2012 Trauma Program Report

TRANSFORMING

TRAUMA CARE
Summary

- In 2012, the Trauma Service at OHSU treated 2618 patients. This is an increase of 51 patients from 2011.
- 1792 patients (68 percent) were brought to OHSU directly from the scene of injury, and 826 (32 percent) were transferred from another hospital.
- The mean injury severity score increased, while the length of stay decreased.
- Number of patients 64 and older increased, while patients 14 and under decreased.
- Injury Prevention: Think First Oregon was named the National Injury Prevention Chapter of the Year.
- The Trauma Research Institute of Oregon had another productive year, publishing 11 research papers and presenting research at major surgical meetings around the world.
Oregon's statewide trauma system is based on landmark legislation. Statutory authority was passed in 1985 by the state legislature as ORS 431.607 – 431.633 under the leadership of the president of the Oregon Senate, John Kitzhaber, M.D., and signed into law by Governor Victor Atiyeh. With the implementation of the trauma system in May 1988, only two Portland hospitals, OHSU and Legacy Emanuel Hospital, were designated as Oregon's Level 1 trauma centers. Injured individuals in the four-county metropolitan region identified by pre-hospital rescue personnel or emergency medical technicians as meeting the criteria for severe injury are transported to one of these Level 1 centers.

Published research comparing inter-hospital transfer practices before and after implementation showed improvement in rapid transfer of critically injured patients to Level 1 and 2 trauma centers as well as improved outcomes.
Trauma Statistics

In 2012, the OHSU Trauma Program patient volume increased by 51 patients over 2011.

Figure 1. Patient Volume 2010 - 2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Scene/ED</th>
<th>Transfers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>1792</td>
<td>826</td>
<td>2618</td>
</tr>
<tr>
<td>2011</td>
<td>1721</td>
<td>846</td>
<td>2567</td>
</tr>
<tr>
<td>2010</td>
<td>1622</td>
<td>826</td>
<td>2448</td>
</tr>
</tbody>
</table>

Figure 2. Gender Distribution of Patients Treated by the OHSU Trauma Program

- Male: 68%
- Female: 32%
Figure 3. Patients Treated by the OHSU Trauma Program: Blunt vs. Penetrating Injuries

Figure 4. Age Distribution of Patients Treated by the OHSU Trauma Program
Figure 5. Distribution of Patients by Month

Figure 6. Distribution of Patients by Day of Week

Figure 7. Distribution of Patients by Time of Arrival
Figure 8. County of Origin, Patients Treated by the OHSU Trauma Team

- Multnomah: 996
- Clackamas: 486
- Washington: 422
- Baker: 0
- Benton: 3
- Clatsop: 18
- Columbia: 16
- Coos: 14
- Crook: 1
- Curry: 2
- Deschutes: 10
- Douglas: 18
- Gilliam: 1
- Grant: 4
- Harney: 2
- Hood River: 12
- Jackson: 20
- Jefferson: 6
- Josephine: 14
- Klamath: 8
- Lake: 0
- Lane: 20
- Lincoln: 13
- Linn: 31
- Malheur: 0
- Marion: 99
- Morrow: 4
- Polk: 11
- Sherman: 3
- Tillamook: 22
- Umatilla: 46
- Union: 4
- Wallowa: 1
- Wasco: 32
- Yamhill: 10
**Length of Stay**

**Figure 9. Total Hospital Length of Stay (days)**

![Bar chart showing Length of Stay](image)

- **Scene/ED**
- **Transfer**

The OHSU trauma team in the Emergency Department
Trauma Team Response

The OHSU Trauma Program uses a three-tiered system to evaluate injured patients. The level of activation is based on information provided by pre-hospital personnel (Tables I and II). In the Portland metropolitan area, paramedics evaluate patients at the scene of injury and enter them into the trauma system if they meet established triage criteria for serious injury. Since OHSU implemented a three-tiered system in 2004, we have noted a high proportion of injured patients meeting criteria for Level 2 or 3 activation (Figure 10). Our analyses indicate patients can be safely and efficiently treated with a limited team response, saving our full trauma team activations for those truly critically injured patients.

