older.

Intentional Injuries

- Assault was the mechanism of injury among 1,333 trauma system patients.
- Suicide and suicide attempts occurred among 402 of trauma system patients.

Contributing Factors: the role of alcohol and drug use

- Almost 60 percent of trauma system patients were screened for alcohol use - 34 percent tested positive at or above the legal limit of 0.08 percent blood alcohol content.
- Only 26 percent of trauma system patient were screened for drug use – 47 percent tested positive. Cannabis and opiates accounted for 62 percent of the drugs found in positive tests.

Trauma System Metrics

Entry into system

- The greatest prehospital performance variation by Area Trauma Advisory Board (ATAB) region is observed during emergency medical services (EMS) transport operations. Lower transport times were observed in urban compared to rural regions.
- Most transfers (43 percent) to Level I trauma hospitals were generated by non-trauma hospitals.

Level of Care

- The Level I trauma hospitals received and provided care for 49 percent of patients while Level II, III, and IV hospitals received and provided care for 23 percent, 15 percent and 13 percent of patients.

Discharge

- About 23 percent of patients treated in the emergency department were discharged into the community.

Recommendations

Trauma System

1) The chair of the State Trauma Advisory Board, in collaboration with the Public Health Division, will convene a meeting of trauma system stakeholders to review data variables, data definitions, determine if national standards should be met, and begin building consensus for benchmarking.

Injury Prevention

1) Increase the number of clinicians who screen patients 55 and older for falls, document the falls reported, and refer patients to community based exercise, and if needed home safety assessments, physical assessments, and physical therapy.
2) Support an effort to mandate the use of bicycle helmets among riders over the age of 16 years.
3) Support an effort to mandate the use of protective headgear among adult all terrain vehicle riders 18 and older.
4) Support an effort to increase alcohol tax to reduce motor vehicle traffic crash injury.
5) Require all prescribers of controlled substances to use the state Prescription Drug Monitoring Program electronic database to inform prescribing decisions.
6) Participate in public planning processes led by the Oregon Department of Transportation regions and statewide processes aimed at reducing pedestrian, bike, and motor vehicle traffic injury.

7) Require clinicians in hospital to screen patients for depression and suicidality and advise removal of firearms in the households of individuals at risk for suicide.
8) Require clinicians in hospitals to screen patients for family violence and refer patients to appropriate community interventions.
9) The State Trauma Advisory Board should partner with the state Injury Community Planning Group to support broad efforts to reduce injury through community and statewide planning, research, and policy development.

Background

Brief History of the Oregon Trauma System

The Oregon Trauma System was established by landmark legislation (ORS 431.607 – 431.633) in 1985 and implemented between 1987 and 1991. Oregon has been recognized throughout the nation as a leader in trauma systems development, trauma research and trauma care. Oregon was the first state to develop a system that included both small rural hospitals and large urban facilities, formally integrating hospitals across the state into the trauma system. Today, 44 Oregon hospitals and 6 out-of-state hospitals (in Idaho, Washington and California) participate in Oregon's Trauma System Program.

Trauma System Services in Oregon

The trauma system represents an organized medical delivery system for injured patients at the local, regional and state levels to provide optimal coordinated care for patients. The Oregon Trauma System has 7 regions. Each region is supervised by an Area Trauma Advisory Board (ATAB), which continuously evaluates quality assurance, quality improvement and other aspects of trauma care in the region.

The Oregon Trauma System provides the infrastructure for 44 trauma hospitals to provide varying levels of care and treatment. Trauma hospitals are designated by the state to provide trauma care and must meet specific benchmarks required for a given level of care. There are two Level I trauma centers in Oregon, both located in Portland (ATAB 1). Four Level II trauma centers exist in Oregon (two in ATAB 2, one in ATAB 3 and one in ATAB 7). Three of the trauma regions do not have a Level I or II hospital. There are 13 Level III trauma centers and 26 Level IV trauma centers throughout the state. Two Level I hospitals provide specialty pediatric services and one hospital is a burn center.

Emergency Medical Services and the Trauma System

Emergency medical services (EMS) play a critical role in the Oregon Trauma System. EMS includes dispatch centers (the initial 9-1-1 call point of contact), emergency medical response, field triage, treatment and stabilization, and transport by ground or air ambulance. EMS provides inter-hospital transfers, and transport patients by ground ambulance, helicopter or fixed-wing aircraft between hospitals. Inter-hospital transport can span hundreds of miles and is an integral aspect of a functional trauma system for moving complex patients to higher levels of care. There are standardized protocols for the field triage of injured persons and for selecting transport destinations for trauma patients. Statewide EMS data were collected for 2010-2011 and will be presented in a separate report.

The Oregon Trauma Registry

An integral aspect of an effective trauma system is the ability to track, measure and quantify care through systematic data collection. All 44 Oregon hospitals participating in the Oregon Trauma

System submit regular, standardized data to the State EMS and Trauma Systems Program for all patients entered into the trauma system.

A trauma registry provides a dashboard for the health of a trauma system and the patients cared for by this system. The Oregon Trauma Registry collects data to: 1) identify the causes of traumatic injury and recommend prevention activities; and 2) assure timely, quality treatment, education, and research. This systematic tracking trauma care in Oregon is critical for 1) identifying which patients are receiving care in the system, 2) assessing the level of care received; 3) tracking outcomes of patients in order to ensure high-quality trauma care throughout the state.

Oregon Trauma Registry Statutory Authority

§ Oregon Revised Statute 431.611 requires the Oregon Health Authority to adopt rules:

… which specify state trauma objectives and standards, hospital categorization criteria and criteria and procedures to be utilized in designating trauma system hospitals.

§ Oregon Revised Statute 431.611 requires that:

The Oregon Health Authority shall continuously identify the causes of trauma in Oregon, and propose programs of prevention thereof for consideration by the Legislative Assembly or others.

Oregon Administrative Rule:

§ Oregon Administrative Rule 333-200-0020, adopted by the Oregon Health Authority, outlines the objectives of the Trauma System:

The objective of the statewide trauma system is to reduce deaths and disabilities which result from traumatic injuries by:

(1) Identifying the causes of traumatic injuries and recommending, promoting, and coordinating prevention activities;

(2) Developing a statewide trauma system plan to assure timely, quality, definitive care through coordinated identification, transportation and treatment of trauma patients:

(3) Adopting the standards, policies and procedures necessary to unify area trauma system plans into a statewide trauma system; and

(4) Promoting quality treatment, education, research and prevention of traumatic injuries utilizing as a model “Resources for Optimal Care of the Injured Patient: Committee on Trauma, American College of Surgeons, 1999.”

Introduction

This report presents information on patients and patient encounters that were documented in Oregon's State Trauma Registry System during 2010-2011. Information is presented in two sections. Section I provides information on the overall magnitude of the morbidity and mortality due to all injuries and presents more detailed information on patients entered into the Oregon Trauma Registry. Trauma Registry data describe demographic characteristics; mechanisms that caused the injuries for both unintentional and intentional injuries; risk factors; and contributing factors such as alcohol and drug use. Section II provides descriptive information on the trauma system metrics.

Patient population

The population of patients entered into the Oregon Trauma Registry must meet the following criteria:

1) Arrive for care at an Oregon-designated trauma center as a result of a traumatic injury.

2) Meet Oregon Trauma Registry entry criteria in the field or at the hospital (see below).

3) Both Oregon residents and non-residents treated in an Oregon-designated trauma center.

4) Previously treated within the trauma system (at any trauma hospital) that required unplanned readmission for treatment of injuries or complications resulting from the initial injury.

Exclusions:

1) Patients not meeting entry criteria below.

2) Injured patients not transported to the hospital, including those who are declared dead at the injury site, or who refuse or do not seek hospital care,

3) Injured persons receiving care at a non-trauma hospital in Oregon.

Because of these criteria, conclusions from this report are not appropriate to extrapolate to all injured patients.

Trauma System Entry Criteria

Patients meet criteria for trauma system entry in one of four ways:

1. Field Entry**:** patients who are entered into the Trauma System by field personnel based on identified prehospital triage criteria.

2. Emergency Department (ED) Entry: any patient for whom the trauma team is activated at the receiving hospital or any patient whose injuries require a surgeon's evaluation and treatment.

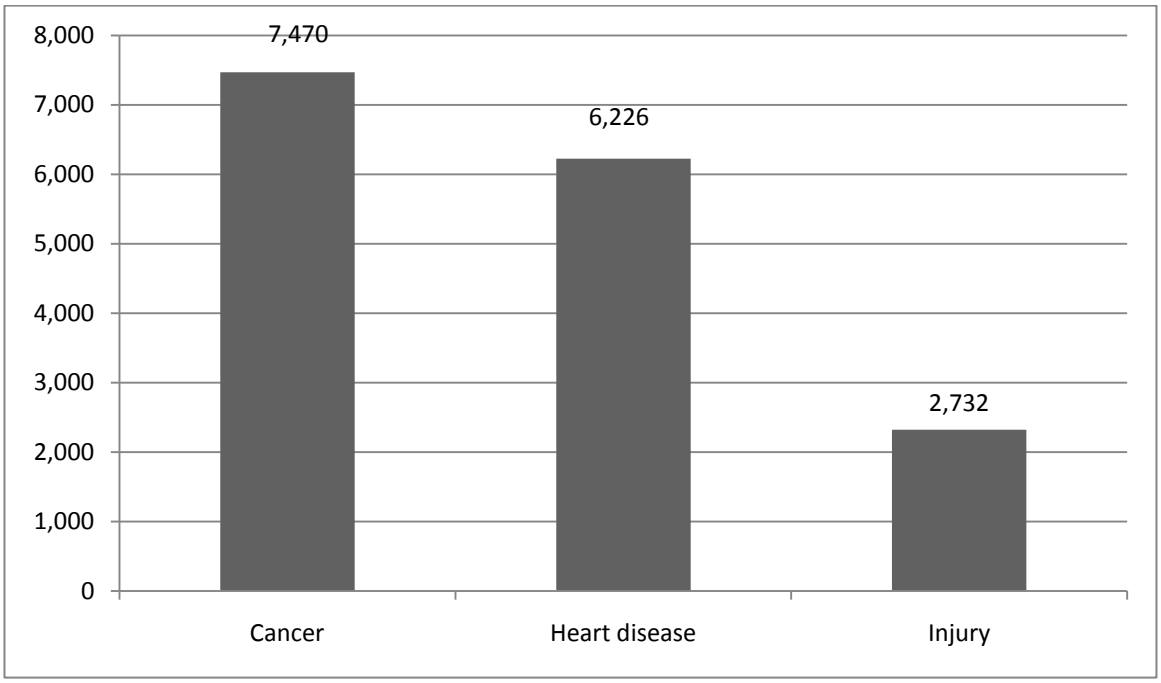
3. Entry at Transfer: any patient transferred to a trauma center for trauma care not available at their facility; patients who met triage criteria or interhospital transfer guidelines at the transferring facility.
4. Retrospective Entry: patients who did not receive a trauma team response but retrospectively, at either the transferring or receiving facility, have either an Injury Severity Score greater than eight; death; a major operative procedure to head, chest or abdomen within six hours of hospital arrival; or admission to the Intensive Care Unit within 24 hours of arrival.

Section I: Injuries among Oregon Trauma System patients during 2010-2011

Overall Magnitude of Injury among the Leading Causes of Death

In 2009, the most recent year for which statewide data on all manners and causes of death are available, injury was the third leading cause of death among Oregonians after only cancer and heart disease (Figure 1).

Figure 1. Number of deaths among Oregonians due to cancer, heart disease, and all injury, Oregon, 2009

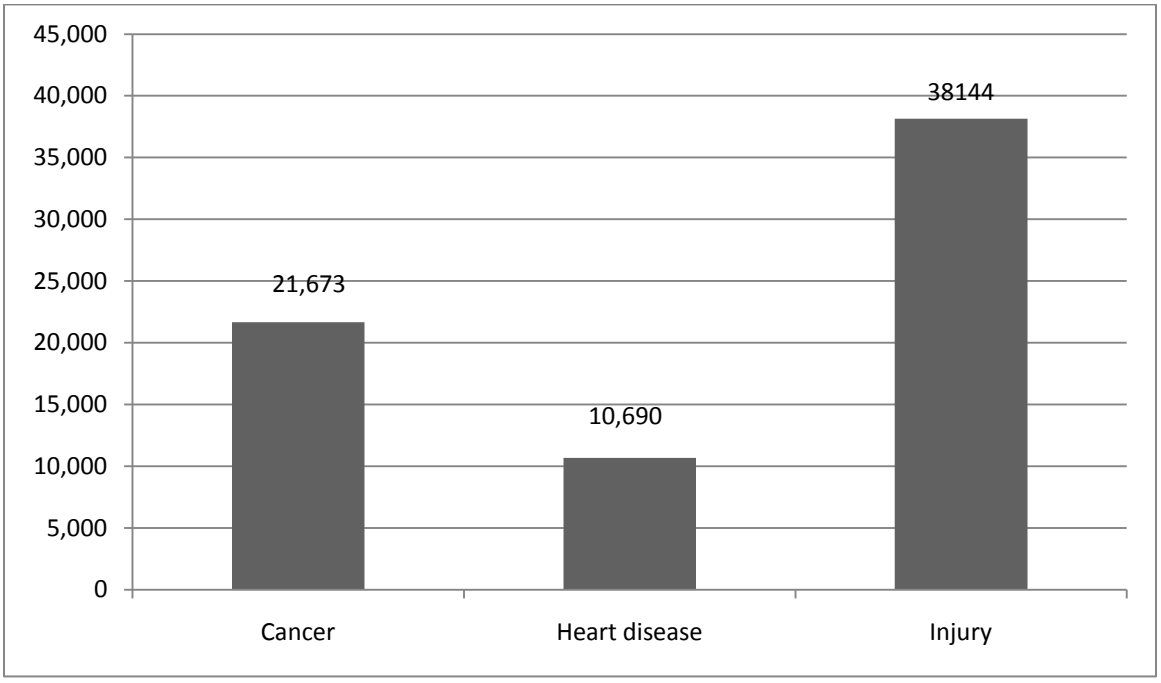


Note: The injury classification includes unintentional, suicide/self harm, and homicide/assault

Injury Kills Younger People

Deaths due to injury have great impact on our communities. While deaths from cancer and heart disease occur mostly among older people, deaths from injury occur among both young and old, and thus injuries contribute more to the loss of the potential years of life (Figure 2). In fact, injury is the leading cause of death among Oregonians under 45 years of age.

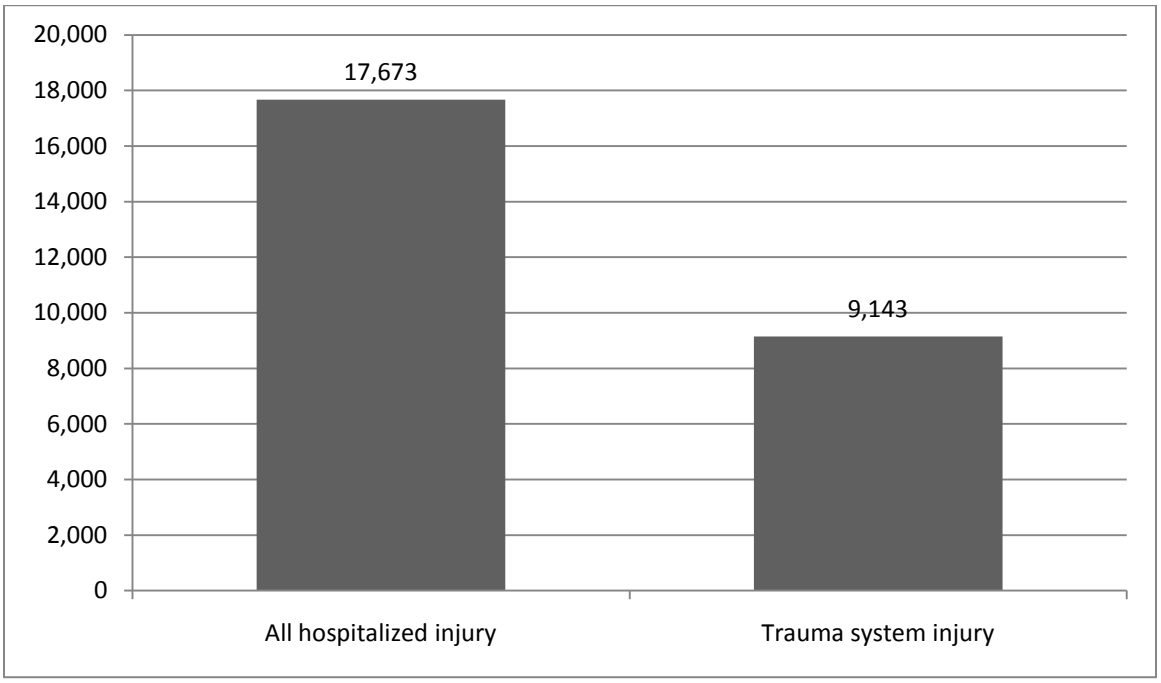
Figure 2. Number of years of potential life lost due to the top three leading causes of death among Oregonians, 2009



Trauma System Patients as a Proportion of all Hospitalizations due to Injury

Injury is among the leading causes of hospitalization in Oregon. In 2010, 9,143 people in Oregon entered the trauma system as trauma patients, and another 17,673 patients were hospitalized due to injuries (these individuals were not entered into the Oregon Trauma System) (Figure 3). The remainder of this report focuses on those injured patients who sustained serious trauma and were entered into Oregon's trauma system (see page 8 for inclusion criteria) in 2010-2011.

Figure 3. Total hospitalizations for all causes of injury, and proportion of trauma system patients among hospitalized injured patients, Oregon 2010



Patients Entered into the Trauma Registry

During 2010-2011, a total of 18,131 patients were documented in Oregon's trauma system.

Demographic Characteristics

The highest number of patients in the Oregon Trauma Registry by age group were 21-30 years of age followed by the 71 and older age group. Twice as many patients were males: 66 percent (11,869) were male and 33 percent (6,239) were female. Males outnumber females in all age groups except older adults aged 71 and older (Figure 4 and Table 1).

Figure 4. Patients entered into the trauma registry by age group and sex, Oregon, 2010-2011, N= 18,131, 23 unknown

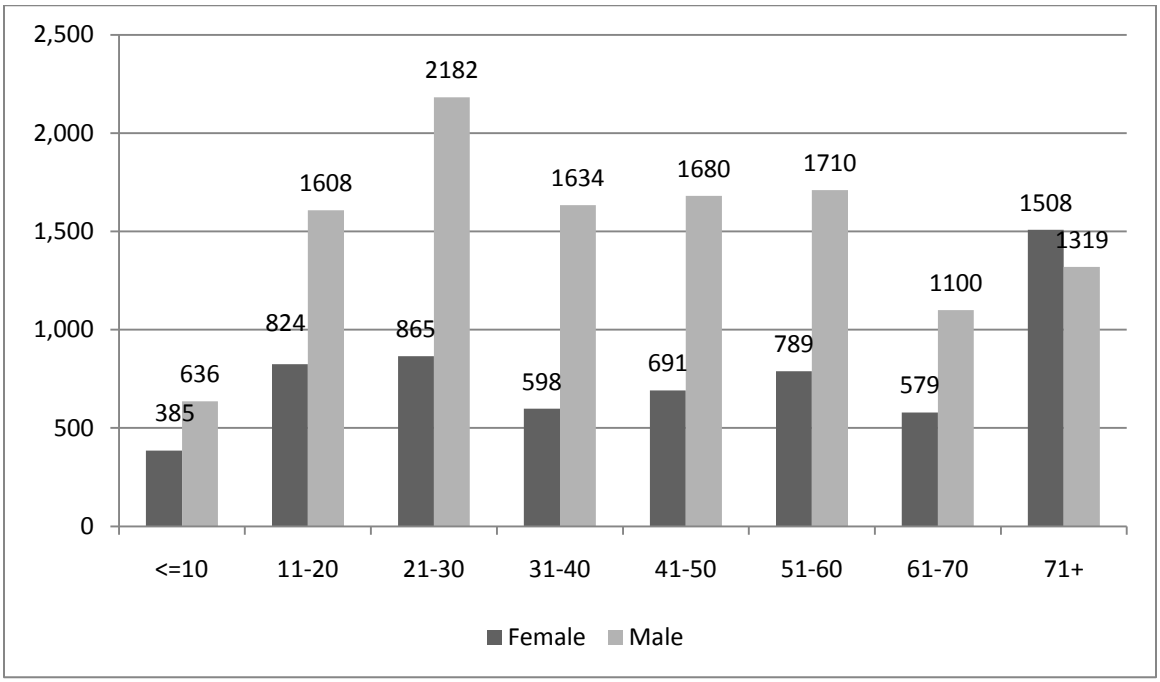


Table 1. Patients entered into the trauma registry by age group and sex, Oregon, 2010 - 2011 , N = 18,131, 23 unknown

	Female	Rate per 100,000	Male	Rate per 100,000	Total number	Total rate per 100,000
<=10	385	249.4	636	235.3	1,021	193.5
11-20	824	330.3	1608	616.8	2,432	476.7
21-30	865	336.4	2182	808.4	3,047	578.5
31-40	598	237.4	1634	610.6	2,232	429.7
41-50	691	267.6	1680	635.3	2,371	453.7
51-60	789	289.9	1710	649.9	2,499	466.8
61-70	579	303.5	1100	604.1	1,679	450.3
71+	1508	797.1	1319	941.4	2,827	858.5
Total	6,239	351.5	11,869	637.7	18,108	488.5

*Crude rates. Unable to calculate age adjusted rates due to age groups not consistent with US 2000 Standard Population Weights.

While the majority of patients treated in the trauma system are people of white race (14,407), the rate among African Americans was approximately 50 percent higher than the overall rate (Table 2). American Indian/Alaskan Natives appear to be under-represented in the trauma system data – most likely due to under reporting and/or misclassification. (Note: Race and ethnicity are treated as a single variable in the trauma system data).

Table 2. Frequency, percent, and rate per 100,000 population of trauma system patients, by race and ethnicity, Oregon, 2010-2011, N=16,967

	Frequency	Percent	Rate per 100,000
American Indian or Alaska Native	189	1.1	68.6
Asian/Pacific Islander	294	1.7	256.3
Black or African American	398	2.3	680.6
Hispanic or Latino	1,398	8.2	41.8
Other	281	1.7	N/A
White	14,407	84.9	460.7
Total	16,967	100	301.6

*Unknown = 1,164

**National Center for Health Statistics. Postcensal estimates of the resident population of the US for July 1, 2000 - July 1, 2009, released June 20, 2010.

***Single race used

#Single race Hispanic, all races used

By county, the highest rate of trauma system patients was observed in Sherman County (2719.5 per 100,000) and the lowest rate was observed in Malheur County (98.6 per 100,000) (Table 3).

Table 3. Number and rate per 100,000 of patients entered into the Oregon trauma system by county of injury, Oregon, 2010-2011, N=18,131

County	Population	Injury frequency	Rate of injury per 100,000 by County
Baker	16,215	48	296.0
Benton	85,995	276	320.9
Clackamas	378,480	1,338	353.5
Clatsop	37,145	239	643.4
Columbia	49,625	136	274.1
Coos	62,960	229	363.7
Crook	20,855	133	637.7
Curry	22,335	105	470.1
Deschutes	158,875	869	547.0
Douglas	107,795	603	559.4
Gilliam	1,880	21	1,117.0
Grant	7,450	26	349.0
Harney	7,375	25	339.0
Hood River	22,625	106	468.5
Jackson	203,950	1,022	501.1
Jefferson	21,845	145	663.8
Josephine	82,820	469	566.3
Klamath	66,580	343	515.2
Lake	7,885	55	697.5
Lane	353,155	1,825	516.8
Lincoln	46,155	187	405.2
Linn	117,340	597	508.8
Malheur	31,445	31	98.6
Marion	318,150	1,907	599.4
Morrow	11,270	42	372.7
Multnomah	741,925	3,289	443.3
Polk	75,965	463	609.5
Sherman	1,765	48	2,719.5
Tillamook	25,255	274	1,084.9
Umatilla	76,580	173	225.9
Union	25,980	149	573.5
Wallowa	6,995	43	614.7
Wasco	25,300	163	644.3
Washington	536,370	1,174	218.9
Wheeler	1,435	24	1,672.5
Yamhill	99,850	404	404.6
Unknown	N/A	762	N/A
Out of State	N/A	388	N/A
Oregon	**3,857,625**	**18,131**	**470.0**
*2010 Population, Population Research Center, Portland State University			

Mechanism of Injuries among patients entered into the Trauma Registry

Although injuries can be categorized in multiple ways—where they occur, how they occur, etc.—it is typical to categorize injuries in terms of mechanism and intent. Mechanism (or cause) typifies how the injury occurred—for instance, by motor vehicle, firearm, struck by an object, by falling, etc. Intent is classified as unintentional or intentional (or else unknown, undetermined). While unintentional injuries often result as a form of rapid transfer of energy from object to person (e.g. being struck by a motor vehicle), intentional injuries are the result of intentional harm imposed upon one person by another, or upon oneself (e.g. suicide) (Tables 4, 5, and 6).