Table I. OHSU Trauma Team Configuration Based on Triage Criteria

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff trauma surgeon</td>
<td>Staff trauma surgeon</td>
<td></td>
</tr>
<tr>
<td>Staff anesthesiologist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff ED physician</td>
<td>Staff ED physician</td>
<td>Staff ED physician</td>
</tr>
<tr>
<td>Trauma chief resident</td>
<td>Trauma chief resident</td>
<td>Trauma chief resident</td>
</tr>
<tr>
<td>Emergency medicine resident</td>
<td>Emergency medicine resident</td>
<td>Emergency medicine resident</td>
</tr>
<tr>
<td>Respiratory care practitioner</td>
<td>Respiratory care practitioner</td>
<td>Respiratory care practitioner</td>
</tr>
<tr>
<td>Primary trauma nurse</td>
<td>Primary trauma nurse</td>
<td>Primary trauma nurse</td>
</tr>
<tr>
<td>Trauma recording nurse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedure nurse</td>
<td>Procedure nurse</td>
<td>Procedure nurse</td>
</tr>
<tr>
<td>Transportation aide</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ED = Emergency Department

Figure 10. OHSU Trauma Team Response Based on Severity of Patient Injury
### Table II. Three-Tiered Response Triage Criteria

<table>
<thead>
<tr>
<th>Level 1 Criteria</th>
<th>Level 2 Criteria</th>
<th>Level 3 Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiologic</td>
<td>Anatomic</td>
<td>Mechanism of injury</td>
</tr>
<tr>
<td>GCS &lt; 9</td>
<td>Intubated patient</td>
<td>Fall &gt; 20 feet</td>
</tr>
<tr>
<td>Inadequate airway/need for emergent airway control or presence of a supraglottic airway (KING, combitube, etc.)</td>
<td>Two or more longbone fractures</td>
<td>Death in same passenger compartment</td>
</tr>
<tr>
<td>Shock as defined as:</td>
<td>Penetrating injury to head, neck or torso</td>
<td>Extrication &gt; 20 minutes</td>
</tr>
<tr>
<td>Systolic BP &lt; 90 (&gt;11 years to adult)</td>
<td>Crush injury to torso or upper thigh</td>
<td>Rollover motor vehicle crash</td>
</tr>
<tr>
<td>Systolic BP &lt; 80 (5-11 years)</td>
<td>Amputation proximal to wrist or ankle</td>
<td>Ejection from motor vehicle</td>
</tr>
<tr>
<td>Systolic BP &lt; 70 (2-4 years)</td>
<td>Pelvic instability</td>
<td>Auto vs. pedestrian &gt; 5 mph</td>
</tr>
<tr>
<td>Systolic BP &lt; 60 (0-2 years)</td>
<td>Paralysis</td>
<td>Special considerations age &lt; 5</td>
</tr>
<tr>
<td>Immediate need for operating room or Patients receiving blood transfusion to maintain blood pressure &gt; 90</td>
<td>Flail chest</td>
<td><strong>Paramedic discretion:</strong> MCC, ATV, bike crash Significant intrusion/impact Hostile environment (cold/heat) Preexisting medical issues Presence of intoxicants Pregnancy</td>
</tr>
<tr>
<td>Emergency medicine discretion</td>
<td>Emergency medicine discretion</td>
<td>Emergency medicine discretion</td>
</tr>
</tbody>
</table>
Mechanism of Injury

Although motor vehicle crashes remain the most common mechanism of injury overall, falls are steadily increasing (Figure 11). Falls accounted for 37 percent of patient injuries in 2012, compared to 36 percent in 2011. Falls are the leading mechanism of injury for both children and older adults.