Table 4. Frequency of fatal and non-fatal trauma system patient injury by mechanism and intent, Oregon, 2010-2011, N=18,094, 37 unknown

External Cause of Injury	Unintentional	Suicide	Homicide	Total
Cut-pierce	107	157	381	645
Drowning-submersion	46			46
Fall	5,695	44	3	5,742
Fire-flame	104	1		105
Fierarm	160	95	164	419
Hot object-substance	36			36
Machinery	105			105
MV traffic-motorcyclist	889			889
MV traffic-occupant	4,971			4,971
MV taffic-other	36	9	6	51
MV traffic-pedacyclist	313			313
MV traffic-pedestrian	711			711
MV traffic-unspecified	44			44
Natural-bites/stings	32			32
Natural-environmental	83			83
Other-specified-classified	132	17	38	187
Other-specified-not classified	49	12	26	87
Overexertion	21			21
Pedalcyslist-other	679			679
Pedestrian-other	107			107
Poisoning	8	8		16
Struck by/against	565		623	1,188
Suffocation	12	49	2	63
Transport-other	1,311			1,311
Unspecified	25	2	21	48
Unknown	116	8	71	195
Total	16,357	402	1,335	18,094
* Missing 37 cases				

Table 5. Frequency of nonfatal injury among trauma system patients by mechanism and intent, Oregon, 2010-2011, N=17,536

External Cause of Injury	Unintentional	Suicide	Homicide	Total
Cut-pierce	106	374	154	634
Drowning-submersion	38			38
Fall	5,476	3	39	5,518
Fire-flame	95	141	1	237
Fierarm	148		48	196
Hot object-substance	35			35
Machinery	104			104
MV traffic-motorcyclist	869			869
MV traffic-occupant	4,890			4,890
MV taffic-other	35	6	9	50
MV traffic-pedacyclist	303			303
MV traffic-pedestrian	678			678
MV traffic-unspecified	42			42
Natural-bites/stings	30			30
Natural-environmental	80			80
Other-specified-classified	126	37	14	177
Other-specified-not classified	48	26	12	86
Overexertion	21			21
Pedalcyslist-other	676			676
Pedestrian-other	100			100
Poisoning	8		8	16
Struck by/against	555	614		1,169
Suffocation	11	1	41	53
Transport-other	1,295			1,295
Unspecified	25	20	2	47
Unknown	115	69	8	192
Total	15,909	1,291	336	17,536
* Missing 37 cases from Ecodes field				

Table 6. Frequency of fatal injury among trauma system patients by mechanism and intent, Oregon, 2010-2011, N=558

External Cause of Injury	Unintentional	Suicide	Homicide	Total
Cut-pierce	1	7	3	11
Drowning-submersion	8			8
Fall	219		5	224
Fire-flame	9			9
Fierarm	12	23	47	82
Hot object-substance	1			1
Machinery	1			1
MV traffic-motorcyclist	20			20
MV traffic-occupant	81			81
MV taffic-other	1			1
MV traffic-pedacyclist	10			10
MV traffic-pedestrian	33			33
MV traffic-unspecified	2			2
Natural-bites/stings	2			2
Natural-environmental	3			3
Other-specified-classified	6	1	3	10
Other-specified-not classified	1			1
Overexertion				0
Pedalcyslist-other	3			3
Pedestrian-other	7			7
Poisoning				0
Struck by/against	10	9		19
Suffocation	1	1	8	10
Transport-other	16			16
Unspecified		1		1
Unknown	1	2		3
Total	448	44	66	558
* Missing 37 cases				

Falls and motor vehicle crashes due to both intentional and unintentional injury were the leading mechanisms of injury among trauma system patients (Tables 4, 5 and 6). See glossary of terms in the appendix for definitions.

Mechanism of Injury

The mechanism of injury by all intents of injury varied by age. Falls are the leading mechanism of injury among trauma system patients aged 0-10 years of age and among patients 51 years and older (Figure 5 and Table 7). Motor vehicle traffic crash was the leading mechanism of injury among trauma system patients aged 11-50 years who were occupants in motor vehicles.

Figure 5. Top 3 mechanisms of injury among patients who entered the trauma registry, by age group, Oregon, 2010-2011, N=12,006, 18 unknown

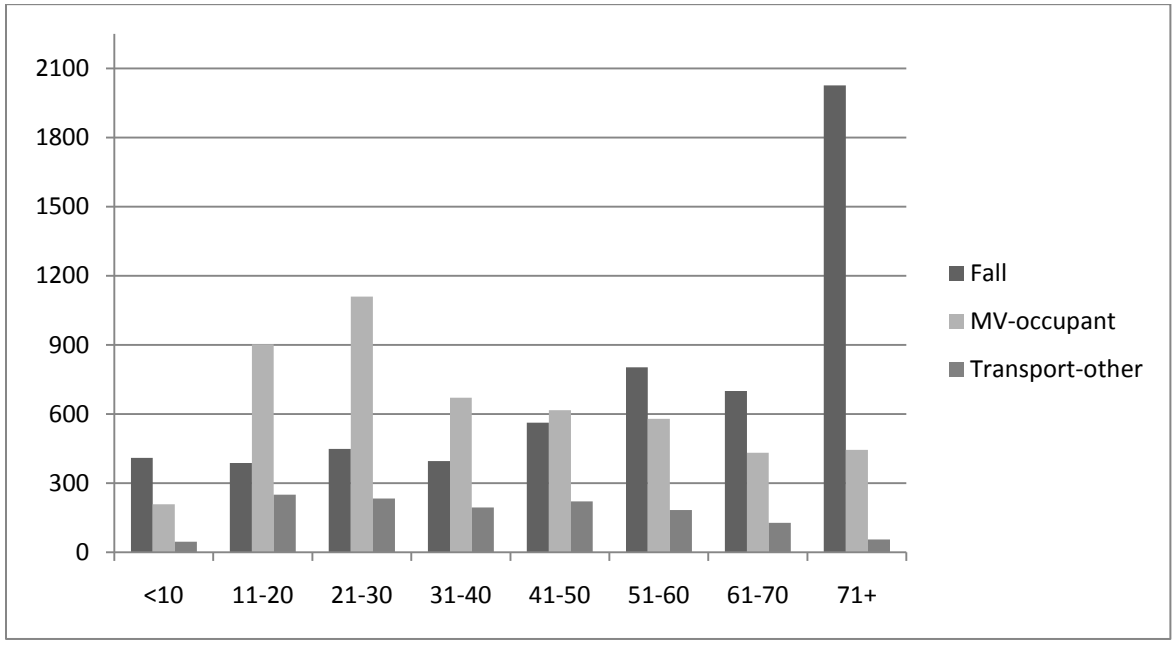


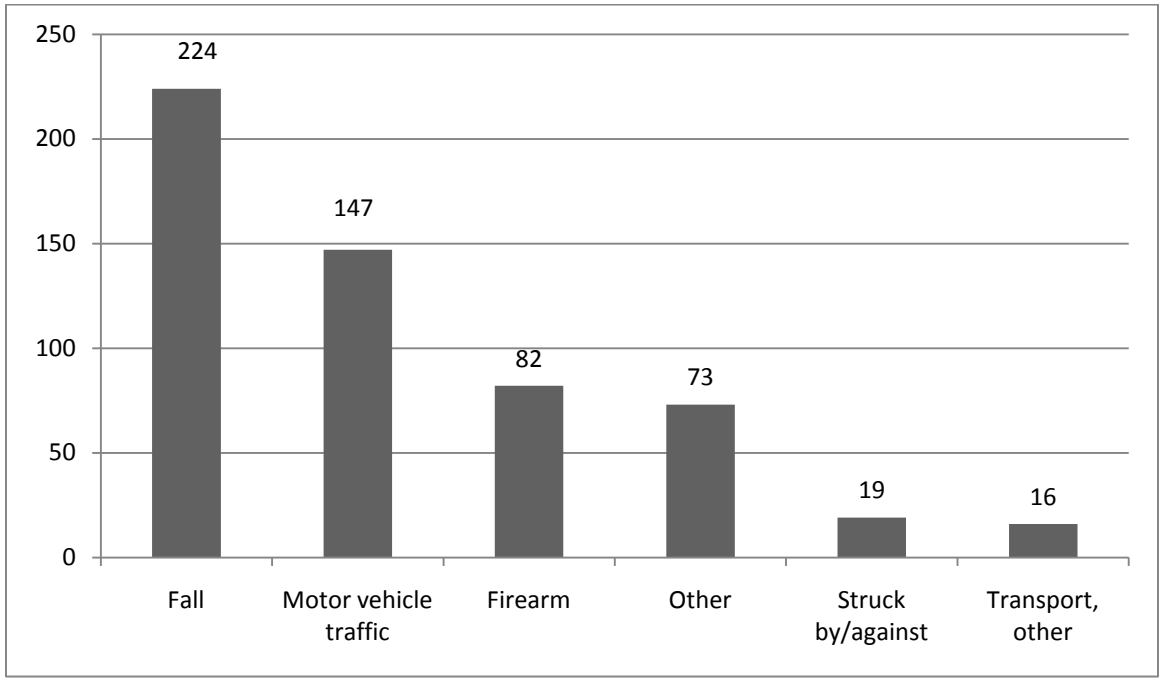
Table 7. Top three mechanisms of injury among patients who entered the trauma registry, by age group, Oregon, 2010-2011, N=12,006, 18 unknowns

Age group	Fall frequency	Rate per 100,000	MV-Occupant frequency	Rate per 100,000	Transport-other frequency	Rate per 100,000
<=10	409	77.5	208	39.4	46	8.7
11-20	387	75.9	903	177	250	49
21-30	448	85.1	1,110	210.7	233	44.2
31-40	396	76.2	671	129.2	194	37.3
41-50	562	107.5	617	118.1	221	42.3
51-60	803	150	579	108.2	184	34.4
61-70	700	187.7	432	115.9	128	34.3
71+	2,026	615.2	444	134.8	55	16.7
Total	5,731	171.9	4,964	129.2	1,311	33.4

Deaths by Mechanism of Injury and by all Manners of Injury

Overall, three percent (561) of trauma system patients died. The mechanisms of injury among patients who died included: falls, motor vehicle crash, and firearms (Figure 6).

Figure 6. Frequency of death among patients entering the trauma system, by mechanism of injury, and all manners of injury, Oregon, 2010-2011, N=561



Unintentional Injuries

Over 90 percent of trauma system patient injuries were due to unintentional intent. Falls were the leading mechanism of unintentional injury accounting for 34 percent of injury and 48 percent of deaths. Motor vehicle traffic occupant injury accounted for 30 percent of injury and eighteen percent of deaths.

Trauma patients involved in motorcycle crashes had the highest Injury Severity Scores (ISS) (ISS=29.9) followed by patients injured by firearms (ISS=26.2) (Table 8).

The injury severity score is a system for numerically stratifying injury severity. The ISS system has a range of 1-75 and risk of death increases with a higher score. This report categorizes ISS 1-8 as minor; 9-15 as moderate; 16-24 as severe; and greater than 24 as very severe.

Table 8. Mechanism of injury, injury severity, frequency, mortality and percent of unintentionally injured trauma system patients, Oregon, 2010-2011, N=16,347, 1,784 unknown

Unintentional mechanism of Injury	Percent of Injury Severity Score >15	Number of patients	Percent	Number of deaths	Percent
Fall	25.2	5,695	34.8	219	48.9
Motor Vehicle	19.4	4,971	30.4	81	18.1
Other	20.3	1,742	10.6	47	10.5
Transport-Other	19.0	1,311	8.0	16	3.6
Motor Vehicle-Motorcyclist	29.9	889	5.4	20	4.5
Motor Vehicle-Pedestrian	25.2	701	4.3	33	7.4
Struck-by-Against	19.1	565	3.5	10	2.2
Motor Vehicle-Pedalcyclist	23.8	313	1.9	10	2.2
Firearm	26.2	160	1.0	12	2.7
Total		16,347		448	

Unintentional Injuries by Age Group and Sex

The mechanism of injury varies by age and sex. For example, whereas falls are the leading mechanism of injury among women ages 71 and older, motor vehicle crashes are the leading mechanism of injury among 21-30 year old men.

Mechanism of Injury: Falls

Falls are the leading mechanism of injury overall and among geriatric patients (aged 55 and older) in the trauma system. Female trauma system patients 71 and older are observed to have the highest number fall injuries (Figure 7 and Table 9).

Figure 7. Frequency of injury due to falls among trauma system patients, by age group and sex, 2010-2011, N= 5,731

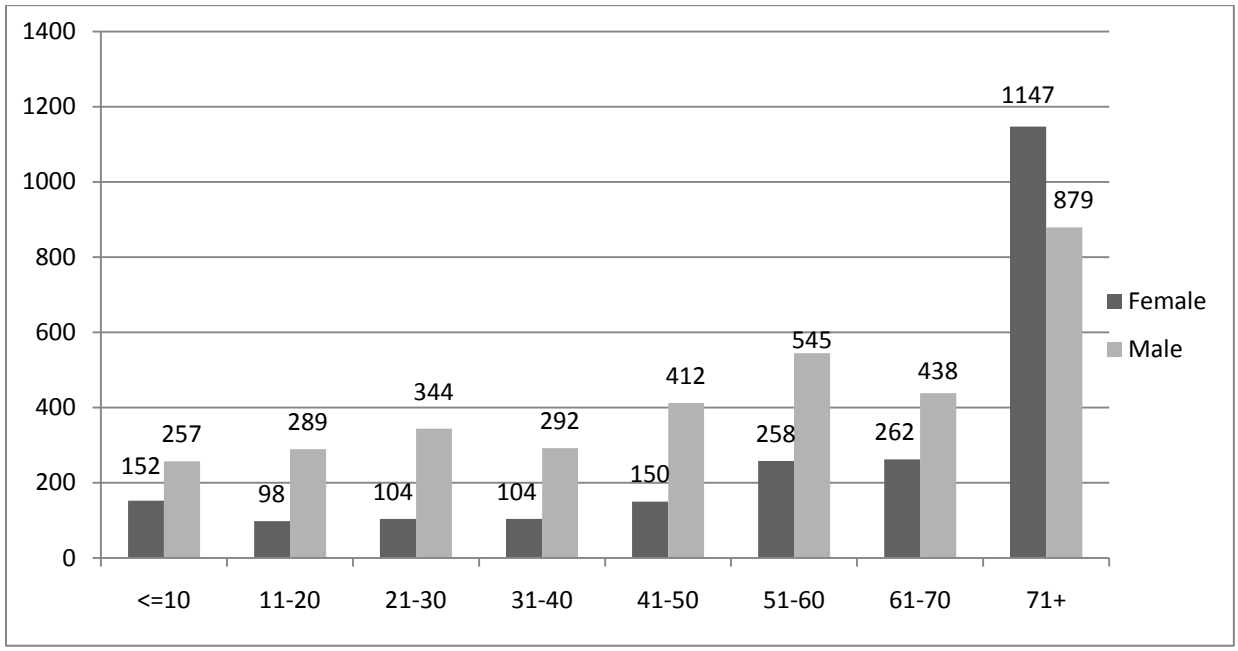


Table 9. Frequency of injury due to falls among trauma system patients, by age group and sex, 2010 - 2011, N = 5,731

	Female	Rate per 100,000	Male	Rate per 100,000	Total number	Total rate per 100,000
<=10	152	98.5	257	95.1	409	77.5
11-20	98	39.3	289	110.9	387	75.9
21-30	104	40.5	344	127.4	448	85.1
31-40	104	41.3	292	109.1	396	76.2
41-50	150	58.1	412	155.8	562	107.5
51-60	258	94.8	545	207.1	803	150
61-70	262	137.3	438	240.5	700	187.7
71+	1147	606.2	879	484.6	2,026	554.5
Total	2,275	153.8	3,456	202.8	5,731	164.3

*Crude rates. Unable to calculate age adjusted rates due to age groups not consistent with US 2000 Standard Population Weights.

Mechanism of Injury: Motor Vehicle Crashes

Motor vehicle crash was the leading mechanism of injury among male trauma system patients aged 21-30 years who were the occupants in crashes (Figure 8 and Table 10).

Figure 8. Frequency of injury among trauma system patients due to motor vehicle traffic occupant crashes, by age group and sex, 2010-2011, N = 4,964

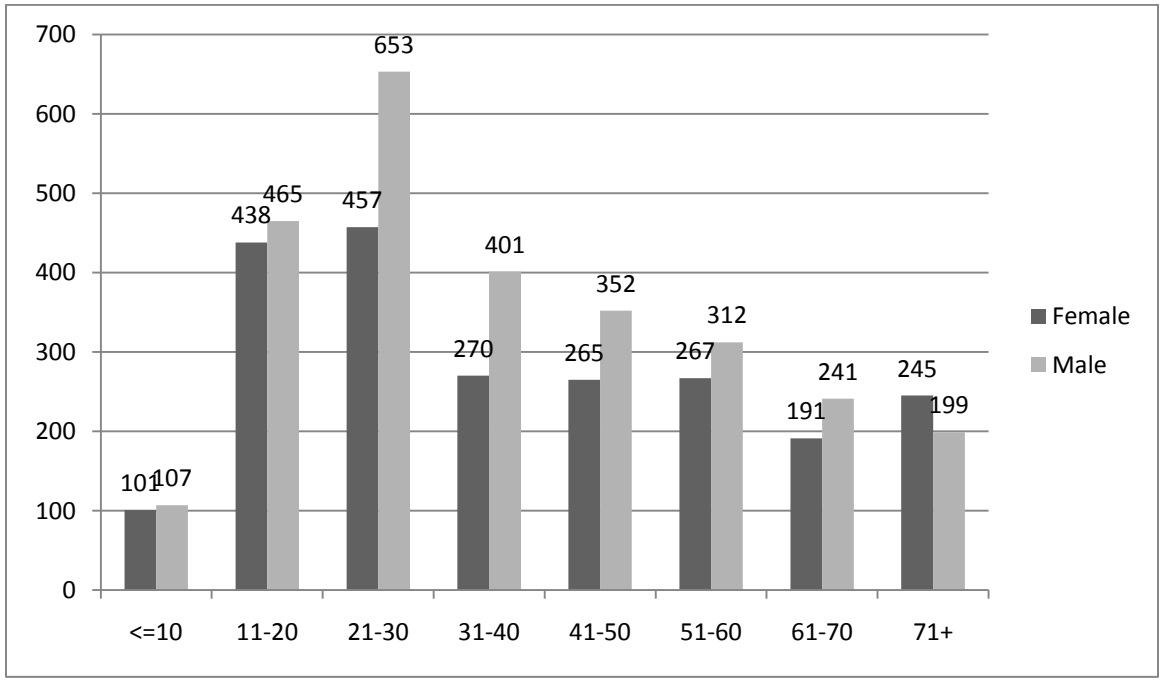


Table 10. Frequency of injury among trauma system patients due to motor vehicle traffic crashes, by age group and sex, 2010-2011, N=4,964

Age group	Female	Rate per 100,000	Male	Rate per 100,000	Total frequency	Rate per 100,000
<=10	101	65.4	107	39.6	208	39.4
11-20	438	175.5	465	178.4	903	177.0
21-30	457	177.9	653	241.9	1,110	210.7
31-40	270	107.2	401	149.8	671	129.2
41-50	265	102.6	352	133.1	617	118.1
51-60	267	98.1	312	118.6	579	108.2
61-70	191	100.1	241	132.3	432	115.9
71+	245	129.5	199	142.0	444	134.8
Total	2,234	119.5	2,730	142.0	4,964	129.2

*Crude rates. Unable to calculate age adjusted rates due to age groups not consistent with US 2000 Standard Population Weights.

Almost sixteen percent of trauma system patients who were occupants in motor vehicle crashes weren't using a seat belt or child safety seat. In an additional five percent of cases data on restraint use was missing or unknown (Table 11).

Table 11. Restraint use among trauma system patients involved in motor vehicle traffic crashes, Oregon, 2010-2011, N=4,969

Restraint	Frequency	Percent
3 point seat belt only	1,878	37.8
Air bag & 3 point seat belt	1,212	24.4
None	784	15.8
Seat belt, not classified	540	10.9
N/A	262	5.2
Airbag only	198	4
Child safety seat	95	1.9

Note: more than one restraint is used, not mutually exclusive.

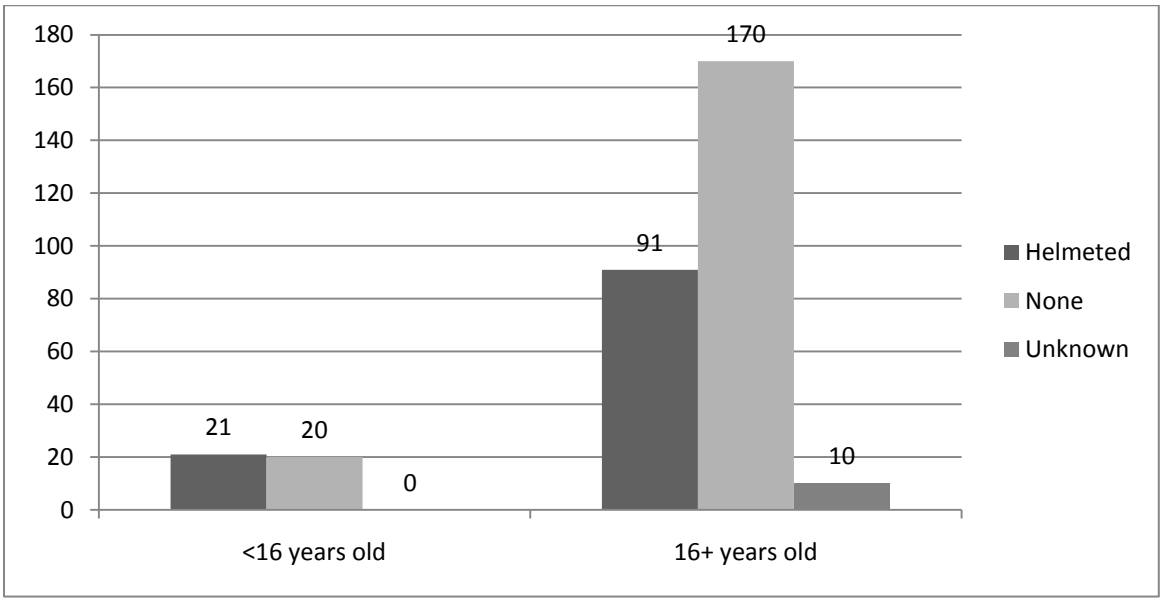
Pedalcyclists, also known as bicyclists, are most often injured in crashes that don't involve motor vehicles. The rate of injury per 100,000 among trauma system patients involved in pedalcyclist crashes not involving motor vehicles is higher than crashes involving motor vehicles in every age group (Table 12).

Table 12. Pedalcyclist crash injury, and rate per 100,000 among trauma system patients, Oregon, 2010-2011, N=312

Age group	Frequency MV-Traffic-Pedalcyclist	Rate per 100,000	Frequency pedalcyclist-Other	Rate per 100,000	Total frequency	Rate per 100,000
<=10	15	2.8	36	6.8	51	9.7
11-20	76	14.9	116	22.7	192	37.6
21-30	78	14.8	117	22.2	195	37
31-40	36	6.9	87	16.7	123	23.7
41-50	47	9	114	21.8	161	30.8
51-60	35	6.5	138	25.8	173	32.3
61-70	16	4.3	50	13.4	66	17.7
71+	9	3	21	6.4	31	9.4
Total	312	7.8	679	17.0	991	24.8

Oregon law requires all youth under the age of 16 to wear a helmet when they ride a bicycle. The majority of trauma system patients aged 16 and older involved in bicycle crashes were not wearing a helmet (Figure 9).

Figure 9. Helmet use in all pedacyclist motor vehicle traffic and pedalcyclist other (non-traffic) crashes among trauma system patients, by age group, Oregon 2010-2011, N=302, 10 unknown



The frequency of motorcycle crash injury increases with age among trauma system patients until the age of 61 when a sharp decrease in trauma system admissions due to motorcycle crash occurs (Figure 10 and Table 13).

Figure 10. Frequency of trauma system patients injured in motorcycle crashes, by age group, Oregon 2010-2011, N=889

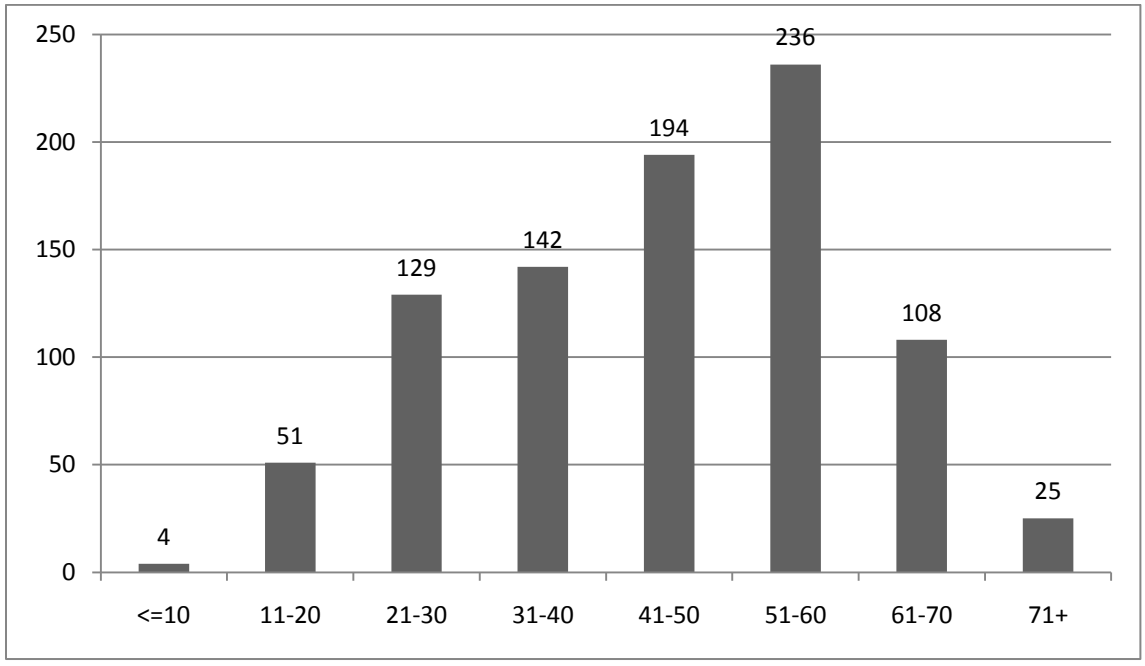


Table 13. Frequency and rate per 100,000 of trauma system patients injured in motorcycle crashes, by age group, Oregon, 2010-2011, N = 889

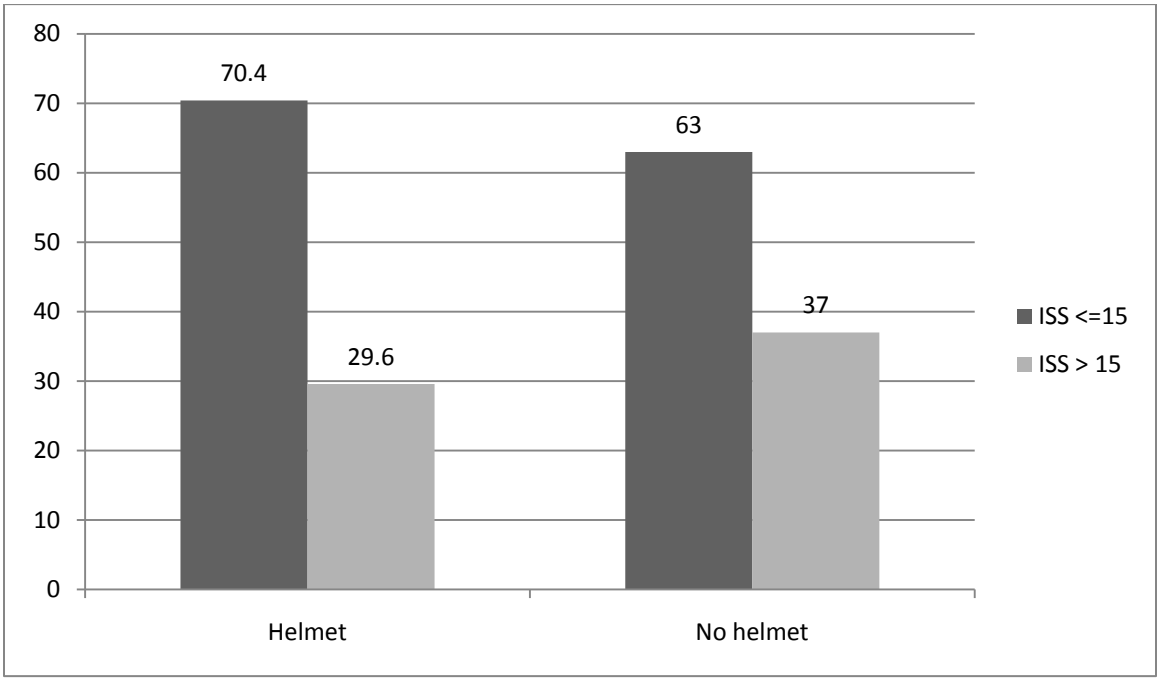
	Frequency	Rate per 100,000
<=10	4	0.8
11-20	51	10.0
21-30	129	24.5
31-40	142	27.3
41-50	194	37.1
51-60	236	44.1
61-70	108	29.0
71+	25	7.6
Total	889	22.6

*Crude rates. Unable to calculate age adjusted rates due to age groups not consistent with US 2000 Standard Population Weights.

Oregon law requires all motorcycle riders to wear helmets when riding on Oregon roads and highways. Surveyors who collected observational data for the Oregon Department of Transportation in 2010 reported no observations of motorcyclists without helmets riding on Oregon roads and highways. However, a large number of patients in the trauma system who were riders involved in motorcycle crashes were reported to have been involved in crashes when they weren't wearing a helmet.

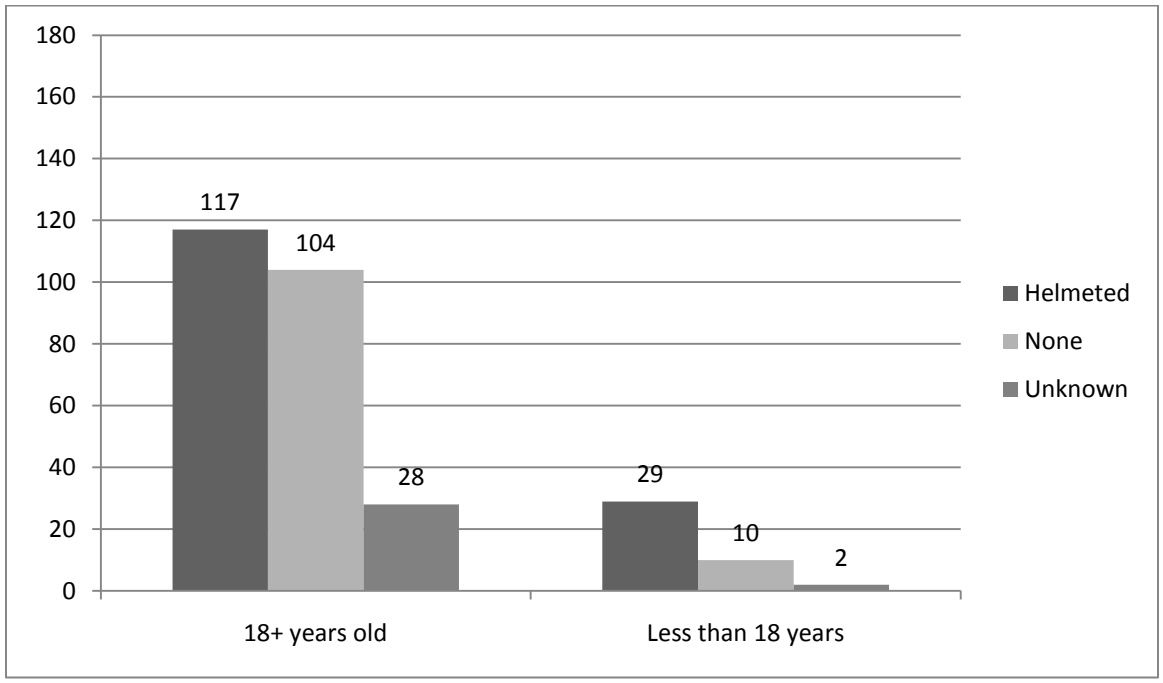
Head injury severity >15 is observed in 37 percent of patients not wearing a helmet and 29.6 percent of helmeted trauma system patients injured in motorcycle crashes (Figure 11).

Figure 11. Percent of trauma system patients with head injury severity <= 15 and >15 injured in motorcycle crashes by helmet use Oregon, 2010-2011, N = 620



Youth under the age of eighteen are required by Oregon law to wear a helmet when riding all terrain vehicles (ATV) on public lands. Overall, 114 (39%) of ATV riders entered into the trauma system were not wearing helmets (Figure 12). Among trauma system patients aged 17 and younger ten youth were not wearing helmets. Among adults aged 18 and older 104 were not wearing helmets.

Figure 12. Helmet use among trauma patients injured in ATV crashes, by age group, Oregon 2010-2011, N=290, 30 unknown



Note: Riders injured on private land are included

The frequency of pedestrian injury among trauma system patients peaks among patients eleven to twenty years of age. Males outnumber females in every age group except adults 61-70 years of age (Figure 13 and Table 14).

Figure 13. Frequency of pedestrians injured in motor vehicle traffic incidents among trauma system patients, by age group, Oregon 2010-2011, N= 710, 1 unknown

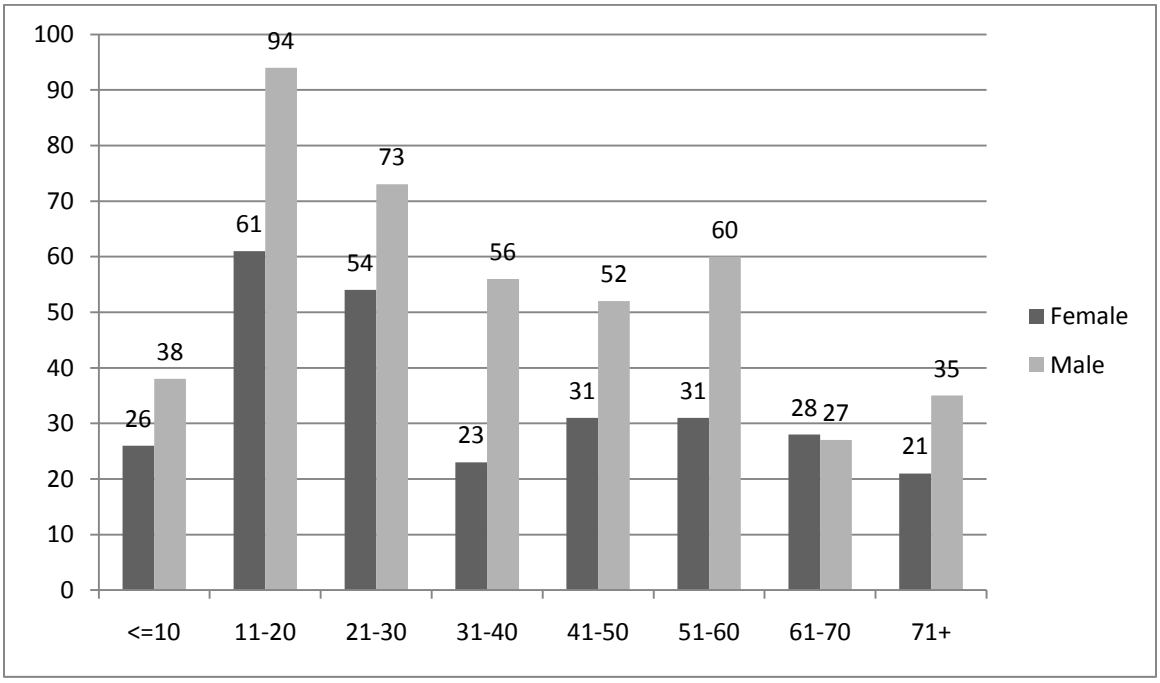


Table 14. Frequency and rate per 100,000 of motor vehicle - pedestrian injury among trauma system patients, by age group, Oregon 2010 - 2011, N = 710, 1 unknown

	Female	Rate per 100,000	Male	Rate per 100,000	Total number	Total rate
<=10	26	16.8	38	14.1	64	12.1
11-20	61	24.4	94	36.1	155	30.4
21-30	54	21	73	27	127	24.1
31-40	23	9.1	56	20.9	79	15.2
41-50	31	12	52	19.7	83	15.9
51-60	31	11.4	60	22.8	91	17
61-70	28	14.7	27	14.8	55	14.8
71+	21	11.1	35	25.0	56	17.0
Total	275	15.1	435	22.6	710	18.3

*Crude rates. Unable to calculate age adjusted rates due to age groups not consistent with US 2000 Standard Population Weights.

Intentional Injuries

There are two types of intentional injury, suicide or suicide attempts and assault or homicide. The mechanism of struck by-against includes a variety of circumstances where an individual receives a blow that transmits energy that injures the body. The mechanism of injury known as stuck by-against was the leading mechanism of intentional injury followed by cut-pierce injury. Assaults with firearms result in the most serious injuries resulting in over 45 percent of cases with ISS greater than 15 (Table 15).

Table 15. Mechanism of injury, injury severity, number of patients and mortality among intentionally injured trauma system patients, Oregon 2010-2011, N=1,737

Intentional mechanisms of Injury	Percentage Injury Severity Score >15	Number of patients	Percent	Number of deaths	Percent
Struck-by-Against	17.4	623	35.9	9	8.2
Cut-pierce	17.5	538	31.0	10	9.1
Other	26.3	317	18.2	21	19.1
Firearm	45.7	259	14.9	70	63.6
Total		1,737	100	110	100

Suicide and suicide attempts occurred among 402 of trauma system patients in 2010-2011. Males outnumber females more than 2:1 (Figures 14, 15, and 16 and Table 16).

Figure 14. Frequency of self harm, suicide attempt, and suicide among trauma system patients, by age group and sex, Oregon 2010-2011, N = 402

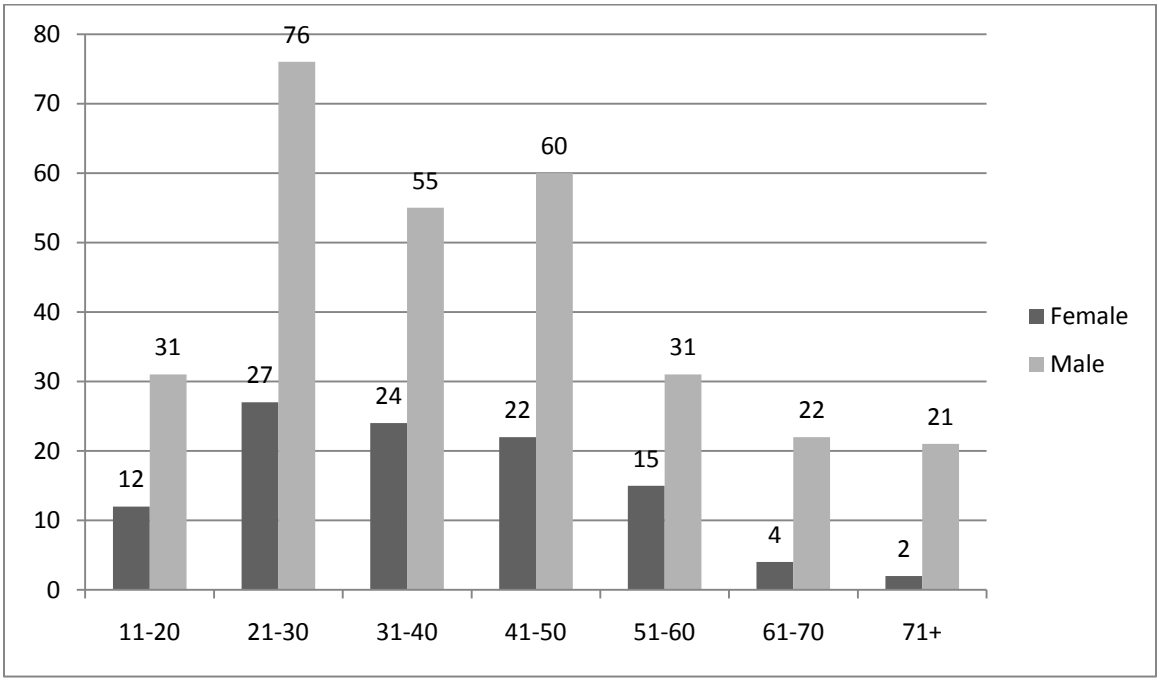


Table 16. Frequency and rate per 100,000 of injury due to self harm, suicide attempt, and suicide among trauma system patients, by age group, and sex, Oregon, 2010-2011, N = 402

	Female	Rate per 100,000	Male	Rate per 100,000	Total number	Total rate per 100,000
11-20	12	4.8	31	11.9	43	8.4
21-30	27	10.5	76	28.2	103	19.6
31-40	24	9.5	55	20.6	79	15.2
41-50	22	8.5	60	22.7	82	15.7
51-60	15	5.5	31	11.8	46	8.6
61-70	4	2.1	22	12.1	26	7.0
71+	2	1.1	21	15.0	23	7.0
Total	106	6.2	296	18.4	402	11.6

Figure 15. Frequency of suicide by method and sex, Oregon, 2010-2011, N=66

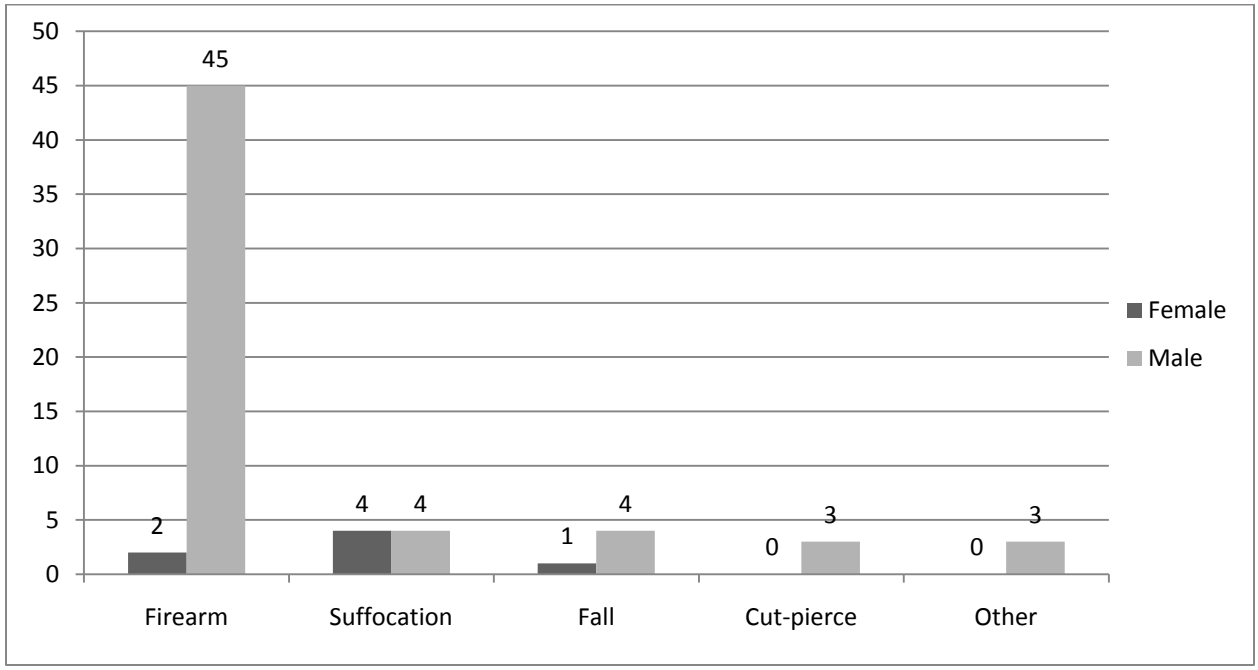
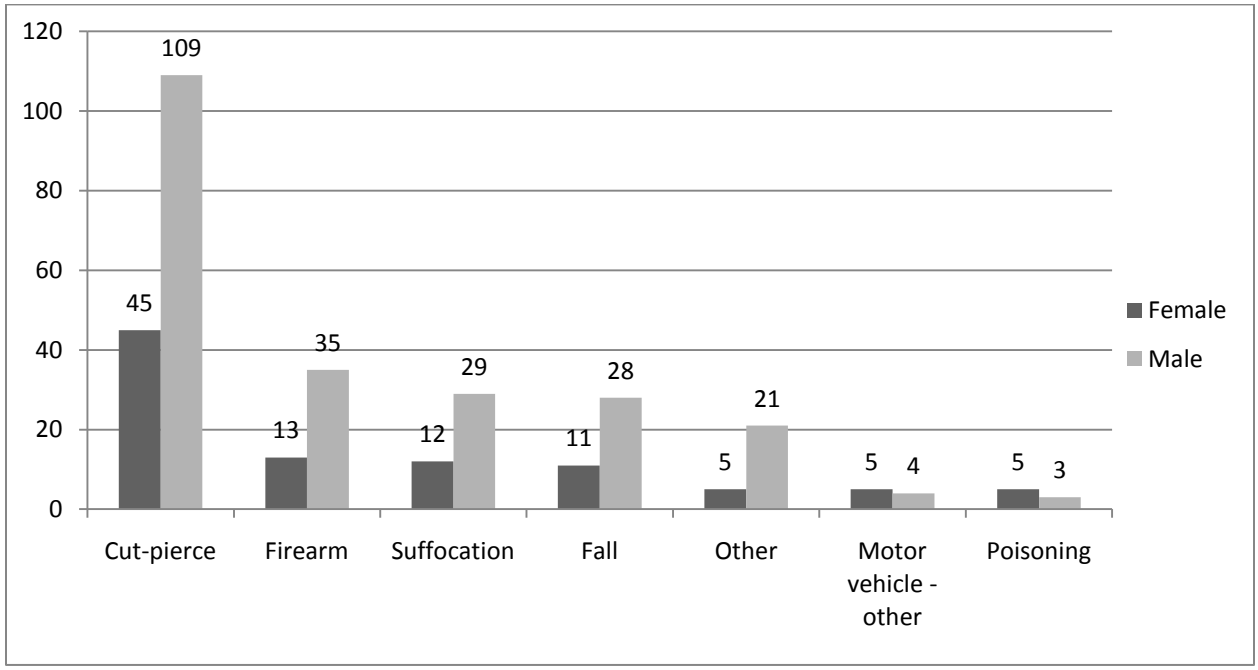


Figure 16. Non-fatal self harm and suicide attempt by method and sex, Oregon, 2010-2011, N=325



Injury due to assault occurs most frequently among male trauma system patients (89%) as compared to female trauma patients (Figure 17 and Table 17).

Figure 17. Frequency of injury due to assault among trauma system patients, by age group, Oregon 2010-2011, N= 1,333

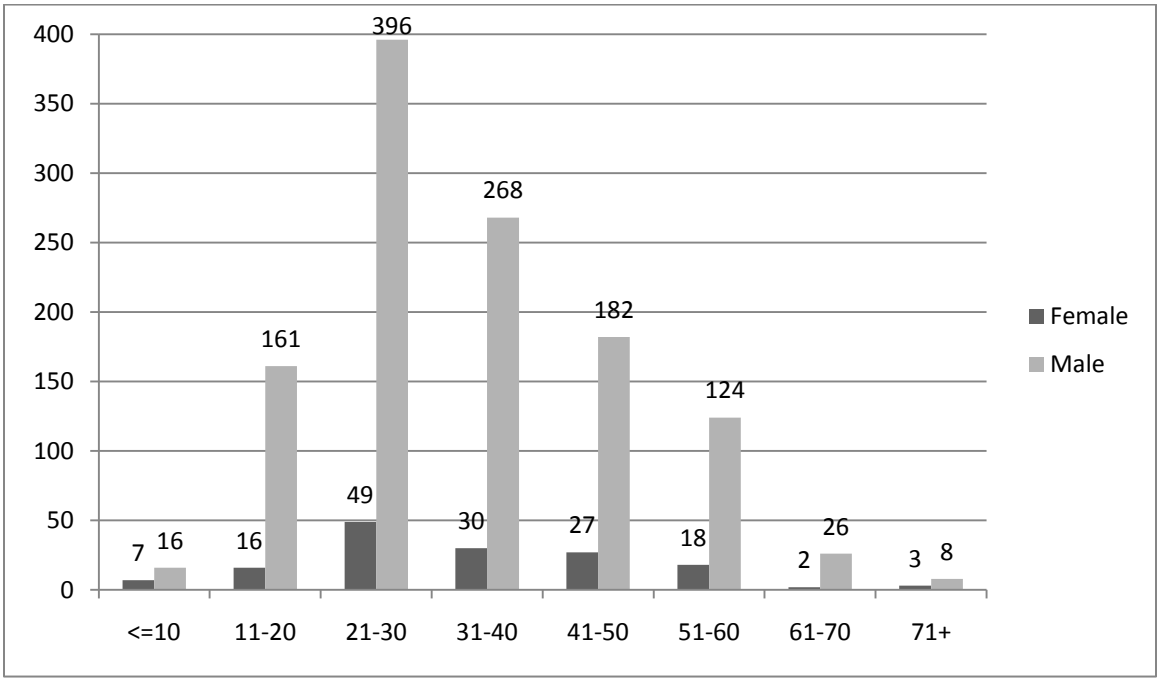


Table 17. Frequency and rate per 100,000 of assault among trauma system patients, by age group, Oregon, 2010-2011, N = 1,333

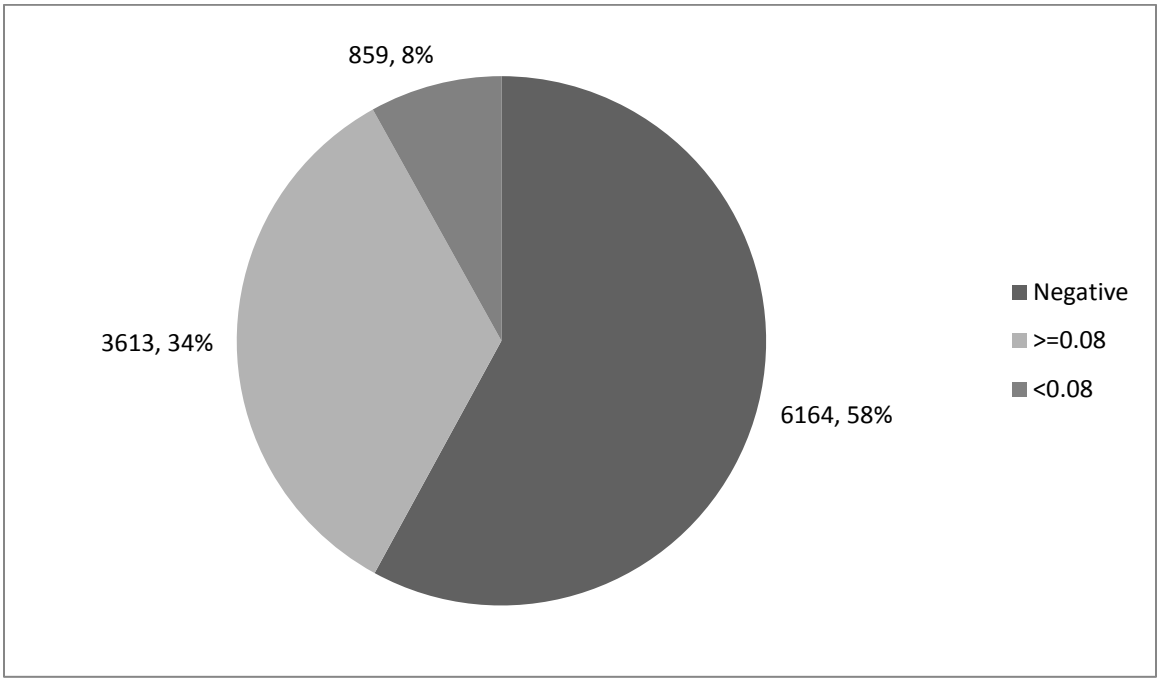
	Female	Rate per 100,000	Male	Rate per 100,000	Total number	Total rate
<=10	7	4.5	16	5.9	23	4.4
11-20	16	6.4	161	61.8	177	34.7
21-30	49	19.1	396	146.7	445	84.5
31-40	30	11.9	268	100.1	298	57.4
41-50	27	10.5	182	68.8	209	40.0
51-60	18	6.6	124	47.1	142	26.5
61-70	2	1	26	14.3	28	7.5
71+	3	1.6	8	5.7	11	3.3
Total	152	7.7	1,181	56.3	1333	32.3

*Crude rates. Unable to calculate age adjusted rates due to age groups not consistent with US 2000 Standard Population Weights.