**Figure 11. Causes of Injury for Patients Seen by the OHSU Trauma Team**

- Vehicle Collisions
- Non-intentional Falls
- Suicide & Self-inflicted Injury
- Homicide & Injury Purposely Inflicted by Others
- Other
Body Region of Injury and Injury Severity Score

In the OHSU trauma registry, injuries are recorded using two methods: 1) International Classification of Disease (ICD-9) codes and 2) Abbreviated Injury Scale (AIS). Definitions of these tools can be found in Appendix A.

### Table III. Frequency of Injury by AIS Body Region in All Patients

<table>
<thead>
<tr>
<th>AIS Body Region</th>
<th>Number of patients with at least one injury in region</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head and neck</td>
<td>1309</td>
<td>50</td>
</tr>
<tr>
<td>Face</td>
<td>511</td>
<td>20</td>
</tr>
<tr>
<td>Chest</td>
<td>637</td>
<td>24</td>
</tr>
<tr>
<td>Abdomen</td>
<td>379</td>
<td>15</td>
</tr>
<tr>
<td>Extremities, pelvis or both</td>
<td>752</td>
<td>29</td>
</tr>
<tr>
<td>External</td>
<td>2048</td>
<td>78</td>
</tr>
</tbody>
</table>

**Figure 12: Injury Severity Scores for Patients Treated by OHSU Trauma Team**
Figure 13. Mean Injury Severity Score of Patients Treated by OHSU Trauma Team

Trauma Team members Scott Sherry, P.A., and Jennifer Watters, M.D., in the ICU
Emergency Observation Unit

Faculty from the Department of Emergency Medicine are responsible for managing patients with minor injuries admitted to the Observation Unit (OBS) in the Emergency Department. Of the hundreds of trauma patients sent to ED OBS in 2012, 17 percent required hospital admission (Figure 14). The ED OBS unit is an effective way to assure efficient use of inpatient beds while providing quality medical care for injured patients.

Figure 14. Number of Patients Sent to Emergency Observation Unit

- Patients Requiring Subsequent Inpatient Admission
- Total Trauma Admissions to ED OBS
In 2012, we admitted 1846 patients (70 percent) to OHSU Hospital (Figure 15). Patients at the extremes of age were more likely to require hospital admission. Most of these patients were able to return home after admission (Figure 16).
Mortality

In 2012, 100 patients (3.8 percent) expired. Nine patients expired in the Emergency Department and 91 after hospital admission.

Figure 17. Mortality of Patients Transferred to OHSU from Other Hospitals vs. Transported from Scene of Injury

![Image of Life Flight landing at OHSU Hospital](Life Flight landing at OHSU Hospital)
Motor vehicle collisions are the leading cause of injury in patients treated by the OHSU Trauma Team, but falls are the leading cause of death.

*Rounds on the Trauma Ward*
Care for Patients Older than 64

In 2012, the OHSU Trauma Team treated 477 patients older than 64, up from 460 in 2011. Of these, 177 (37 percent) were transferred to OHSU from another hospital or clinic. Most of the transfer patients were injured in falls. Of the 477 injured patients, 390 (82 percent) required hospital admission. Forty-five (9.4 percent) died from their injuries, up from 7.4 percent in 2011. Figures 19-21 provide additional information regarding our Trauma Team care for patients older than 64 at OHSU.

Figure 19. Patient Volume, Age 65 and Older
Figure 20. Disposition from the Emergency Department, Patients 65 and Older

Figure 21. Mechanism of Injury, Patients 65 and Older

Vehicle Collisions: 21%
Fall: 74%
Other: 3%
Suicide & Self-inflicted Injury: 1%
Homicide & Injury Purposely Inflicted by Others: 1%
Patients 14 Years and Younger

In 2012, the OHSU Trauma Team evaluated 324 patients aged 14 and younger. Of these, 213 (66 percent) were transferred to OHSU from hospitals around the Pacific Northwest. Patient disposition included 234 (72 percent) admitted to OHSU Doernbecher Children’s Hospital: 126 (39 percent) to the ICU and 85 (26 percent) to the ward. Three children (1 percent) died as a result of their injuries. As with patients 65 and older, the leading mechanism of injury in this population was falls.