Contributing Factors: Role of Alcohol and Drug Use

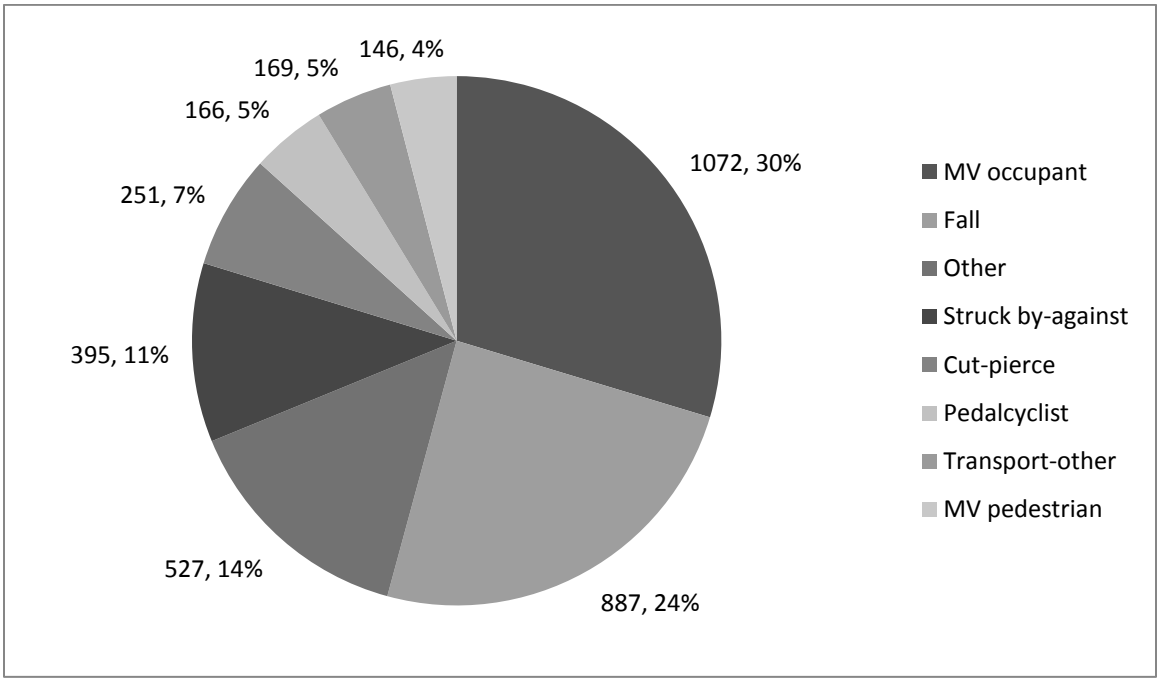
Almost 60 percent (10,636) of trauma system patients were tested for alcohol use – almost half of those tested were found to have some level of blood alcohol content. Overall, 25 percent (4,472/18,131) of all trauma system patients were reported to have some level of alcohol in their blood. Among those tested, 34 percent had blood alcohol contents greater than or equal to the legal limit of 0.08 (Figure 18).

Figure 18. Results of alcohol testing among trauma registry patients, Oregon, 2010-2011, N=10,636, 6 unknown



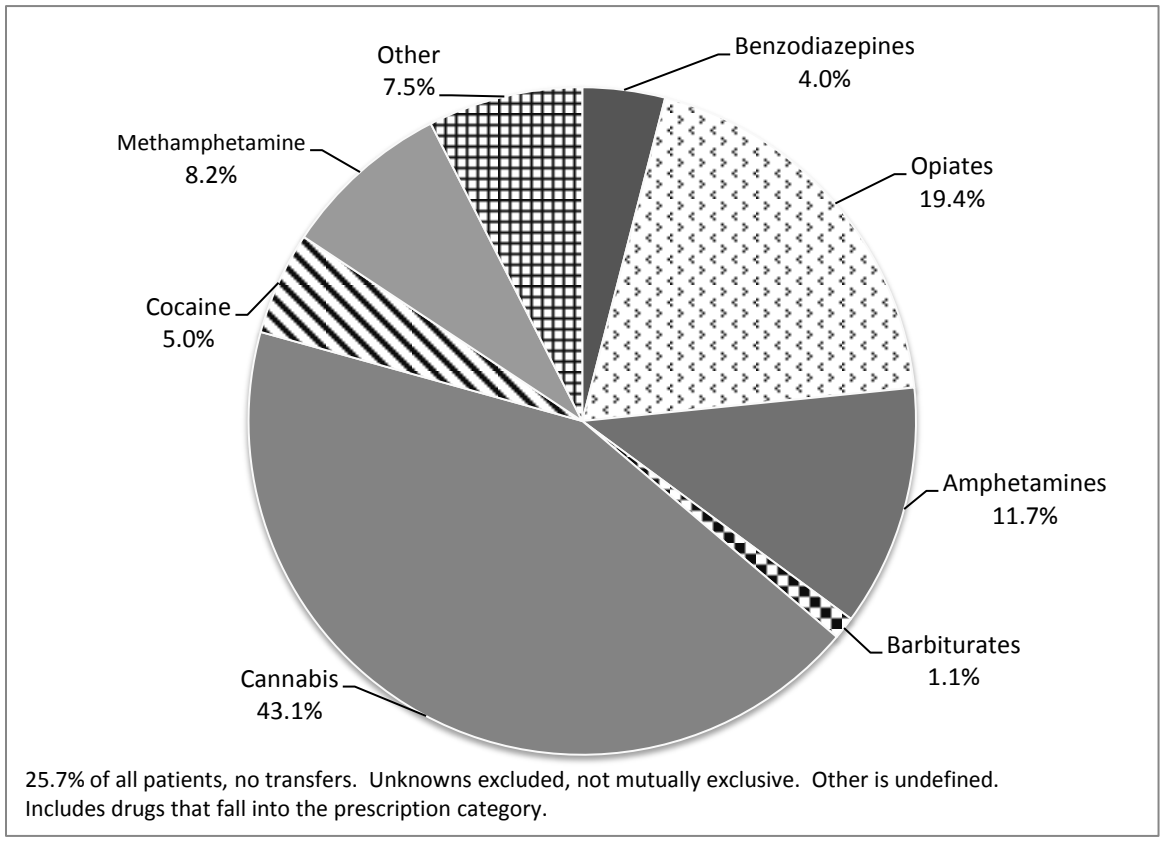
Among the patients who were screened for alcohol use, 34 percent tested positive at or above the legal limit of 0.08 percent blood alcohol content. Of these 3,613 patients, 30 percent were injured in motor vehicle traffic crashes and 24 percent were injured in falls (Figure 19).

Figure 19. Percentage of patients with positive alcohol tests among Oregon trauma registry patients, by mechanism of injury, Oregon, 2010-2011 N=3,613, 6 unknown



In 2010-2011, 4658 (26%) trauma system patients were tested for drug use. Among them, 2186 (47%) tested positive. Cannabis, opiates, and amphetamines were observed most frequently in patients who tested positive for drugs (Figure 20).

Figure 20. Drug use among injured trauma system patients, Oregon, 2010-2011, N= 2,186



25.7% of all patients, no transfers. Unknowns excluded, not mutually exclusive. Other is undefined. Includes drugs that fall into the prescription category.

Among the 4,658 patient tested for drugs, 2,186 tested positive. Among those who tested positive for drug use 40 percent were injured in motor vehicle crashes and 20 percent were injured by falls (Figure 21 and Table 18).

Figure 21. Positive test for drug use among trauma system cases by mechanism of injury, Oregon, 2010-2011, N=2,078, 108 unknown

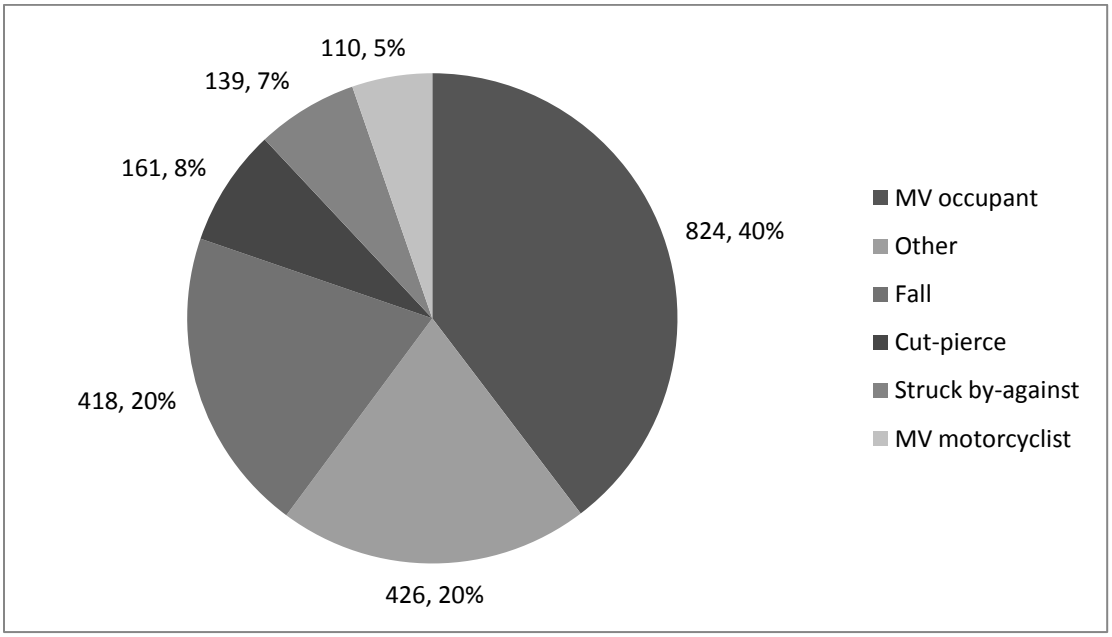


Table 18. Frequency of alcohol and drugs present in trauma system patients by selected mechanisms of injury, Oregon, 2010-2011, N=7,765

	MV occupant	Motorcycle	Pedalcyclist	Pedestrian
Total pts by mechanism	5066	889	992	818
Tested for BAC	3520	637	613	580
BAC >=0.08	1104	129	202	163
BAC < 0.08	307	68	32	29
Missing data	14	1	2	2
Tested for drugs	1722	272	208	229
Positive test	850	110	80	100
Missing data	21	2	1	1
Tested for BAC & drugs	1660	265	202	223
Positive >=0.08 BAC & drugs	310	27	39	36
Positive <0.08 BAC & drugs	412	43	47	42

More male trauma system patients experienced traumatic brain injury than females in every age group except adults aged 71 and older (Figure 22 and Table 19).

Figure 22. Frequency of traumatic brain injury among trauma system patients, by age group and sex, Oregon 2010-2011, N= 4,971, unknown 11

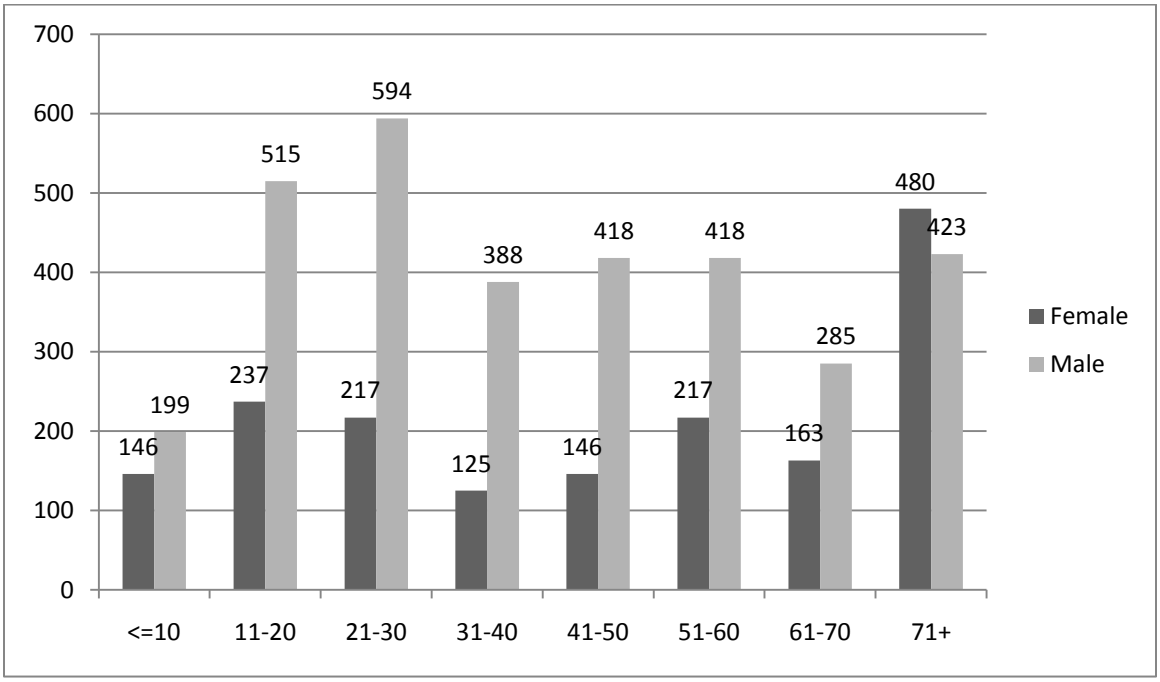


Table 19. Frequency and rate per 100,000 of traumatic brain injury among trauma system patients, by age group and sex, Oregon 2010 - 2011, N = 4,982

	Female	Rate per 100,000	Male	Rate per 100,000	Total number	Total rate per 100,000
<=10	146	94.6	199	73.6	345	65.4
11-20	237	95.0	515	197.5	752	147.4
21-30	217	84.5	594	220.1	811	154
31-40	125	49.6	388	145	388	74.7
41-50	146	56.5	418	158.1	418	80
51-60	217	79.7	418	158.9	418	78.1
61-70	163	85.4	285	156.5	285	76.4
71+	480	253.7	423	301.9	423	128.5
Total	1,731	99.9	3240	176.5	4971	100.6

*Crude rates. Unable to calculate age adjusted rates due to age groups not consistent with US 2000 Standard Population Weights.

SECTION II: Trauma System Metrics

Oregon has four levels of trauma care, with two Level I facilities, three Level II centers, twenty Level III hospitals, and nineteen Level IV facilities in Oregon (Figure 23), as well as six hospitals outside the state's borders that participate in the Oregon Trauma System. Trauma facilities are categorized and designated as prescribed in ORS 413.609 according to a system based on the model of the American College of Surgeons. The Oregon trauma hospital locations illustrate that advanced life support services and definitive care resources are more readily available in the densely populated areas of the Willamette Valley and I-5 corridor than in the less populated areas of rural Eastern Oregon (Figure 23).

The two Level I trauma centers are located in Portland, and many Level II, Level III, and Level IV hospitals are situated along the valley region between Portland and Medford (along the I-5 corridor). Additionally, there are a number of Level III and Level IV facilities located along the east-west I-84 corridor and along Oregon's coastal Highway 101. There is a cluster of Level II, Level III, and Level IV hospitals in the central Oregon area, and additional Level III and Level IV hospitals providing services throughout Southern and Eastern Oregon.

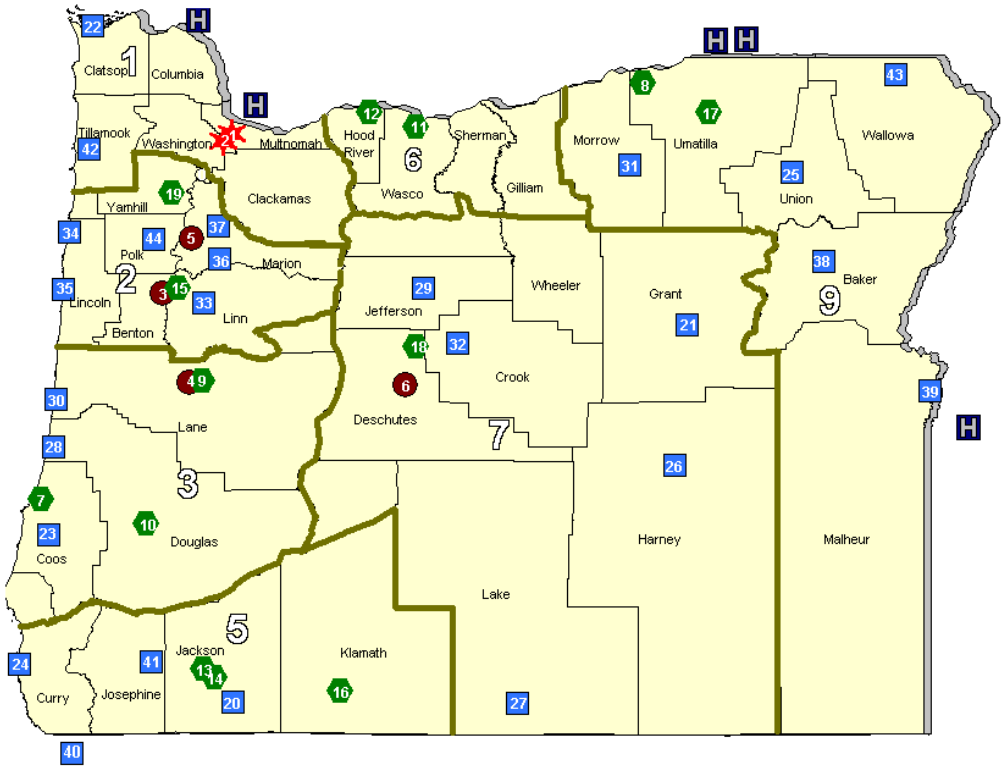
Diminishing availability of physician and hospital resources has required Oregon's trauma hospitals to reassess the level of trauma care services they are able to provide. In rare instances, hospitals have been able to increase their trauma hospital level, committing to the provision of a higher level of services. However, more often trauma hospitals are forced to decrease the level of trauma care they are able to provide to their community and the region.

The state is divided into seven Area Trauma Advisory Board (ATAB) regions (Figure 23). Each regional board is composed of prehospital and hospital trauma care providers and interested citizens who oversee the regional trauma system. In 1985, the ATABs were created with consideration for existing geographic boundaries, patient referral patterns, and county borders. In 1999, the original nine ATABs were consolidated into the current seven regions.

Entry into the Trauma System

Forty-four hospitals participate in the Oregon State Trauma System (Figure 23).

Figure 23. Oregon Trauma System Hospitals, 2012



Level I hospitals
1. Legacy Emanuel Hospital & He
2. Oregon Health & Science University, Portland

Out of state hospitals

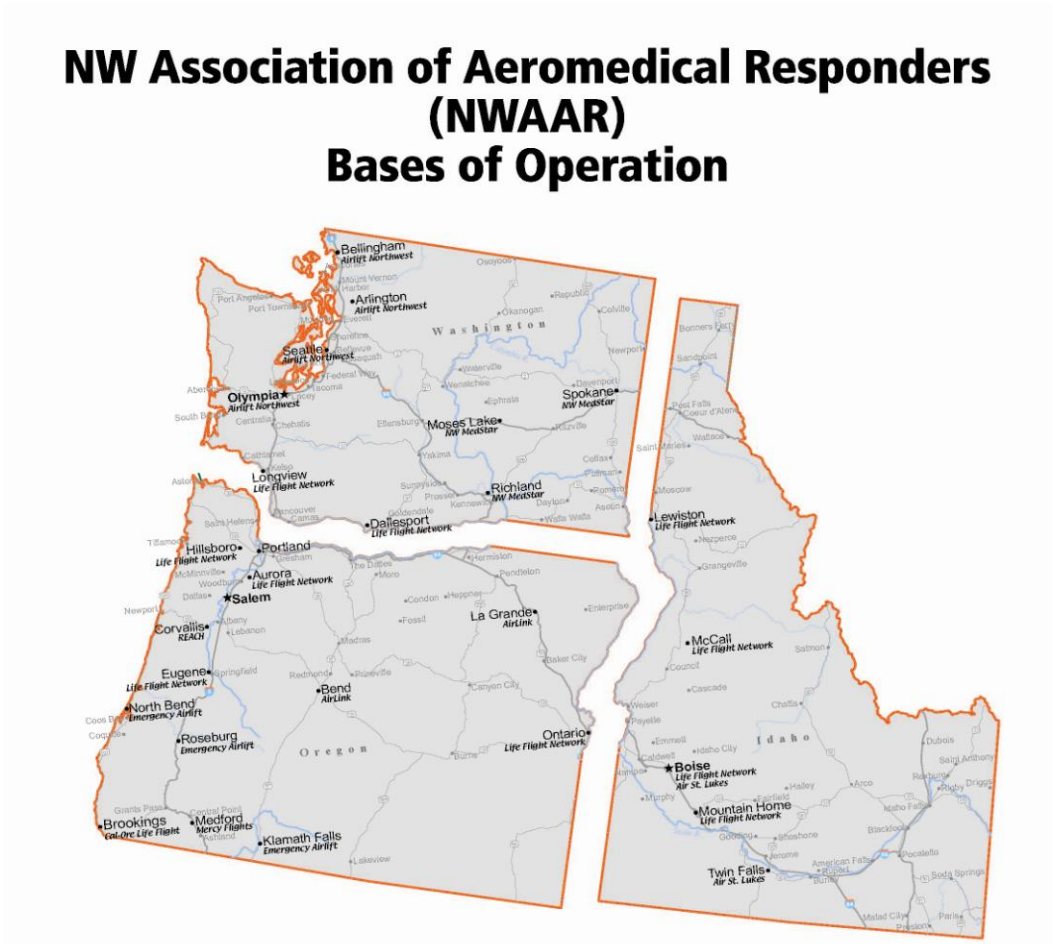
Level II hospitals
3. Good Samaritan Regional Medical Ctr., Corvallis
4. Sacred Heart Medical Center, Eugene
5. Salem Hospital, Salem
6. St. Charles Medical Center, Bend

Level III hospitals
7. Bay Area Hospital, Coos Bay
8. Good Shepherd Medical Center, Hermiston
9. McKenzie-Willamette Hospital, Springfield
10. Mercy Medical Center, Roseburg
11. Mid-Columbia Medical Center, The Dalles
12. Providence Hood River Hospital, Hood River
13. Providence Medford Medical Center, Medford
14. Rogue Valley Medical Center, Medford
15. Samaritan Albany General Hospital, Albany
16. Sky Lakes Medical Center, Klamath Falls
17. St. Anthony Hospital, Pendleton
18. St. Charles Medical Center, Redmond
19. Willamette Valley Medical Center, McMinnville

Level IV hospitals
20. Ashland Community Hospital, Ashland
21. Blue Mountain Hospital, John Day
22. Columbia Memorial Hospital, Astoria
23. Coquille Valley Hospital, Coquille
24. Curry General Hospital, Gold Beach
25. Grande Ronde Hospital, La Grande
26. Harney District Hospital, Burns
27. Lake District Hospital, Lakeview
28. Lower Umpqua Hospital, Reedsport
29. Mountain View Hospital, Madras
30. Peace Harbor Hospital, Florence
31. Pioneer Memorial Hospital, Heppner
32. Pioneer Memorial Hospital, Prineville
33. Samaritan Lebanon Community Hospital, Lebanon
34. Samaritan North Lincoln Hospital, Lincoln City
35. Samaritan Pacific Communities Hospital, Newport
36. Santiam Memorial Hospital, Stayton
37. Silverton Hospital, Silverton
38. St. Alphonsus Medical Center, Baker City
39. St. Alphonsus Medical Center, Ontario
40. Sutter Coast Hospital, Crescent City, CA
41. Three Rivers Community Hospital, Grants Pass
42. Tillamook County General Hospital, Tillamook
43. Wallowa Memorial Hospital, Enterprise
44. West Valley Hospital, Dallas

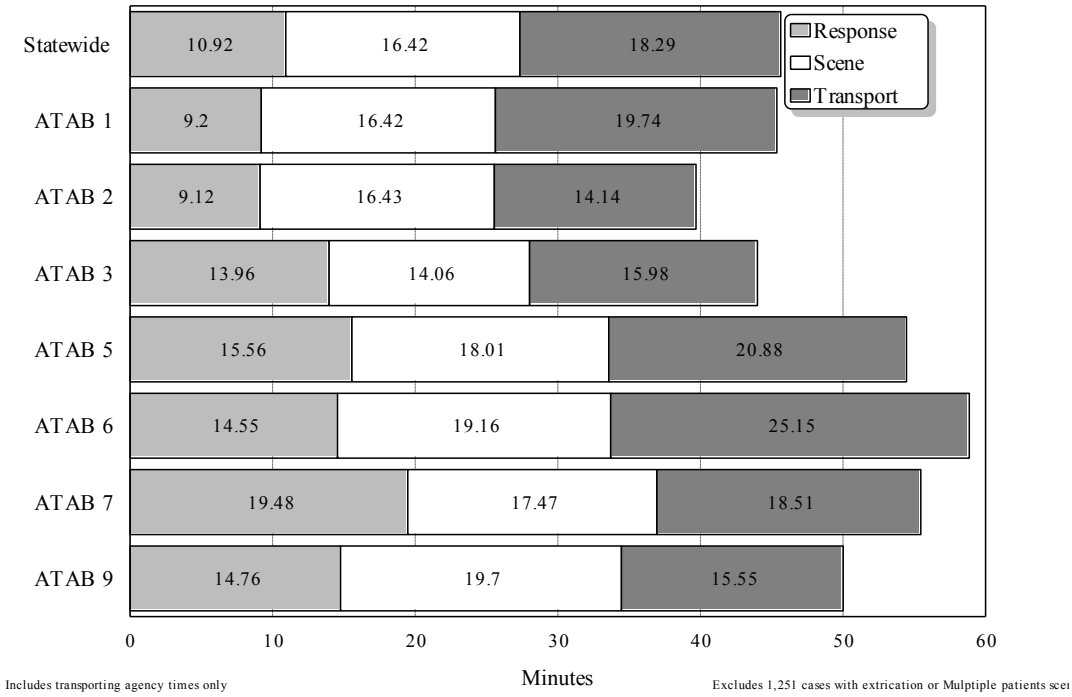
The bases of operation for aeromedical responders during the years 2010-2011 are illustrated in Figure 24.

Figure 24. Air medical resources of the Oregon trauma system, 2012



Prehospital time includes the time to respond to the scene, provide care and prepare patient for transport, and transport time to a trauma system hospital. Figure 25 provides average prehospital times by ATAB.

Figure 25. Estimated average time for medical services response, treatment at the scene, and transport by ATAB region, Oregon 2010-2011



The time in which 90 percent of all emergency medical services (EMS) responses were completed varies by rural and urban regions with the shortest response times in urban areas and the longest response times in rural areas (Figure 26).

Figure 26. Prehospital response times in minutes (90th percentile) by ATAB for field identified trauma system patients, Oregon 2010-2011, N=10,089

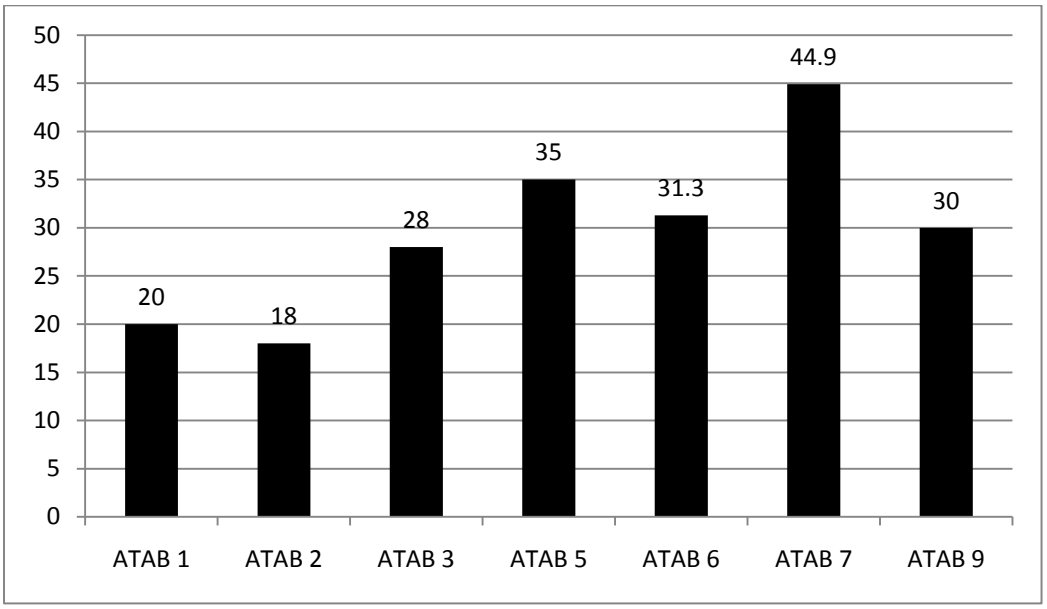


Figure 27. Average time in minutes (90th percentile) scene time with extrication and Mass Casualty Incident (MCI), by ATAB, N=10,226, 310 unknown

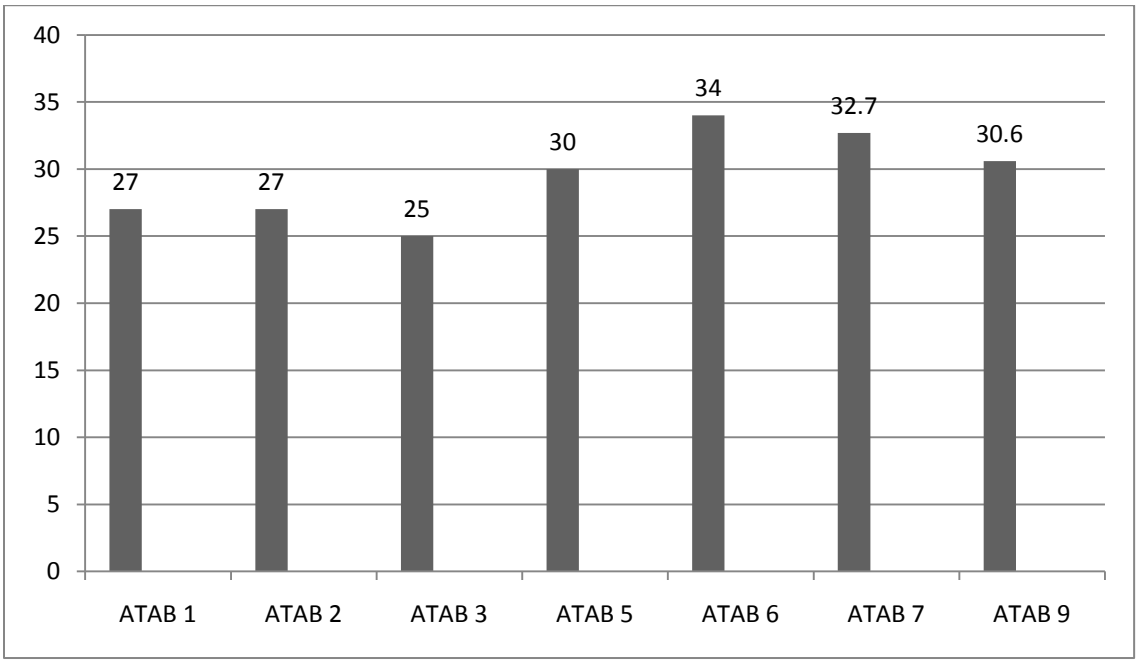
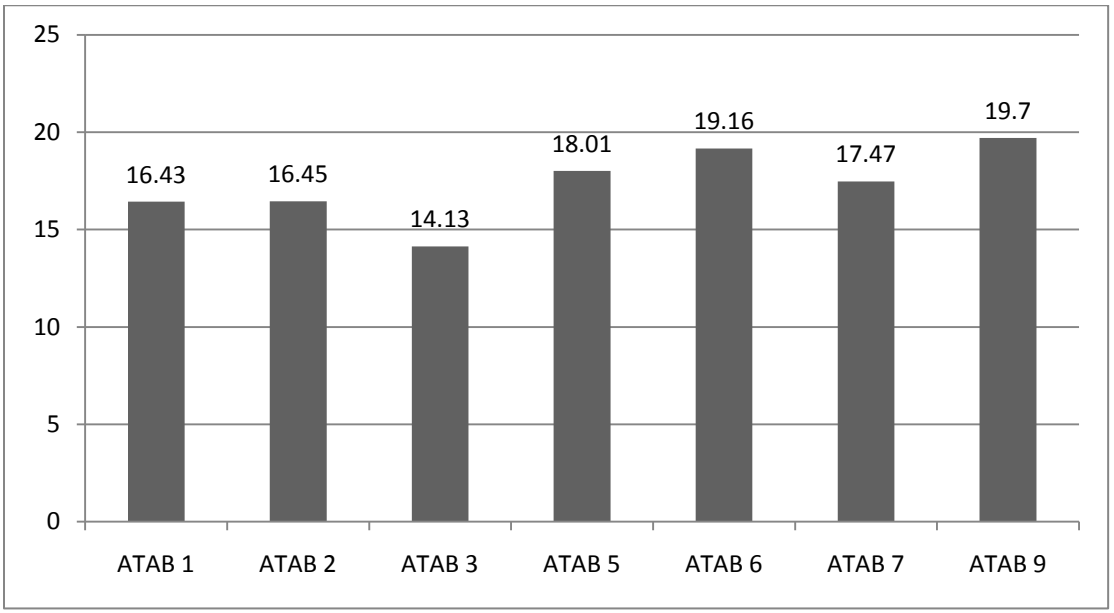


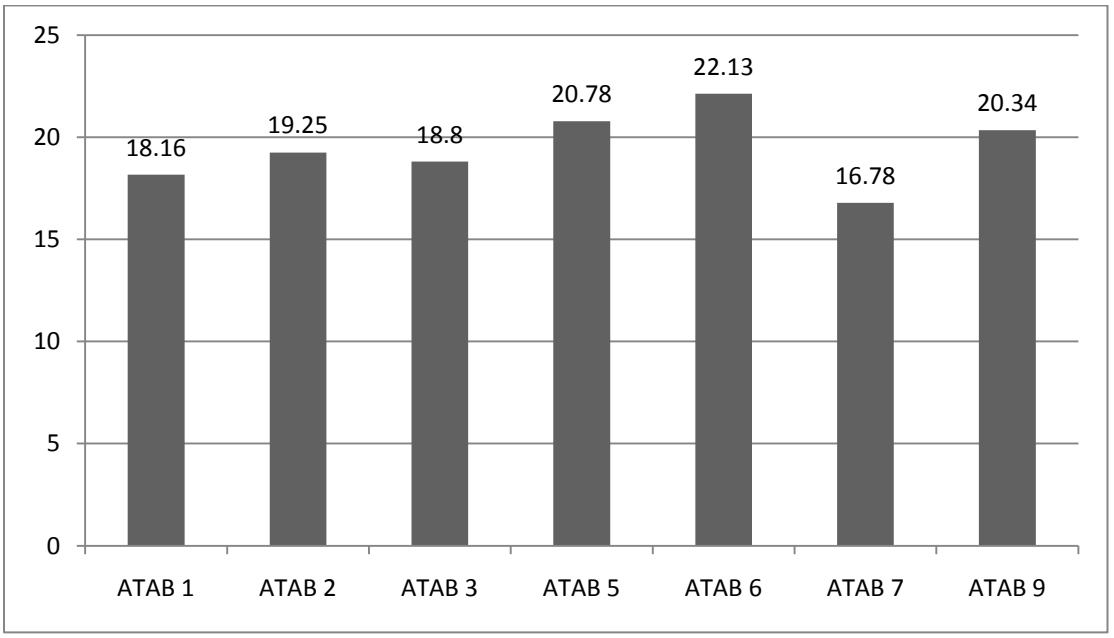
Figure 28. Average prehospital scene times in minutes by ATAB for field identified trauma patients excluding extrication or Mass Casualty Incident (MCI), N=10,949



Note: Statewide average is 16.44

In all cases where extrication occurs, the average scene time increases on average between one and four minutes across all ATABs (Figures 28 and 29).

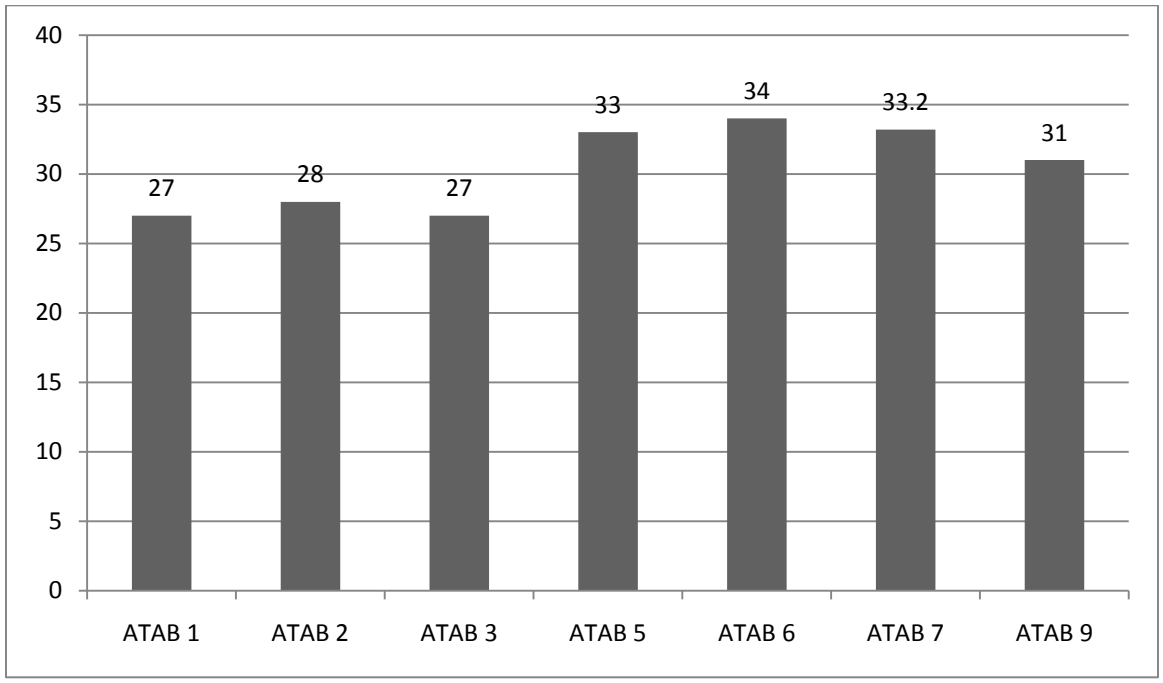
Figure 29. Average prehospital scene times in minutes by ATAB for field identified patients with extrication and Mass Casualty Incident (MCI), N=1,110



Note: Statewide average 19.15 minutes

There is small variation between urban and rural emergency medical services (EMS) time spent at the scene (Figure 30), however scene time ranged between one minute and 179 minutes.

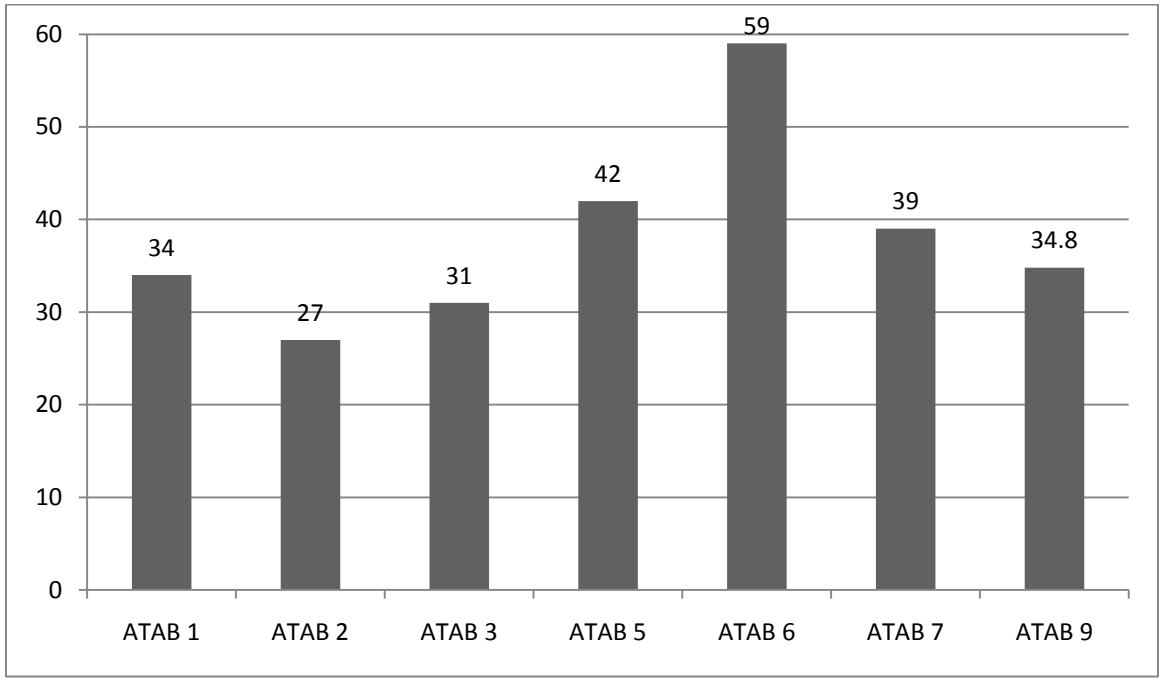
Figure 30. Average time in minutes (90th percentile) EMS spent at the scene preparing field identified trauma system patients for transport, by ATAB, Oregon 2010-2011, N=10,226, 310 unknown



Note: Extraction is included in scene time

The greatest prehospital performance variation is observed during EMS transport operations by region. Urban regions had lower transport times than rural regions (Figure 31).

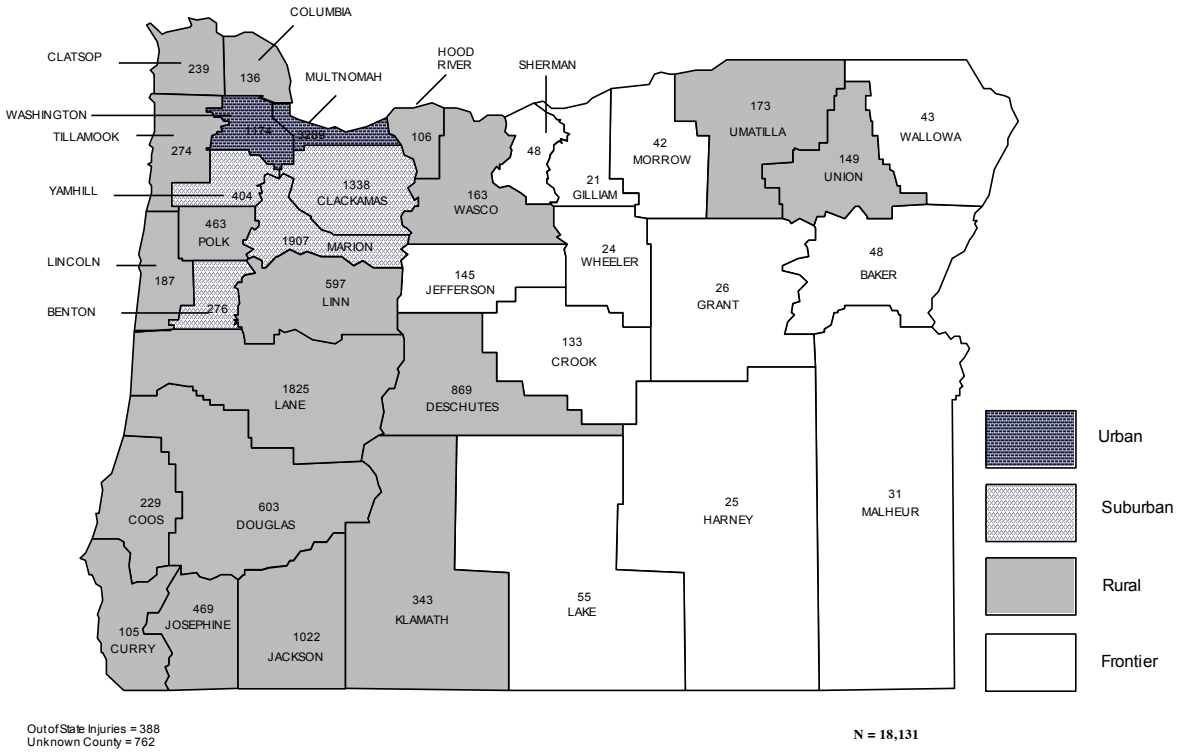
Figure 31. Average time in minutes (90th percentile) transporting patients to trauma hospitals, by ATAB, Oregon 2010-2011, N=10,205, 28 unknown



Level of Care

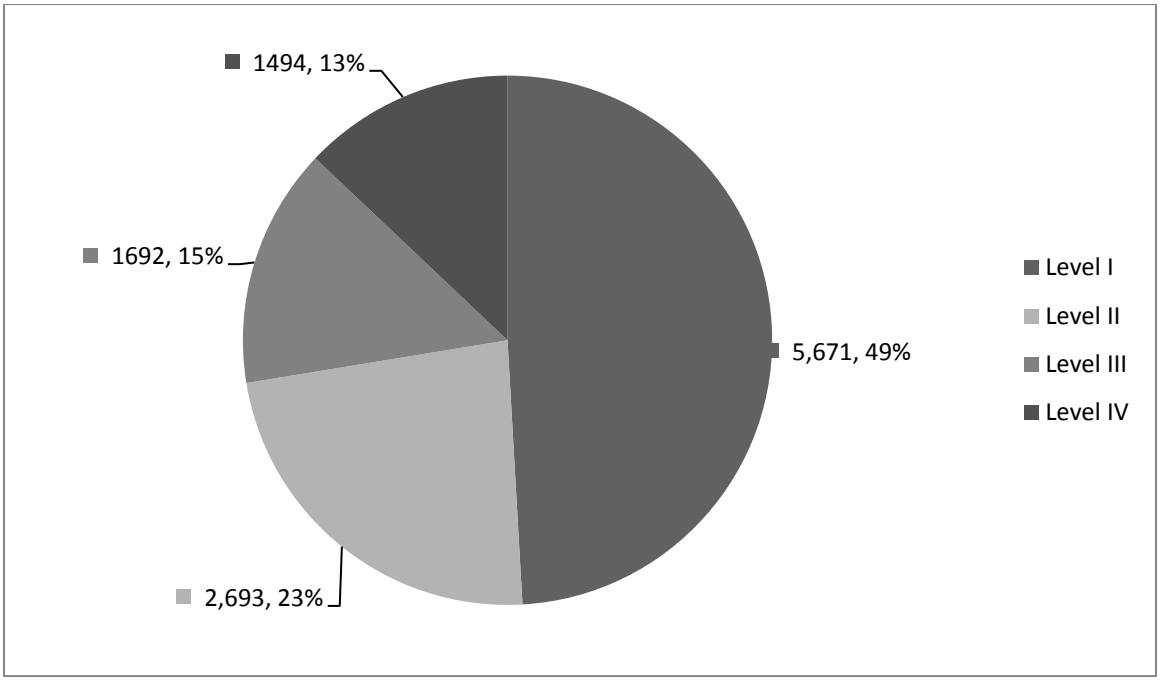
The rate per 100,000 and number of patients who received care by county of injury in the Oregon trauma system is shown in Table 3 above. The designations of urban, suburban, rural, and frontier are based on residents per square mile (Figure 32).