Figure 22. Patient Volume, Age 14 and Younger

Figure 23. Disposition from the Emergency Department, Patients 14 and Younger
Pediatric trauma admissions related to homicide and injury purposely inflicted on others increased from 2.7 percent in 2011 to 9.6 percent in 2012.
Figure 25. Disposition after Admission, Patients 14 and Younger

Figure 26. Arrival by Time of Day, Patients 14 and Younger
Figure 27: Volume by Quarter, Patients 14 and Younger

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Volume (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January-March</td>
<td>17%</td>
</tr>
<tr>
<td>April-June</td>
<td>26%</td>
</tr>
<tr>
<td>July-September</td>
<td>38%</td>
</tr>
<tr>
<td>October-December</td>
<td>19%</td>
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OHSU Doernbecher Children's Hospital
2012 Injury Prevention Activities

ThinkFirst Oregon

ThinkFirst is an organization dedicated to reducing the incidence of brain, spinal cord and other traumatic injuries and fatalities by educating youth, parents and community members throughout Oregon. Table IV describes the activity of the OHSU ThinkFirst Oregon team and its injury prevention efforts.

Table IV. 2012 ThinkFirst Oregon Activity Summary

<table>
<thead>
<tr>
<th></th>
<th>Community Events</th>
<th>Community Event Participants</th>
<th>Community Event Presentations</th>
<th>Community Volunteers</th>
<th>Classroom Events</th>
<th>Classroom Presentations</th>
<th>Classroom Participants</th>
<th>Classroom Volunteers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter 1</td>
<td>2</td>
<td>259</td>
<td>104</td>
<td>8</td>
<td>14</td>
<td>24</td>
<td>423</td>
<td>1</td>
</tr>
<tr>
<td>Quarter 2</td>
<td>12</td>
<td>9,486</td>
<td>728</td>
<td>70</td>
<td>15</td>
<td>32</td>
<td>2,798</td>
<td>3</td>
</tr>
<tr>
<td>Quarter 3</td>
<td>10</td>
<td>2,900</td>
<td>420</td>
<td>24</td>
<td>6</td>
<td>6</td>
<td>810</td>
<td>8</td>
</tr>
<tr>
<td>Quarter 4</td>
<td>3</td>
<td>5,650</td>
<td>180</td>
<td>60</td>
<td>5</td>
<td>8</td>
<td>384</td>
<td>2</td>
</tr>
<tr>
<td>YTD</td>
<td>27</td>
<td>18,295</td>
<td>1,432</td>
<td>162</td>
<td>40</td>
<td>70</td>
<td>4,415</td>
<td>14</td>
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</table>

OHSU ThinkFirst activity
ThinkFirst National Injury Prevention Chapter of the Year

The ThinkFirst National Injury Prevention Foundation Chapter of the Year award recognizes one high-performance chapter demonstrating exemplary service and productivity supporting each of the core components of the ThinkFirst mission: education, research and advocacy. Out of 150 national and 45 international chapters, OHSU was presented with this year's Chapter of the Year award. Here are some highlights from that award letter.

OHSU ThinkFirst Oregon was established in 1986 by neurosurgeon Edward Neuwelt, M.D., who is still leading this productive chapter 27 years later. The current program director is Kayt Zundel. Nicole Skala is education coordinator and Jennifer Salame is education presenter. This outstanding chapter has consistently demonstrated excellence in the practice of public health and injury prevention through creative program development, a commitment to research and publication and the support of public policy. In 2012, OHSU ThinkFirst Oregon participated in 38 community events reaching more than 17,000 people and gave 58 presentations to 5,418 students. In addition, there were 1,420 five-minute bike helmet safety presentations; 1,650 helmets were fitted and distributed. Most recently, the chapter has become a training and program delivery site for A Matter of Balance, a program that offers fall prevention classes for seniors.