Figure 32. Number of patients entered into Oregon trauma system, by county of injury, Oregon 2010-2011, N=18,131



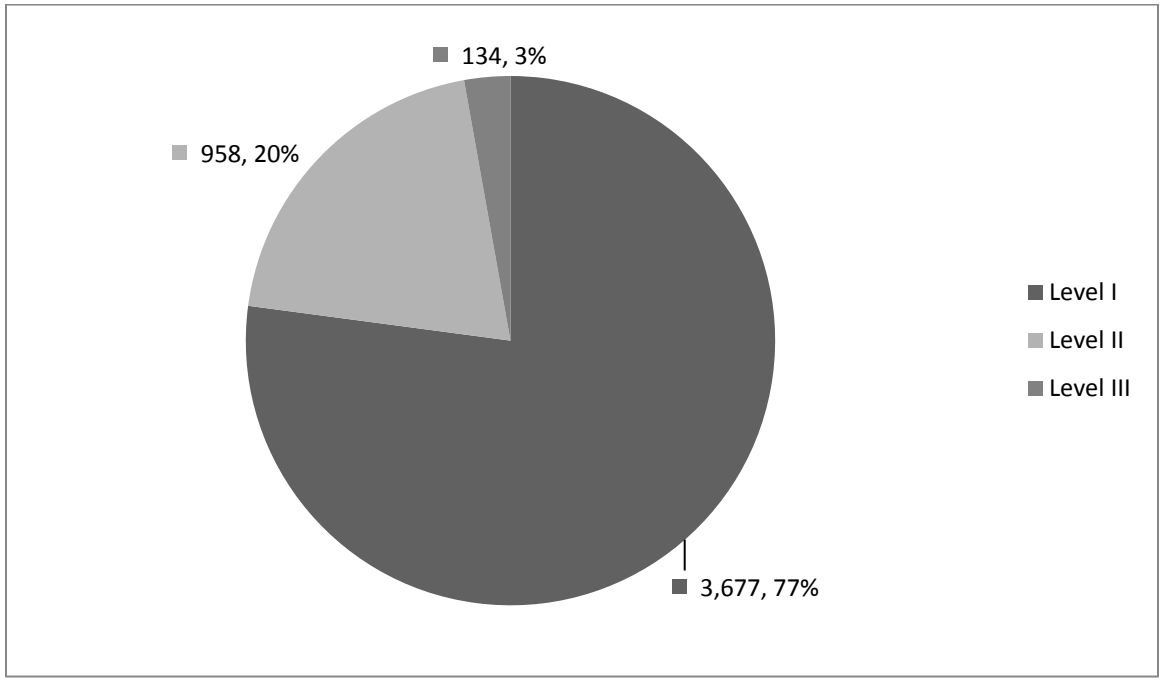
Oregon's trauma centers rapidly provide specialized care to patients arriving directly to the hospital from the scene of injury. Of the 11,550 field entered trauma patients, the two Level I trauma hospitals received and provided care for 49 percent of patients while Level II, III, and IV hospitals received and provided care for 23, 15 and 13 percent of patients (Figure 33).

Figure 33. Frequency of patients entered into the trauma hospital from the field, by hospital level of care, Oregon 2010-2011, N=11,550



Patient transfers occur according to protocols among Oregon trauma system hospitals. Figure 34 illustrates the number and percentage of patients received at Level I, II, and III trauma hospitals.

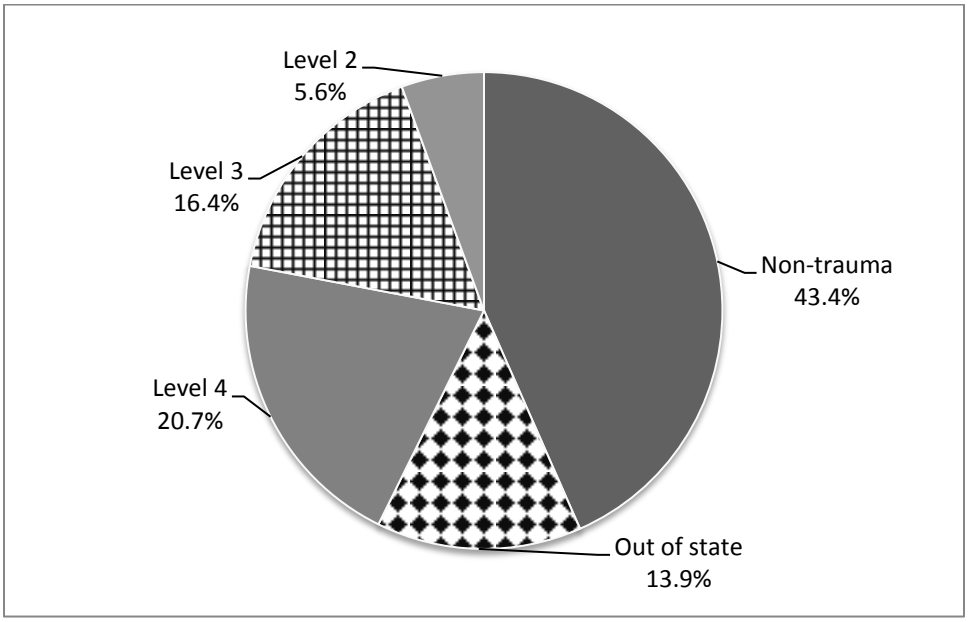
Figure 34. Number and percentage of patients entering Level I, Level II, and Level III trauma hospitals, Oregon, 2010-2011, N=4,769



Note: Excludes Level IV as no transfers are associated with Level IV hospitals

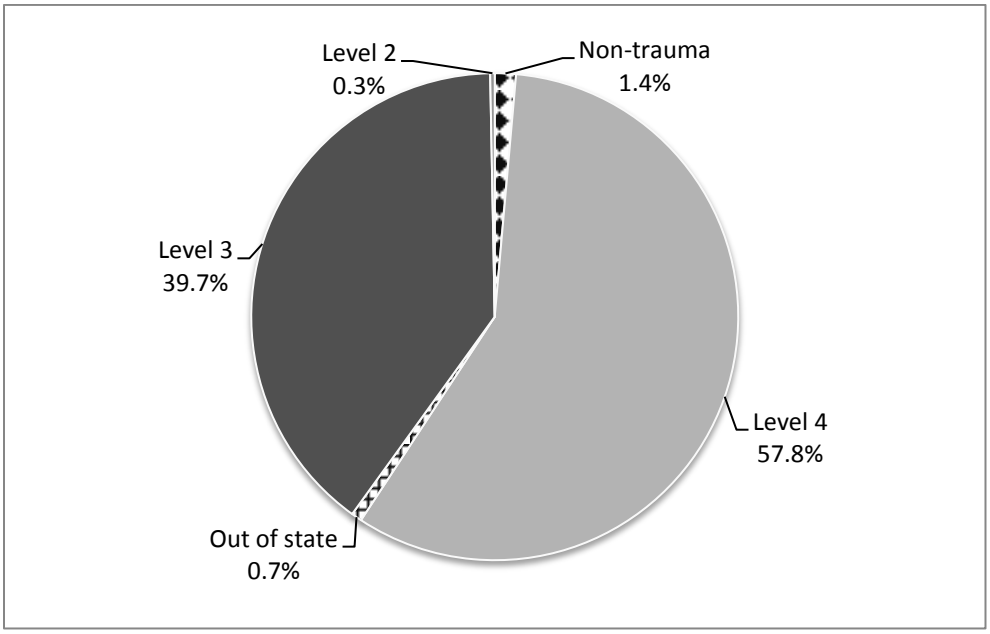
Patients who need higher levels of care are systematically transferred to the appropriate level of care. Most transfers (43%) to Level I trauma hospitals were generated by non-trauma hospitals (Figure 35).

Figure 35. Source of patients transferred to Level I hospitals, Oregon, 2010-2011, N=3,677



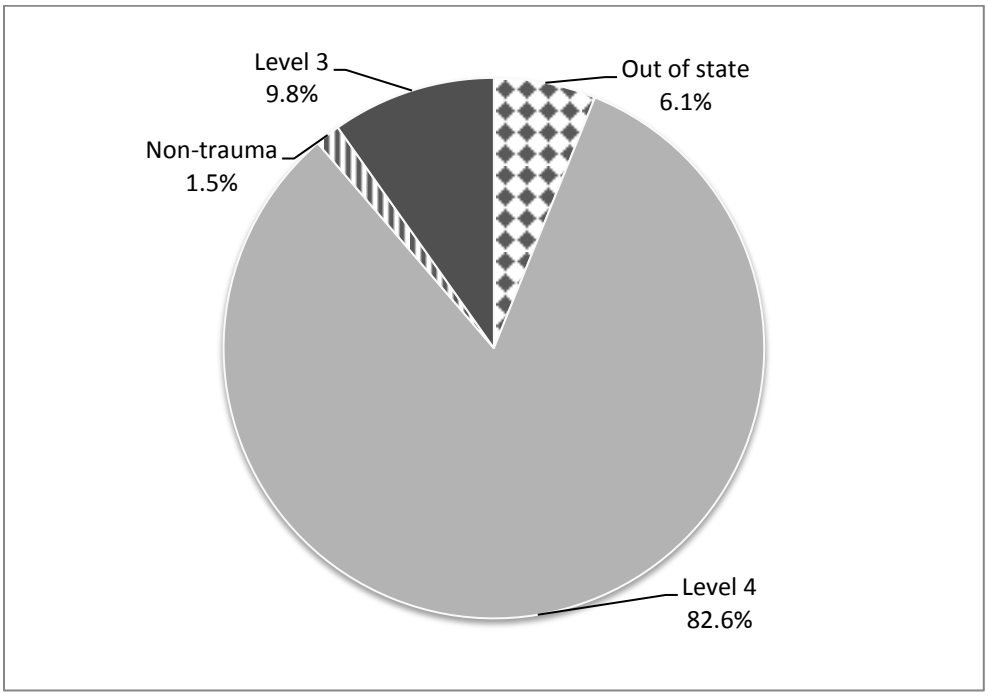
Most transfers (57.8%) to Level II trauma hospitals were generated by Level IV trauma hospitals (Figure 36).

Figure 36. Source of patients transferred to Level II hospitals, Oregon, 2010-2011, N=958



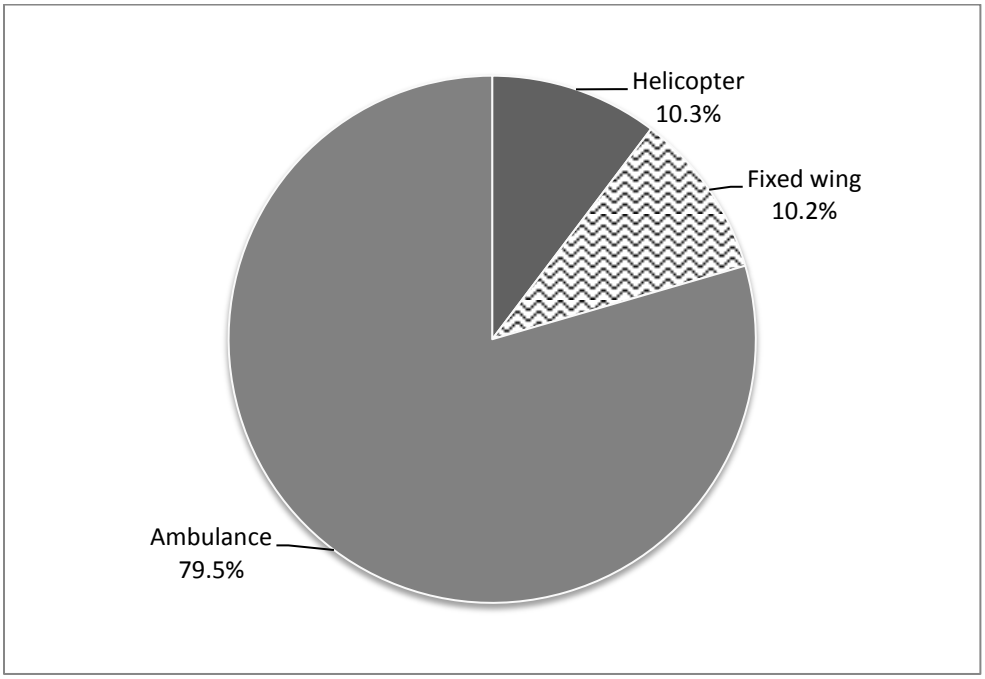
Most transfers (82.6%) to Level III trauma hospitals were generated by Level IV trauma hospitals (Figure 37).

Figure 37. Source of patients transferred to Level III hospitals, Oregon, 2010-2011, N=134



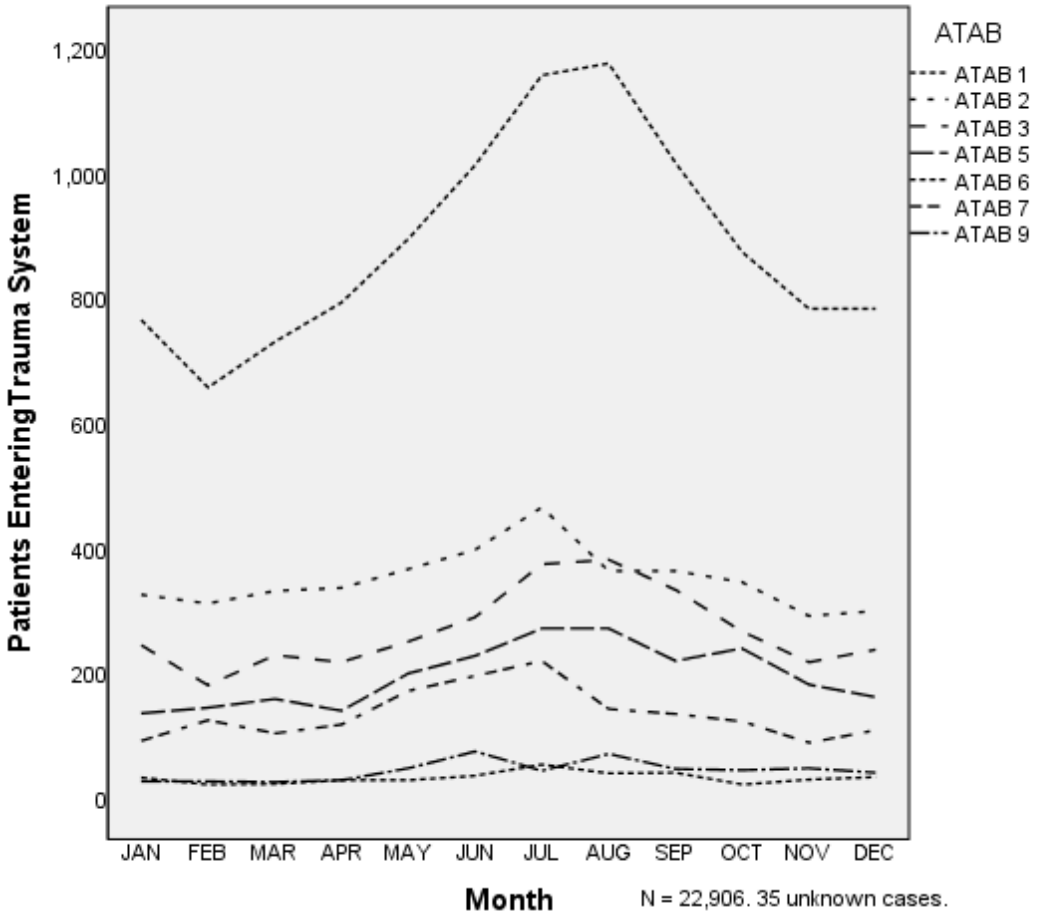
Seventy-nine percent of transfers occur by ground ambulance. Helicopters and fixed wing aircraft modes account for the transport twenty percent of patients (Figure 38).

Figure 38. Transport method for transfer of trauma system patients to hospitals, Oregon, 2010-2011, N=4,775



The majority of patients enter the trauma system during the summer months (Figure 39).

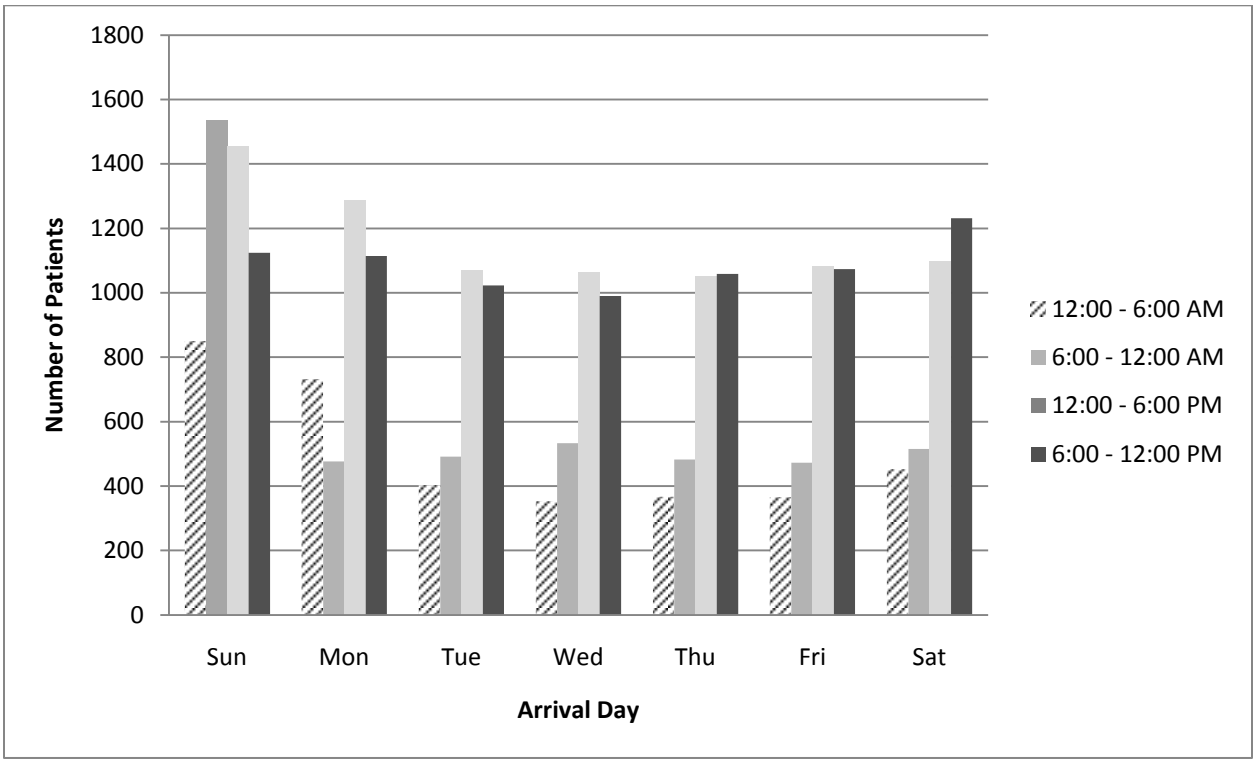
Figure 39. Patients entering trauma hospitals by month and by ATAB, Oregon 2010-2011, N=22,906, 35 unknown



Note: Includes transferred patients, readmissions, and multiple transfers of same patient

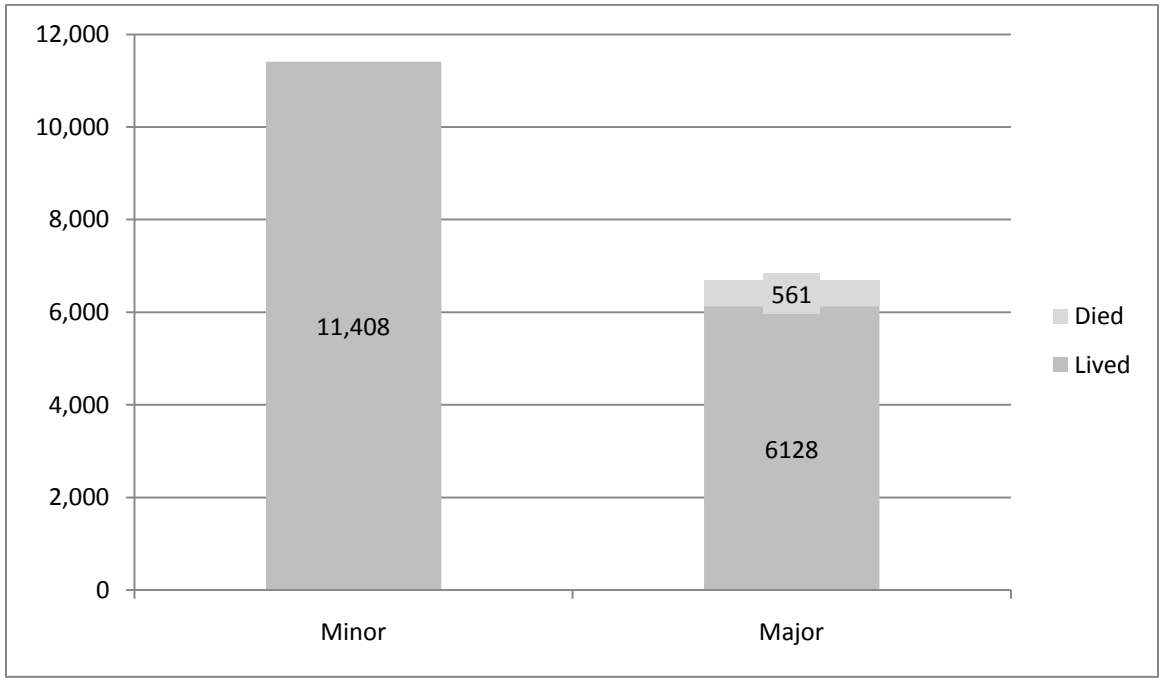
The majority of patients enter the trauma system on Saturday and Sunday during the morning and early afternoon hours (Figure 40). The lowest number of trauma system entries occur on Tuesdays, Wednesdays and Thursdays.

Figure 40. Number of trauma system patients entering the trauma system, by arrival time and days of the week, Oregon 2010-2011



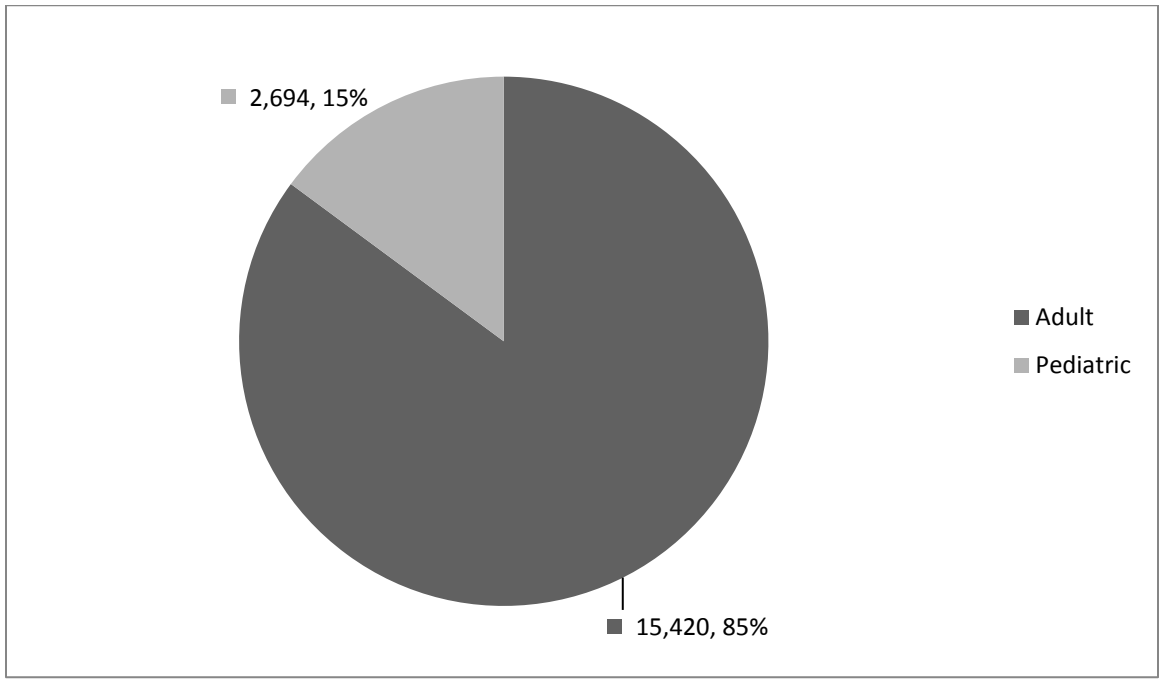
Sixty-three percent of cases were minor trauma with an average ISS of 5.6. Thirty-four percent of cases were major trauma with an average ISS of 16.2. Three percent of the major trauma cases died with average ISS of 21.9 (Figure 41).

Figure 41. Patients entering the trauma system, by major and minor trauma scores, and survival, Oregon 2010-2011, N=18,097, 525 unknown



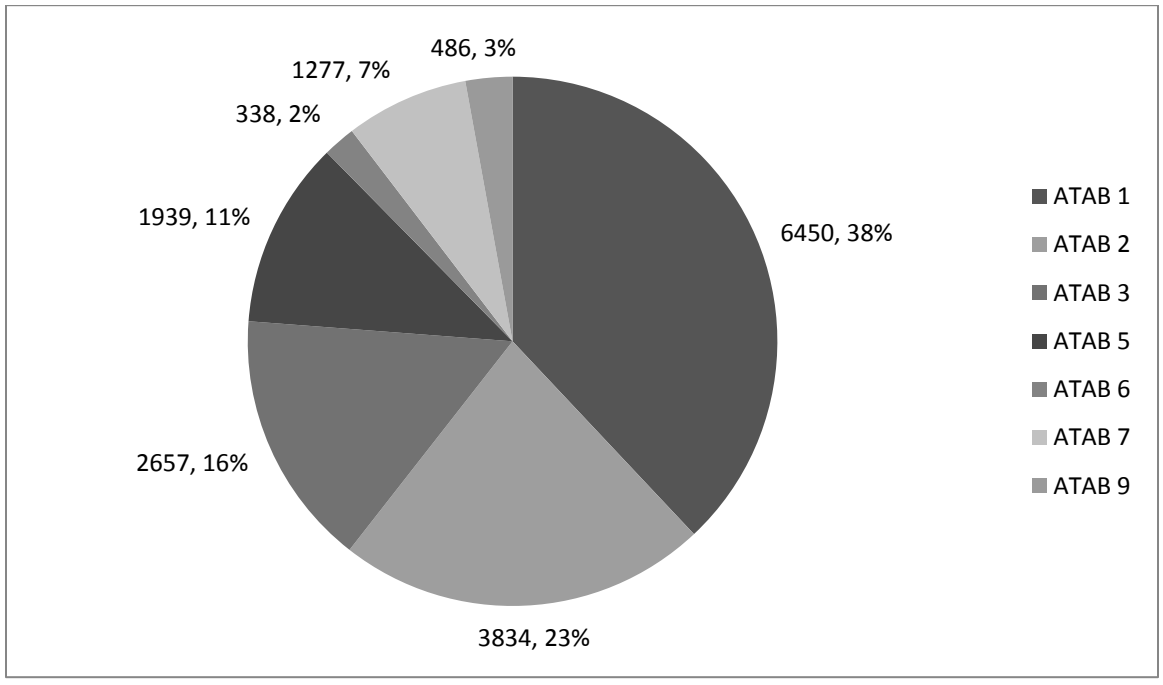
Eighty-five percent of patients entering the trauma system are adults (Figure 42).