Due to its prolific work in injury prevention, OHSU ThinkFirst Oregon has become a key partner of several state agencies, including the Oregon Department of Public Health. Whenever and wherever there are state-level injury issues being addressed, you will find OHSU ThinkFirst Oregon at the table. In past years, this chapter supported policy changes related to ATV helmet use and the concussion bill. Most recently, OHSU ThinkFirst Oregon has assumed a lead role in the policy, systems and environmental change movement for pedestrian injury prevention in Oregon.

Dr. Neuwelt, Nicole Skala, Jennifer Salame, Kayt Zundel
Matter of Balance

Matter of Balance is a program designed to reduce the fear of falling and increase activity levels among older adults. The course includes eight two-hour sessions for a small group led by a trained facilitator. This nationally recognized program was developed at Boston University following a randomized, single-blind controlled trial that was conducted to test the efficacy of a community-based group intervention to reduce fear of falling and associated restrictions in activity levels among older adults.

Table V. 2012 Matter of Balance Activity Summary

<table>
<thead>
<tr>
<th>Date</th>
<th>Meeting</th>
<th>Description of Topics Discussed</th>
<th>Number of hours</th>
<th>Location</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb. – March</td>
<td>Matter of Balance</td>
<td>Senior fall prevention</td>
<td>16</td>
<td>Portland</td>
<td>15</td>
</tr>
<tr>
<td>Oct. 23 and 30</td>
<td>Matter of Balance</td>
<td>Coach training</td>
<td>10</td>
<td>Portland</td>
<td>22</td>
</tr>
</tbody>
</table>

Matter of Balance participants
Performance Improvement and Patient Safety

Adult Performance Improvement

As a part of the OHSU Trauma Program’s Performance Improvement and Patient Safety initiative, patient care and quality are continuously monitored in an effort to decrease variation in care and improve patient safety. Processes and outcomes that are measured include unexpected returns to the operating room, delays in diagnosis and falls in the hospital. As a part of this effort, OHSU has implemented Rapid Safety Rounds. These interdisciplinary rounds aim to decrease falls and increase peer-to-peer communication with a biweekly comprehensive evaluation of patients at high risk for falls. The trauma ward’s designated Professional Practice Leader leads the discussion of each patient in order to increase accountability and transfer of knowledge. Participants include the pharmacist, case manager, nursing unit manager, professional practice leader and bedside nurse. When rounds started in the summer of 2011, the fall rate on the trauma ward was 5.41 per 1000 patient care days. For 2012, it dropped to 3.05 falls per 1000 patient care days.

Figure 28. Adult Patient Falls per 1000 Patient Care Days
In 2012, the Trauma Research Institute of Oregon continued its research in the areas of transfusion and coagulation under the direction of Martin Schreiber, M.D. Preliminary results from the study “Frozen Red Blood Cell Transfusions in Trauma Patients,” sponsored by the United States Air Force demonstrated improved tissue oxygenation levels indicating superior oxygen-carrying capacity in subjects receiving previously frozen red blood cell units compared to those receiving standard refrigerated RBCs. The Pragmatic Randomized Optimal Platelet and Plasma Ratios study comparing the use of 1:1:1 versus 1:1:2 transfusion ratios of platelets:plasma:RBCs in trauma patients began in late August and will continue in 2013. In October, a multi-center study investigating the use of TEG to determine optimal dosing of enoxaparin for deep vein thrombosis prophylaxis in trauma and surgical patients started enrolling the first subjects at OHSU. The University of Texas and Harborview Medical Center in Seattle are expected to begin enrolling in 2013. Dr. Schreiber also received an additional year of funding to investigate the potential use of lyophilized plasma in trauma treatment. The team will continue its work on optimizing lyophilized plasma for field use.

Additionally, Laszlo Kiraly, M.D., received funding from the Medical Research Foundation of Oregon to evaluate platelet function in trauma patients both with and without anti-platelet therapy such as clopidogrel or aspirin. The study will compare results of the Thrombelastogram, Multiplate 5.0 Analyzer and VerifyNow tests and correlate the transfusion of platelets and change in platelet function over the first 48 hours of hospital admission.

These publications represent the culmination of the many studies and reviews conducted by our trauma faculty and surgical residents:


Appendix A

The Abbreviated Injury Scale is used to generate the Injury Severity Score. The ISS is a single value between one and 75 that corresponds to a patient’s injury severity on the AIS. It is calculated using the highest AIS score from as many as three of the six body regions. The ISS is the sum of the squared highest three AIS scores from three separate body regions. It is useful in making risk-adjusted comparisons between groups of patients. For example, based on analysis of national trauma databases, it can be predicted that patients with an ISS of less than 15 have less than a 5 percent risk of death, and patients with an ISS greater than 40 have greater than 60 percent risk of death.

The American College of Surgeons Committee on Trauma has proposed that for the staff of a Level I trauma center to have enough experience to be fully competent, the trauma center should admit more than 1,200 patients each year, 240 of whom should have an ISS greater than 15.
Glossary of Terms

**Abbreviated Injury Scale** is a consensus-derived system that classifies injuries by body region. A numerical value is assigned to individual anatomic injuries based on severity. 0 = no injury; 1 = minor injury; 2 = moderate injury; 3 = severe but not life-threatening injury; 4 = severe life-threatening injury; 5 = critical injury; and 6 = untreatable injury. The six body regions are the head and neck, face, chest, abdomen and pelvic contents, limbs including the bony pelvis and external region.

**E-codes** are supplementary classifications of external causes of injury that describe the circumstances surrounding the cause of injury, such as from what type of firearm (handgun, rifle, etc.) the bullet was fired or from where the patient fell (balcony, steps, etc.). E-codes are used with ICD-9-CM scores to provide a more detailed analysis of the mechanism of injury.

**Glasgow Coma Scale** is a quantitative measure of the patient's level of consciousness. It is the sum of scores for three areas of assessment: eye opening, verbal response and motor response. The GCS reported in the tables of this document are the first recorded after the patient arrives in the Emergency Department. Minimum score is three and maximum is 15. Patients with endotracheal tubes, some of whom have been pharmacologically paralyzed, cannot be assigned a GCS on admission.

**Hospital Length of Stay** includes only those patients admitted to the hospital and excludes patients who were discharged to home, observed in the ED Observation Unit or died in the ED. Every patient in this population has a minimum one-day length of stay. Some patients are transported to the operating room from the ED and die during surgery; these patients are considered to have a one-day length of stay.

**International Classification of Diseases, Ninth Revision, Clinical Modification** assigns a specific number to a disease or condition experienced by a patient. For example, a spleen injury with a capsular tear is given the ICD-9-CM code of 865.02. Parkinson's disease has the code 332.0.

**Injury Severity Score** is an estimate of the overall severity of the patient's injuries. AIS scores are used to calculate the ISS: the squares of the highest AIS code in each of the patient's three most severely injured body regions are squared and then added to produce the ISS. Scores can range from one to 75. An AIS of six in any body region automatically confers an ISS of 75, usually a non-survivable injury. An ISS of 15 or more denotes a serious injury.

**Intensive Care Unit Length of Stay** includes only patients admitted to an ICU at some time during their hospitalization.

**Past Medical History** is noted in the Trauma Registry when patients are known to have cardiovascular disease, diabetes, renal or liver disease, respiratory or immunologic disease. It is also used for patients who are pregnant or have had a splenectomy. An “other” category is included where providers may indicate a PMH of chronic alcohol or drug abuse or other relevant conditions.

**Trauma** is characterized by an abnormal energy transfer involving energy from mechanical sources (moving objects) or thermal, electrical, chemical and radiation sources. For example, the catastrophic injuries arising from some automobile crashes are the result of transfer of energy from a stationary source (tree, pole) or moving object (another vehicle) to the victim.