Figure 42. Percent and frequency of adult and pediatric patient volume, Oregon trauma system, Oregon, 2010-2011, N=18,131, 17 unknown



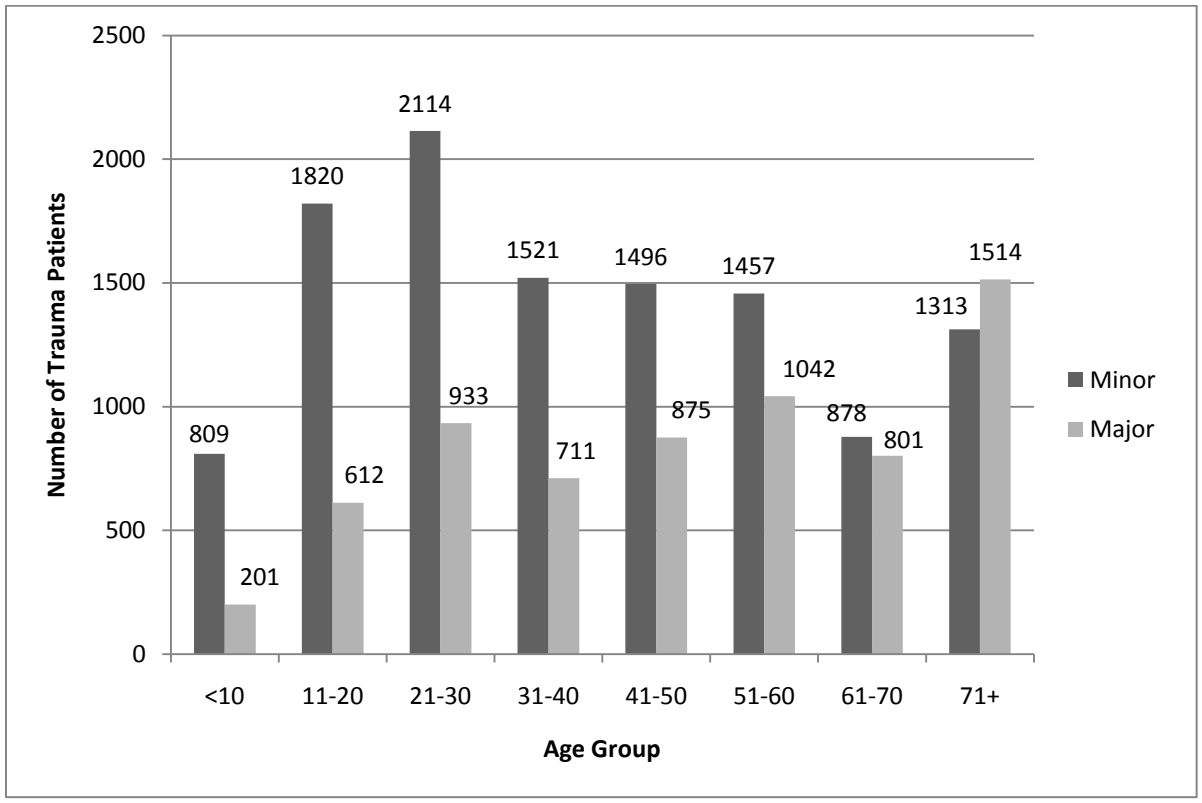
ATAB 1 receives the highest number of patients from the field (Figure 43).

Figure 43. Number and percent of trauma system patients by ATAB, Oregon, 2010-2011



The number of minor trauma patients (<=15 ISS) peaks at the patient age 21-30 and number of patients with minor trauma drops by 30 percent at age 31 and remains flat until the age of 61 where a 40 percent drop occurs. A final sharp increase occurs (primarily due to falls) starting at age 71 (Figure 44). The number of major trauma (>15 ISS) patients increases to a peak at 21-30 and the number of cases of major trauma remain relatively flat until a rising to the highest peak after age 70.

Figure 44. Injury severity among trauma patients by age group, Oregon, 2010-2011, N=18,097, 34 unknown



Note 246 patients were one year old or younger.

Falls (33%) and motor vehicle traffic (29%) were the leading mechanisms of injury among trauma system patients with blunt trauma (Figure 45 and Table 20).

Figure 45. Percent of trauma system patients, with blunt force injury by mechanism, Oregon 2010-2011, N=16,933

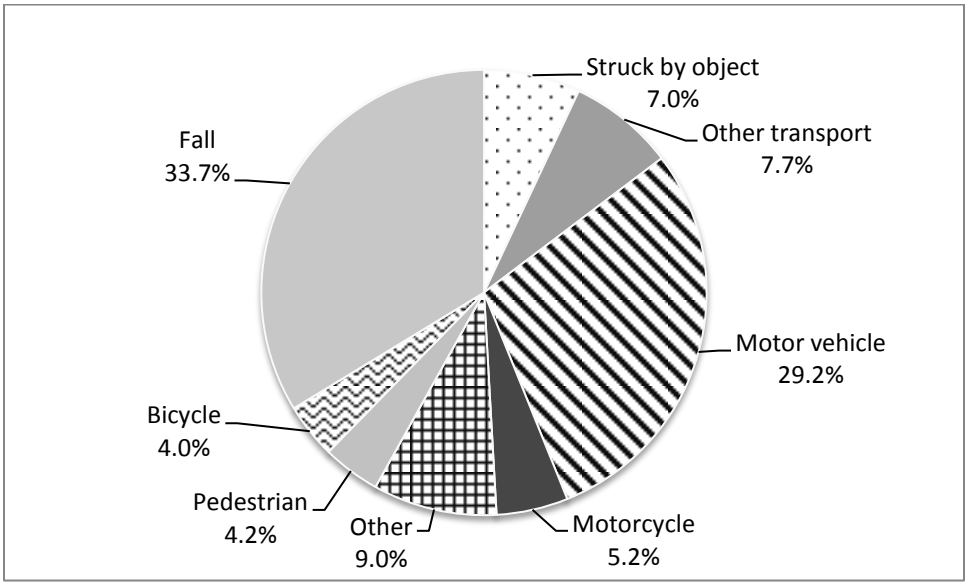


Table 20. Mechanism of blunt force injuries, number of patients, number of deaths, average ISS, and percentage of cases, Oregon, 2010-2011, N=16,933

Mechanism of blunt force injury	Average Injury Severity Score	Number of patients	Number of deaths	%
Fall	10	5,714	223	33.7
Motor Vehicle-Occupant	9	4,936	81	29.2
Other	10	1,525	62	9.0
Transport-Other	10	1,308	16	7.7
Struck-by-Against	9	1,180	19	7.0
MV-Motorcyclist	12	886	20	5.2
MV-Pedestrian	12	708	33	4.2
Pedalcyclist-Other	11	676	3	4.0
Total	10	16,933	457	12.5

Cutting/piercing (54%) and firearm (40%) were the leading mechanisms of injury among trauma system patients with penetrating trauma (Figure 46 and Table 21).

Figure 46. Penetrating injuries among trauma system patients, by mechanism, Oregon 2010-2011, N=1,021

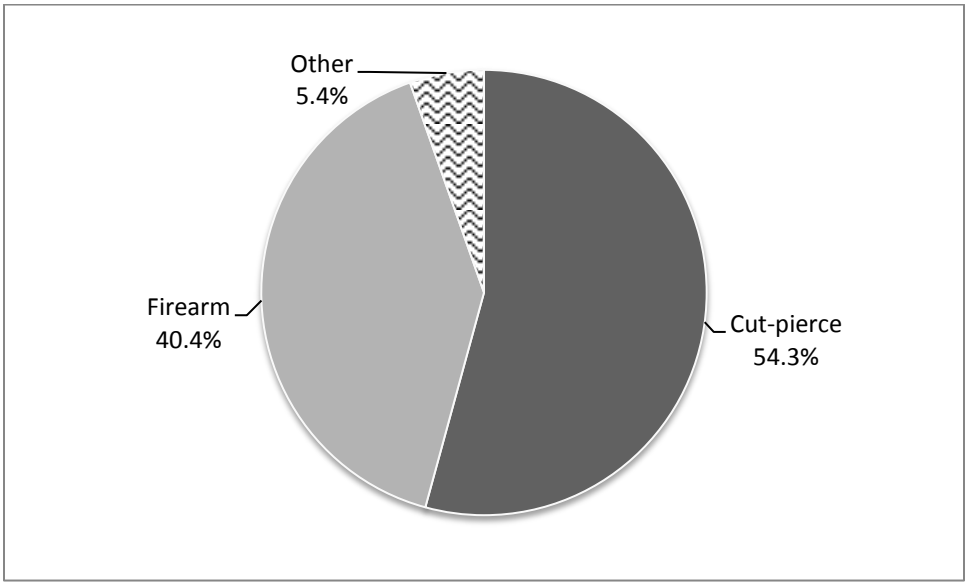


Table 21. Mechanism of penetrating injuries among patients, number of patients, number of deaths, and percent of cases, Oregon, 2010-2011, N=1,021

Penetrating injury	Average Injury Severity Score	Number of patients	Number of deaths	%
Cut-Pierce	7	554	11	54.3
Firearm	13	412	80	40.4
Other	7	55	3	5.4
Total	9	1,021	94	33.3

Falls (39%) and motor vehicle occupant (27%) were the leading mechanisms of injury among trauma system patients with blunt head trauma (Figure 47 and Table 22).

Figure 47. Blunt force head injuries among trauma system patients, by mechanism, Oregon 2010-2011, N=8,177

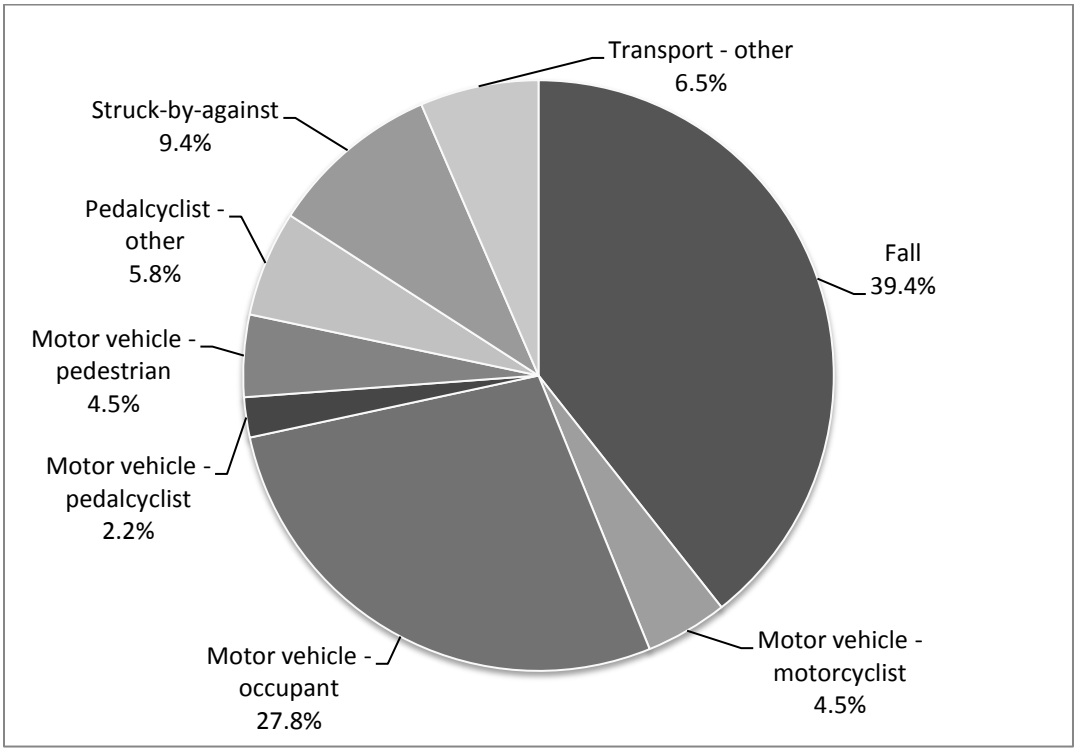
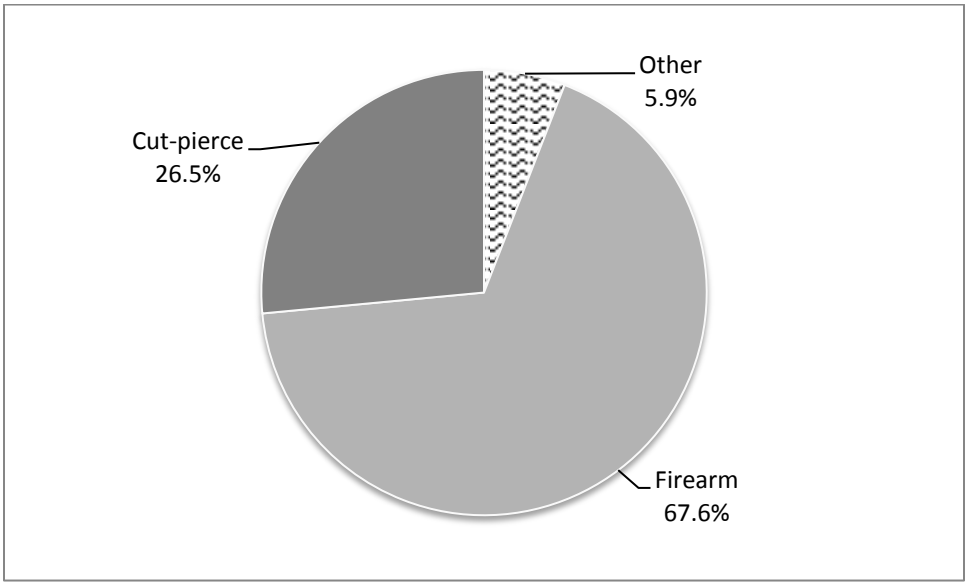


Table 22. Mechanism of blunt force head injury, average ISS, number of patients, number of deaths, and percent of cases, Oregon, 2010-2011, N=8,177

Mechanism of blunt force injury to the head	Average Injury Severity Score	Number of patients	Number of deaths	%
Fall	13	2,925	150	35.8
Motor Vehicle-Occupant	12	2,064	43	25.2
Other	14	750	20	9.2
Struck-by-Against	11	696	14	8.5
MV-Pedestrian	17	331	27	8.2
Transport-Other	13	484	7	5.9
Pedalcyclist-Other	12	431	1	5.3
MV-Motorcyclist	16	331	15	4.0
MV-Pedalcyclist	14	165	9	2.0
Total	13	8,177	286	11.6

Firearms (67%) and cutting and piercing (26%) were the leading mechanisms of injury among trauma system patients with penetrating head trauma (Figure 48 and Table 23).

Figure 48. Penetrating head injuries among trauma system patients, by mechanism, Oregon 2010-2011, N=136



Sixty-seven percent of penetrating head trauma is due to firearm injury (Table X).

Table 23. Mechanism of penetrating head injuries, AISS, number of patients, number of deaths, and percent of cases, Oregon, 2010-2011, N=136

Mechanism of penetrating Injury to the head	Average Injury Severity Score	Number of patients	Number of deaths	%
Firearm	23	92	46	67.6
Cut-Pierce	13	36	2	26.5
Other	19	8	0	5.9
Total	18	136	48	33.3

Motor vehicle occupant (39%) and falls (29%) were the leading mechanisms of injury among trauma system patients with blunt chest/abdomen injury (Figure 49 and Table 24).

Figure 49. Blunt force chest and abdomen injuries among trauma system patients, by mechanism, Oregon 2010-2011, N=5,051

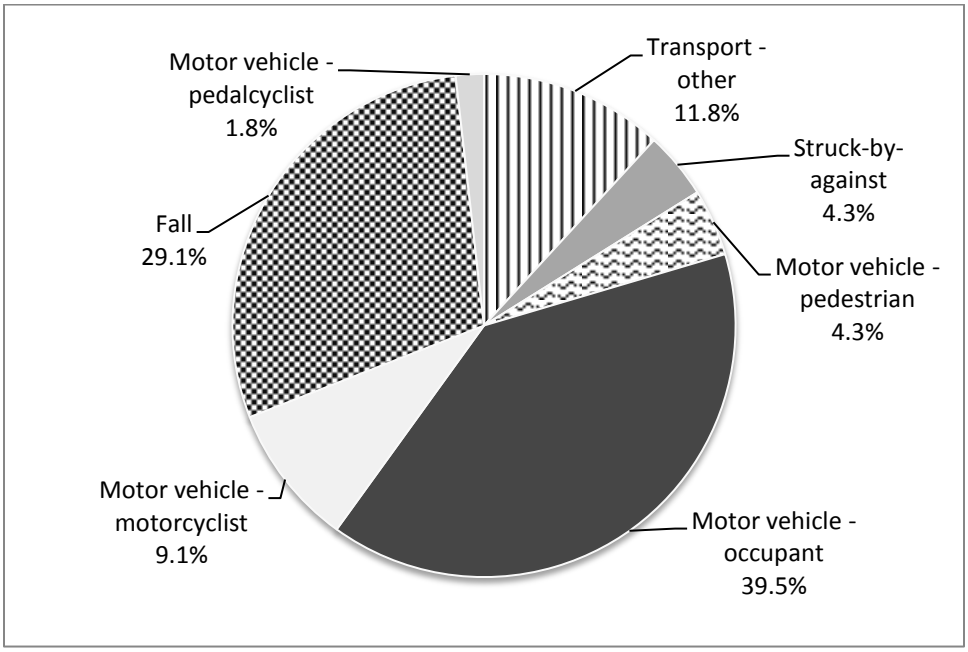


Table 24. Mechanism of blunt force injury to the chest/abdomen, average injury severity score, number of patients, number of deaths, and percent of cases, Oregon, 2010-2011, N=5,051

Mechanism of blunt force injury to the chest or abdomen	Average Injury Severity Score	Number of patients	Number of deaths	%
Motor Vehicle-Occupant	15	1,823	58	36.1
Fall	14	1,344	40	26.6
Transport-Other	14	546	11	10.8
MV-Motorcyclist	18	418	17	8.3
Other	16	270	21	5.3
MV-Pedestrian	22	200	23	4.0
Struck-by-Against	13	195	3	3.9
Pedalcyclist-Other	16	171	2	3.4
MV-Pedalcyclist	20	84	7	1.7
Total	17	5,051	182	11.1

Cutting and piercing (58%) and firearm (37%) were the leading mechanisms of injury among trauma system patients with penetrating chest/abdomen injury (Figure 50 and Table 25).

Figure 50. Penetrating chest and abdomen injuries among trauma system patients, by mechanism, Oregon 2010-2011, N=296

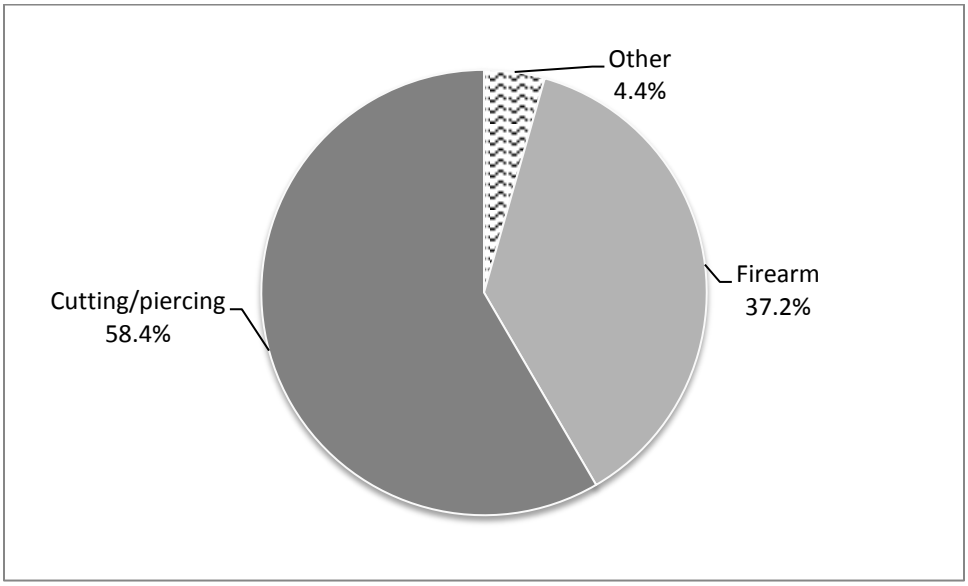


Table 25. Penetrating chest/abdomen injury, average injury severity score, number of patients, number of deaths, and percent of cases, Oregon, 2010-2011, N=296

Penetrating Injury of Chest or Abdomen	Average Injury Severity Score	Number of patients	Number of deaths	%
Cut-Pierce	14	173	6	58.4
Firearm	19	110	22	37.2
Other	17	13	1	4.4
Total	17	296	29	33.3

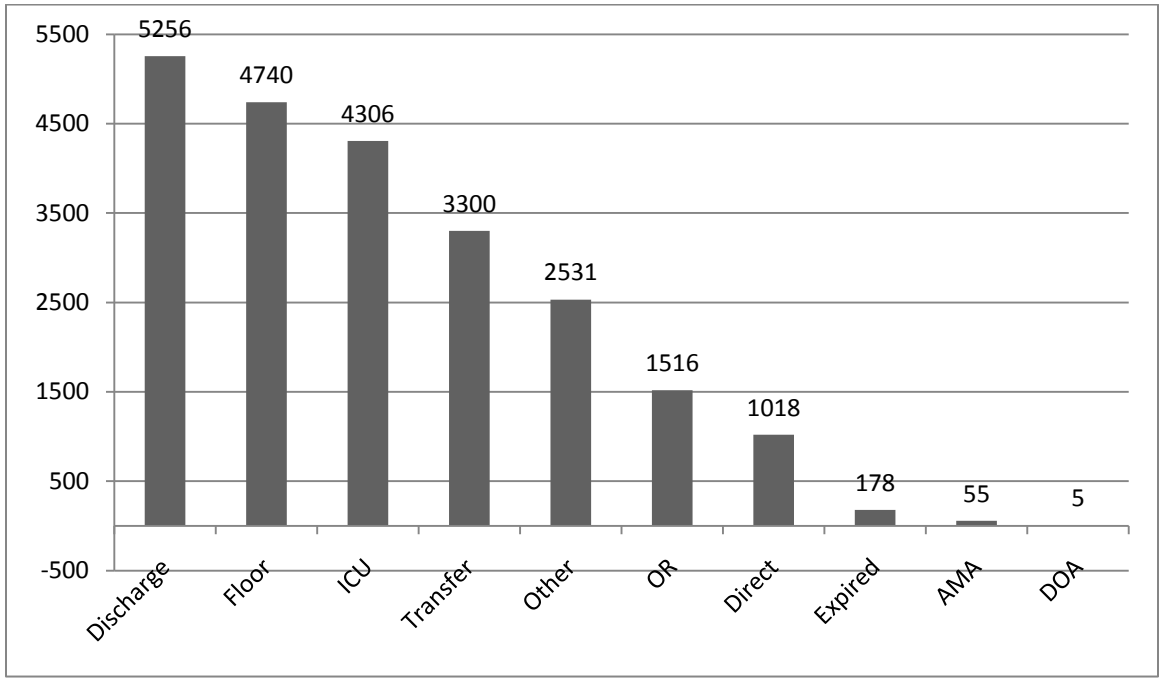
Table 26. Frequency of pre-existing conditions among trauma system by condition, Oregon, 2010-2011, N=18,131, 21 unknown

Condition	Frequency	Percent
None	7,999	44.0
Hypertension	2,159	11.9
Other	1,381	7.6
Psychiatric	895	4.9
Chronic alcohol abuse	690	3.8
Asthma	473	2.6
Smoker	466	2.6
Bulimia	429	2.4
Chronic drug abuse	372	2.1
Coronary artery disease	362	2.0
Non-insulin dependent diabetes	347	1.9
Insulin dependent diabetes	254	1.4
Coagulation	234	1.3
Obesity - BMI >35	220	1.2
Seizures	212	1.2
Chronic obstructive pulmonary disease	197	1.1
Nicotine dependence	195	1.1
Congestive heart failure	176	1.0
Alcoholic	164	0.9
CVA/Stroke with residual deficit	143	0.8
Cardiac Surgery	126	0.7
Dementia	103	0.6
Myocardial infarction	89	0.5
Cancerous metastasis	75	0.4
Alzheimer's disease	47	0.3
Cirrhosis	31	0.2
Creatinine > 2 mg % on admission	31	0.2
Parkinsons	24	0.1
Dialysis	23	0.1
Inflamatory bowel disease	22	0.1
Pregnancy	22	0.1
Unknown	21	0.1
Muscular sclerosis	19	0.1
Rheumatoid arthritis	19	0.1
HIV/AIDS	18	0.1
Chronic pulmonary condition	16	0.1

IMM-Post Splenectomy	13	0.1
Pulmonary disease	12	0.1
Existing spinal cord injury	10	0.1
Chronic demyelinating disease	6	0.0
Ulcer	6	0.0
Systemic lupus erythematous	5	0.0
Transplant patient	5	0.0
Gastric or esophageal varices	5	0.0
Active chemotherapy	4	0.0
Organic brain syndrome	3	0.0
Pancreatitis	3	0.0
Routine steroid use	3	0.0
Cor pulmonale	1	0.0
Bilirubin > 2 mg % on admission	1	0.0
Total	18,131	100.0

About 23 percent of patient encounters in the emergency department resulted in discharge into the community (Figure 51).

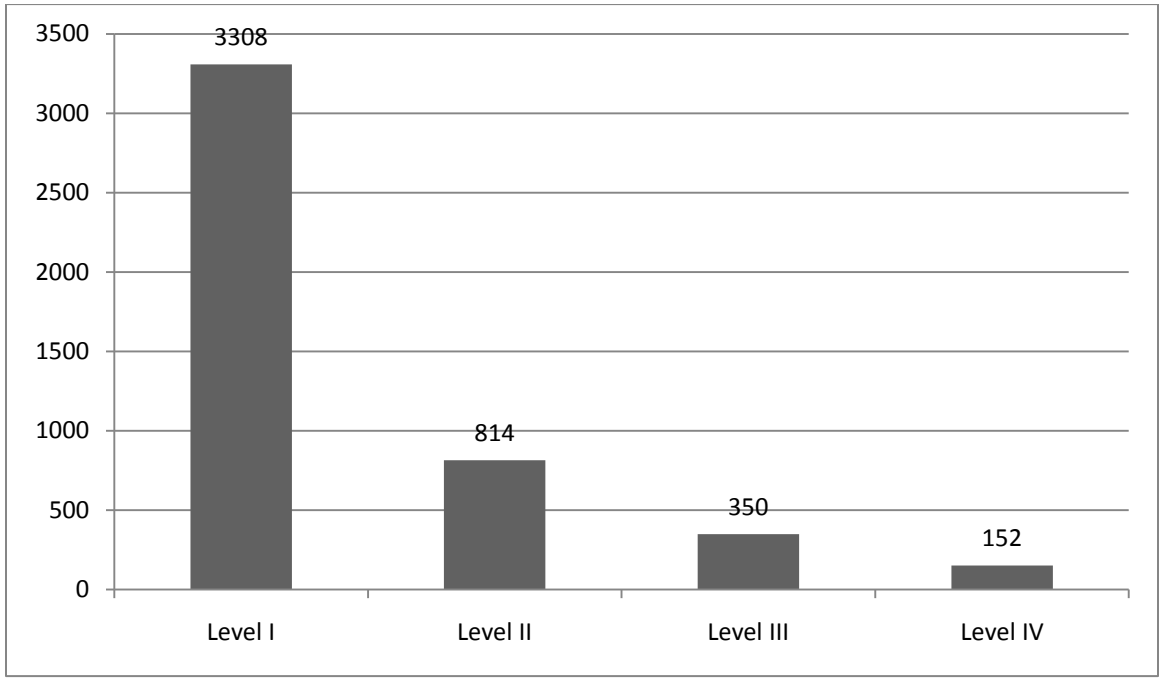
Figure 51. Trauma patient disposition from the emergency department, Oregon, 2010-2011, N=22,905, 1 unknown



Notes:
ICU – intensive care unit
OR – operating room
Direct – direct admission
AMA – against medical advice
DOA – dead on arrival
Individuals experience multiple transfers within the system and metrics are record in this figure by encounter not by patient

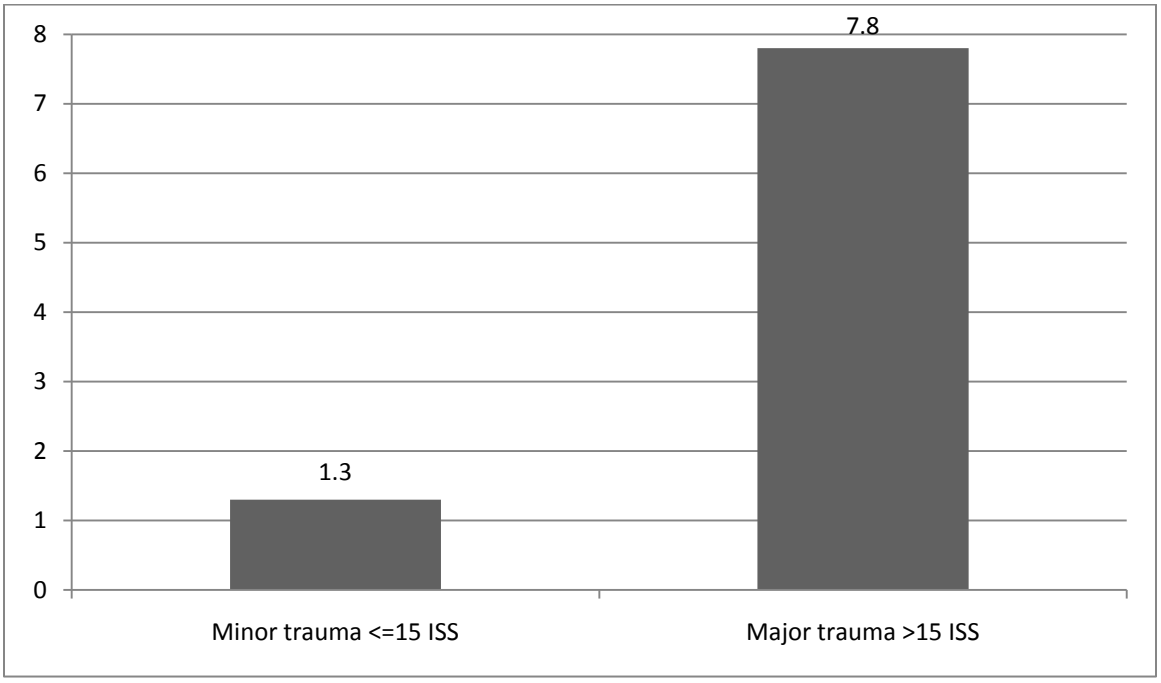
Intensive care admissions occurred in 4,624 patient encounters (Figure 52). Seventy one percent of cases were admitted to intensive care units (ICU) in Oregon's two Level I trauma hospitals. The average length of stay among patients at Level I ICUs was 7.9 days. Eighteen percent of cases were admitted to intensive care units in Oregon's Level II trauma hospitals. The average length of stay among patients in ICU was 9.2 days. Eight percent of cases were admitted to intensive care units in Level III hospitals and the average length of stay in ICUs was 6.2 days. Three percent of cases were admitted to intensive care units in Level IV hospitals and the average length of stay in ICUs was 3.2 days. The average injury severity score was 16.6 at Level I hospitals, 19.1 at Level II hospitals, 14.7 at Level III hospitals, and 11.9 at Level IV hospitals.

Figure 52. Patient admissions to ICU by trauma hospital level, Oregon 2010-2011, N=4,624, 111 unknown



The average length of stay among major trauma patients in Oregon trauma hospitals was 7.8 days (Figure 53). Overall, the average length of stay was five days.

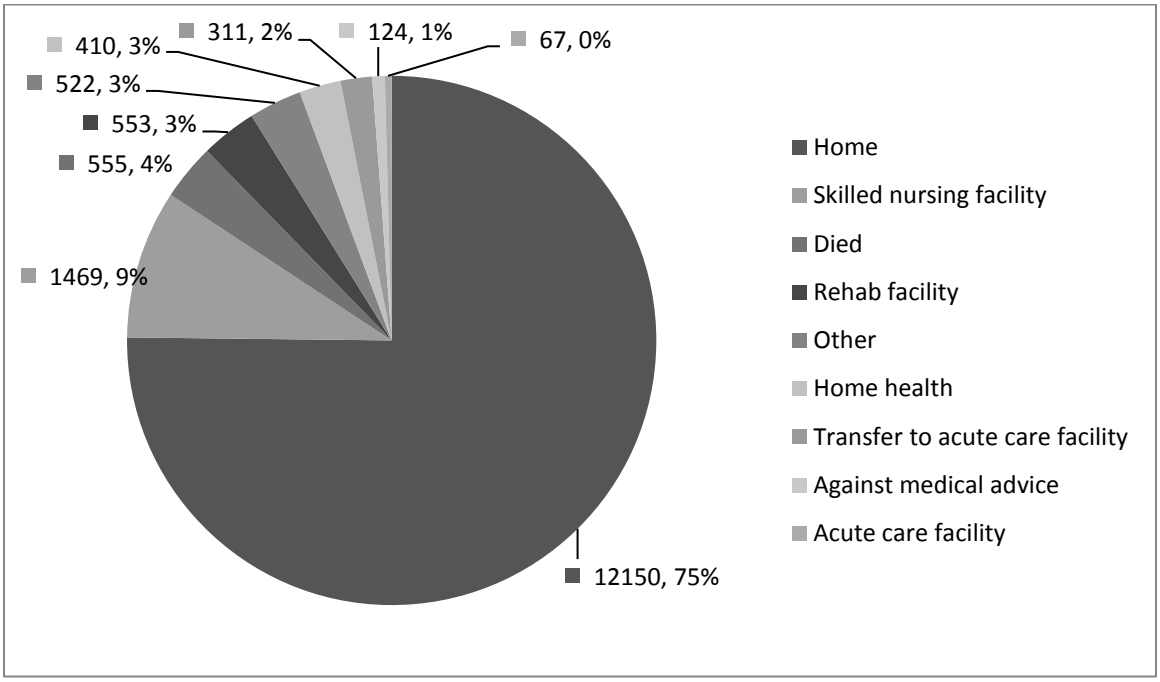
Figure 53. Average trauma patient length of stay by major and minor trauma severity, Oregon, 2010-2011, N=14,913



Discharge

The vast majority (75%) of cases were discharged to home after hospitalization (Figure 54). Only three percent of patients died in care.

Figure 54. Patient discharge disposition from hospital, Oregon 2010-2011, N=16,161



Discussion

Trauma System

Sustained support from leaders in the Oregon State Trauma System and state government are needed to assure ongoing development and maintenance of all facets of the Oregon State Trauma System. The State Trauma Advisory Board plays a key role in organizing and guiding the state Trauma Program. Trauma system partners need valid, reliable, and complete data to inform decisions. Key guidance is needed from stakeholders to direct the development of those data. Specifially, consensus is needed on:

1) A uniform definition of preventable death to be used by all hospitals.
2) Identifying the clinical procedures for trauma patient care that should be monitored.
3) Benchmarking practice and procedures to make comparisons within the Oregon State Trauma System and from year to year.

Injury Prevention

Many trauma deaths are preventable if the injured receive effective care from an organized and well-coordinated trauma system. In addition, strategic implementation of evidence-based public policy, environmental design, education and behavior change can help to reduce injuries and the burden injury places on communities and our healthcare system.

Among the options to reduce injury, public policy that shapes individual behavior and community norms is proven to have the greatest impact. Oregon has many strong public policies that prevent injury in our communities. These policies include: requirements for individuals to wear seat belts when driving; follow speed limits on roads and highways; and use protective headgear when riding bicycles, motorcycles, and all terrain vehicles.

Trauma registry data provide some insight with regard to how evidence based public policy might be used to further reduce injury in Oregon in eight key areas:

1) Falls are the leading cause of injury and death among trauma system patients in an aging population that values independence.
2) Over 3,600 trauma system patients had blood alcohol contents at or over the legal limit of 0.08. – 1,072 of them were involved in motor vehicle crashes.
3) Among patients treated for injuries incurred while riding all terrain vehicles, 114 were not wearing helmets – 104 of those patients were adults over the age of 18 years.
4) Sixty-three percent of bicyclists aged 16 years and older were not wearing helmets when they were injured in motor vehicle involved crashes.
5) The use of opiates has increased dramatically in our communities – trauma system patient drug tests reveal that 1 in 50 patients had been using opiates when they entered care.

6) Over 700 pedestrians were hit by motor vehicles and treated in trauma centers.
7) Among trauma system patients who died by suicide, 63 percent used firearms.
8) The rate of injury due to assaults was 146.7 per 100,000 (396) among adult males 21-30 years of age.

Recommendations

Trauma System

1) The chair of the State Trauma Advisory Board, in collaboration with the Public Health Division, will convene a meeting of trauma system stakeholders to review data variables, data definitions, determine if national standards should be met, and begin building consensus for benchmarking.

Injury Prevention

1) Increase the number of clinicians who screen patients 55 and older for falls, document the falls reported, and refer patients to community based exercise, and if needed home safety assessments, physical assessments, and physical therapy.
2) Support an effort to mandate the use of bicycle helmets among riders over the age of 16 years.
3) Support an effort to mandate the use of protective headgear among adult all terrain vehicle riders 18 and older.
4) Support an effort to increase alcohol tax to reduce motor vehicle traffic crash injury.
5) Require all prescribers of controlled substances to use the state Prescription Drug Monitoring Program electronic database to inform prescribing decisions.
6) Participate in public planning processes led by the Oregon Department of Transportation regions and statewide processes aimed at reducing pedestrian, bike, and motor vehicle traffic injury.
7) Require clinicians in hospital to screen patients for depression and suicidality and advise removal of firearms in the households of individuals at risk for suicide.
8) Require clinicians in hospitals to screen patients for family violence and refer patients to appropriate community interventions.
9) The State Trauma Advisory Board should partner with the state Injury Community Planning Group to support broad efforts to reduce injury through community and statewide planning, research, and policy development.

Conclusion

Statewide efforts to improve response to trauma and reduce the need for care can be strengthened in a variety of ways. Increasing collaboration between the injury response community and the injury prevention community as well as the alcohol and drug prevention community is needed. Strategic planning with a broad group of partners to support key public policy measures could pay great dividends to reduce injury at the societal level. Community clinical practice in primary care and in hospitals that targets some key issues can have an impact on individual level behavior. Finally, refining and strengthening the use of data can inform both practice and public policy.

E-Code Groupings

Recommended framework of E-code groupings for presenting injury mortality and morbidity data (August 10, 2011)

This matrix contains the ICD-9 external-cause-of-injury codes used for coding of injury mortality data and additional ICD-9-CM external-cause-of-injury codes, designated in bold, **only** used for coding of injury morbidity data. In addition, a list of ICD-9-CM external-cause-of-injury codes that have been added since 1994 along with their descriptors is appended to the matrix.

Mechanism/Cause	**Manner/Intent**				
	Unintentional	**Self-inflicted**	**Assault**	**Undetermined**	**Other**[1]
Cut/pierce	E920.0-.9	E956	E966	E986	E974**. E995.2**
Drowning/submersion	E830.0-.9, E832.0-.9 E910.0-.9	E954	E964	E984	**E995.4**
Fall	E880.0-E886.9, E888	E957.0-.9	E968.1	E987.0-.9	
Fire/burn3	E890.0-E899, E924.0-.9	E958.1,.2,.7	E961, E968.0,.3, **E979.3**	E988.1,.2,.7	
Fire/flame3	E890.0-E899	E958.1	E968.0, **E979.3**	E988.1	
Hot object/substance	E924.0-.9	E958.2,.7	E961, E968.3	E988.2,.7	
Firearm3	E922.0-.3,.8, .9	E955.0-.4	E965.0-4, **E979.4**	E985.0-.4	E970
Machinery	E919 (.0-.9)				
Motor vehicle traffic2,3	E810-E819 (.0-.9)	E958.5	**E968.5**	E988.5	
Occupant	E810-E819 (.0,.1)				
Motorcyclist	E810-E819 (.2,.3)				
Pedal cyclist	E810-E819 (.6)				
Pedestrian	E810-E819 (.7)				
Unspecified	E810-E819 (.9)				
Pedal cyclist, other	E800-E807 (.3) E820-E825 (.6), E826.1,.9 E827-E829(.1)				

Pedestrian, other	E800-807(.2) E820-E825(.7) E826-E829(.0)				
Transport, other	E800-E807 (.0,.1,.8,.9) E820-E825 (.0-.5,.8,.9) E826.2-.8 E827-E829 (.2-.9), E831.0-.9, E833.0-E845.9	E958.6		E988.6	
Natural/environmental	E900.0-E909, E928.0-.2	E958.3		E988.3	
Bites and stings3	E905.0-.6,.9 E906.0-.4,**.5**,.9				
Overexertion	E927**.0-.4,.8-.9**				
Poisoning	E850.0-E869.9	E950.0-E952.9	E962.0-.9**,** **E979.6,.7**	E980.0-E982.9	E972
Struck by, against	E916-E917.9		E960.0; E968.2		E973, E975, **E995 (.0,.1)**
Suffocation	E911-E913.9	E953.0-.9	E963	E983.0-.9	**E995.3**
Other specified and classifiable3**,4**	E846-E848, E914-E915 E918, E921.0-.9, **E922.4,.5** E923.0-.9, E925.0-E926.9 **E928(.3-.7)**, E929.0-.5	E955.5,**.6**,.7,.9 E958.0,.4	E960.1, E965.5-.9 E967.0-.9, E968.4,**.6, .7** **E979 (.0-.2,.5,.8,.9)**	E985.5,**.6**,**.7** E988.0,.4	E971, E978, E990-E994, E996 E997.0-.2
Other specified, not elsewhere classifiable	E928.8, E929.8	E958.8, E959	E968.8, E969,E999.1	E988.8, E989	E977, E995 **(.8,.9)**, E997.8 E998, E999.0
Unspecified	E887, E928.9, E929.9	E958.9	E968.9	E988.9	E976, E997.9
All injury3	E800-E869, E880-E929	E950-E959	E960-E969, **E979**,E999.1	E980-E989	E970-E978, E990-E999.0
Adverse effects					E870-E879 E930.0-E949.9
Medical care					E870-E879
Drugs					E930.0-E949.9

All external causes					E800-E999

[1]Includes legal intervention (E970-E978) and operations of war (E990-E999).
[2]Three 4th-digit codes (.4 [occupant of streetcar], .5 [rider of animal], .8 [other specified person]) are not presented separately because of small numbers. However, because they are included in the overall motor vehicle traffic category, the sum of these categories can be derived by subtraction.
[3]Codes in bold are for morbidity coding only. For details see table 2.
[4]E849 (place of occurrence) has been excluded from the matrix. For mortality coding, an ICD-9 E849 code does not exist. For morbidity coding, an ICD-9-CM E849 code should never be first-listed E code and should only appear as an additional code to specify the place of occurrence of the injury incident.

Note: ICD-9 E codes for coding underlying cause of death apply to injury-related death data from 1979 through 1998. Then there is a new ICD-10 external cause of injury matrix that applies to death data from 1999 and after. This can be found on the National Center for Health Statistics website.

Glossary of Terms

Age-Specific Rate - A rate for a specified age group. The numerator and denominator refer to the same age group.

Cause of death - For the purpose of national mortality statistics, every death is attributed to one underlying condition, based on information reported on the death certificate and using the international rules for selecting the underlying cause of death from the conditions stated on the death certificate. For injury deaths, the underlying cause is defined as the circumstances of the accident or violence that produced the fatal injury.

Cut/ Pierce - This category includes injuries caused by cutting and piercing instruments such as cutting and piercing with instruments that include: knives, swords, daggers, power lawn mowers, power hand tools, household appliances.

Drowning - This category includes injuries from drowning/near drowning and submersion with and without involvement of watercraft.

E-code - Code indicating an external cause of an injury. E codes specify the type of circumstance involved, for example: fall from steps/stairs, ladder, building, cliff, furniture.

External cause of injury - The external cause of injury is used for classifying the circumstances in which injuries occur. The external cause is comprised of two axes, the mechanism or cause (e.g. firearm or motor vehicle) and the manner or intent (e.g. homicide or suicide).

External cause of injury matrix - The matrix is a two dimensional array describing both the mechanism or external cause of the injury (e.g., fall, cut, or struck) and the manner or intent of the injury (e.g., unintentional or accidental, suicide or self inflicted, or homicide or assault). For more information, see http://www.cdc.gov/nchs/about/otheract/injury/tools.htm.

Fire/Burn - This category includes injuries caused by fire and flames including those from smoke inhalation, such as in a residential fire. This category also includes injuries caused by hot liquids and steam. It does not include burns from electric current or from ultraviolet light sources (sunburn).

Firearms - This category includes injuries from firearms, including unintentional, suicide, homicide, legal intervention and undetermined intent.

Frequency - The number of times an event happens.

Geriatric - patients aged 55 years or older.

Homicide - The killing or intent to kill of one person by another.

Incidence - The number of instances of illness or injury during a given period of time in a specified population.

Injury - Any unintentional or intentional damage to the body resulting from acute exposure to thermal, mechanical, electrical or chemical energy or from the absence of such essentials as heat or oxygen. According to the Injury Surveillance Guidelines, an injury is the physical damage that results when a human body is suddenly or briefly subjected to intolerable levels of energy. Injury can be a bodily lesion resulting from acute exposure to energy in amounts that exceed the threshold of physiological tolerance, or it can be an impairment of function resulting from a lack of one or more vital elements (i.e., air, water, or warmth), as in strangulation, drowning, or freezing. The time between exposure to the energy and the appearance of an injury is short. The energy causing an injury may be one of the following:

- Mechanical (e.g., an impact with a moving or stationary object, such as a surface, knife, or vehicle)
- Radiant (e.g., a blinding light or a shock wave from an explosion)
- Thermal (e.g., air or water that is too hot or too cold)
- Electrical
- Chemical (e.g., a poison or an intoxicating or mind-altering substance such as alcohol or a drug)

Intent or manner of injury - Intent refers to one of the two dimensions of the external cause of injury matrix. This dimension classifies manner of the injury (e.g., unintentional or accidental, suicide or self inflicted, homicide or assault, or undetermined) in three versions of the external cause of injury matrix: two for injury deaths—one that uses ICD–9 codes and one that uses ICD–10 codes—and one matrix for injury morbidity that uses ICD–9–CM codes.

Intentional Injury - Injuries that are purposely inflicted, either by a person to him/herself or to another person. Examples: suicide or attempted suicide, homicide, rape, assault, domestic abuse, elder abuse, and child abuse.

International Classification of Diseases **(ICD) -** The ICD provides the ground rules for coding and classifying cause‑of‑death data.

Major Trauma is defined as injuries that result in death, intensive care admission, a major operation of the head, chest or abdomen, a hospital stay of three or more days, or an Injury Severity Score (ISS) of greater than 15.

Minor Trauma is defined as patient who is entered into the trauma system, has an ISS of less than or equal to 15, and survives to hospital discharge.

Mechanism of injury - This refers to one of the two dimensions of the external cause of injury matrix. This dimension classifies external cause of the injury (e.g., fall, cut, or struck) in three versions of the external cause of injury matrix: two for injury deaths—one that uses ICD–9 codes and one that uses ICD–10 codes—and one matrix for injury morbidity that uses ICD–9–CM codes.

Mortality - Deaths caused by injury and disease. Usually expressed as a rate, meaning the number of deaths in a certain population in a given time period divided by the size of the population.

Morbidity - Number of persons, nonfatally injured or disabled. Usually expressed as a rate, meaning the number of nonfatal injuries in a certain population in a given time period divided by the size of the population.

Motor Vehicle Traffic - This category includes injuries traditionally called "Motor Vehicle Accidents". This category includes all injuries resulting from motor-vehicle-traffic injuries involving automobiles, vans, trucks, motorcycles, and other motorized cycles traveling on public roads.

Natural/Environmental Factors - This category includes injuries caused by excessive heat, excessive cold, hunger, excessive exposure to weather conditions, cataclysmic storms, cataclysmic land movement, and bites and stings.

Pedal Cyclist - This category includes injuries among pedal cyclists not involving motor-vehicle traffic accidents. It includes persons hit by a train, or by a motor-vehicle while not in traffic or hit by other means of transport. This category is intended to include only injuries to pedal cycle riders, not all injuries involving a pedal cycle.

Pedestrian, Other - This category includes injuries among pedestrians hit by a train, a motor-vehicle while not in traffic or another means of transportation.

Pediatric patients are ages 0 to and including 18 years of age.

Risk Factor - Characteristics of people, behaviors or environments that increase the chances of disease or injury occurring. Examples: alcohol use, poverty, gender.

Response Time is calculated from dispatch time to the time the transporting EMS unit arrives at the scene.

Scene Time is the calculated time from the time the transporting EMS unit arrives at the scene to the time of their departure with the patient.

Struck by/Against - This category includes injuries resulting from being struck or by striking against objects or persons. This category includes being struck (unintentionally) by a falling object, being struck or striking objects or persons (e.g. sports) and injuries sustained in an unarmed fight or brawl.

Suffocation - This category includes injuries caused by the inhalation or ingestion of food or other objects that block respiration and injuries caused by other mechanical means that hinder breathing (e.g., plastic bag over nose or mouth, suffocation by bedding, and unintentional or

intentional hanging or strangulation).

Suicide or attempted suicide - The act of intentionally causing death or intending to cause death to oneself.

Transport, Other - This category includes injuries associated with various other means of transportation: railway, off-road and other motor-vehicles not in traffic, other surface transport, water and aircraft transport. For example injuries caused by streetcars, all-terrain vehicles (4-wheelers) and horse-and-carriages would be included here.

Transport Time is calculated from the time of scene departure to the time of arrival at the trauma center.

Unintentional Injury - Injuries that occur without intent to harm. "Accidents." Examples: Motor Vehicle Traffic, and most burns, drownings, and falls.

Unspecified - This category contains codes to accommodate cases where the mechanisms are not reported on the death certificate.