2013 Trauma Program Report
TRANSFORMING
TRAUMA CARE
Summary

- In 2013, the Trauma Service at OHSU treated 2517 patients.
- 1636 patients (65 percent) were brought to OHSU directly from the scene of injury, and 881 (35 percent) were transferred from another hospital.
- The mean injury severity score of injured patients increased, with a mean of 14.43 for patients who arrived from the scene and 15.33 for transfers.
- The number of patients 64 and older increased, while the number of patients younger than 64 decreased.
- Injury Prevention: ThinkFirst and Matter of Balance Fall Prevention had another successful year, serving more than 46,000 community members.
- The Trauma Research Institute of Oregon had another productive year, publishing 41 research papers and presenting research at major surgical meetings around the world.
OHSU Trauma System Background

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 I 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 I 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.

Oregon’s Area Trauma Advisory Board Regions

Trauma Statistics

In 2013, the OHSU Trauma Program total patient volume decreased by 101 patients from 2012, while the number of transfers increased by 55 patients.

Figure 1. Patient Volume 2011 - 2013

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

- BAKER: 1
- BENTON: 1
- CLACKAMAS: 510
- CLARK: 16
- CLATSOP: 24
- COLUMBIA: 21
- COOS: 32
- COWLITZ: 19
- CROOK: 3
- CURRY: 10
- DEL NORTE: 4
- DESCHUTES: 11
- DOUGLAS: 15
- GILLIAM: 3
- GRANT: 2
- HARNEY: 1
- HOOD RIVER: 11
- JACKSON: 18
- JEFFERSON: 1
- JOSEPHINE: 18
- KLAMATH: 7
- KLiCKITAT: 13
- LAKE: 1
- LANE: 10
- LINCOLN: 12
- LINN: 27
- MALHEUR: 1
- MARION: 112
- MORROW: 7
- MULTNOMAH: 808
- PACIFIC: 8
- POLK: 11
- SHERMAN: 2
- TILLAMOOK: 32
- UMATILLA: 31
- UNION: 9
- WALLowa: 2
- WASCO: 43
- WASHINGTON: 382
- YAMHILL: 100
Length of Stay

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

![Bar chart showing total hospital length of stay for years 2011, 2012, and 2013.](chart)

*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>
<thead>
<tr>
<th>Table I. OHSU Trauma Team Configuration Based on Triage Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1</strong></td>
</tr>
<tr>
<td>Staff trauma surgeon</td>
</tr>
<tr>
<td>Staff anesthesiologist</td>
</tr>
<tr>
<td>Staff ED physician</td>
</tr>
<tr>
<td>Trauma chief resident</td>
</tr>
<tr>
<td>Emergency medicine resident</td>
</tr>
<tr>
<td>Respiratory care practitioner</td>
</tr>
<tr>
<td>Primary trauma nurse</td>
</tr>
<tr>
<td>Trauma recording nurse</td>
</tr>
<tr>
<td>Procedure nurse</td>
</tr>
<tr>
<td>Transportation aide</td>
</tr>
</tbody>
</table>

*ED = Emergency Department*

Figure 10. OHSU Trauma Team Response by Level of Activation
### 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>Anatonic</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</td>
<td>Two or more longbone fractures</td>
<td>Death in same passenger compartment</td>
</tr>
<tr>
<td>emergent airway control or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>presence of a supraglottic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>airway (KING, combitube, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock as defined as:</td>
<td>Penetrating injury to head, neck</td>
<td>Extrication &gt; 20 minutes</td>
</tr>
<tr>
<td>Systolic BP &lt; 90 (&gt;11 years to</td>
<td>or torso</td>
<td></td>
</tr>
<tr>
<td>adult)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic BP &lt; 80 (5-11 years)</td>
<td>Crush injury to torso or upper</td>
<td>Rollover motor vehicle crash</td>
</tr>
<tr>
<td></td>
<td>thigh</td>
<td></td>
</tr>
<tr>
<td>Systolic BP &lt; 70 (2-4 years)</td>
<td>Amputation proximal to wrist or</td>
<td>Ejection from motor vehicle</td>
</tr>
<tr>
<td></td>
<td>ankle</td>
<td></td>
</tr>
<tr>
<td>Systolic BP &lt; 60 (0-2 years)</td>
<td>Pelvic instability</td>
<td>Auto vs. pedestrian &gt; 5 mph</td>
</tr>
<tr>
<td>Immediate need for operating</td>
<td>Paralysis</td>
<td>Special considerations age &lt; 5</td>
</tr>
<tr>
<td>room or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients receiving blood</td>
<td>Flail chest</td>
<td></td>
</tr>
<tr>
<td>transfusion to maintain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>blood pressure &gt; 90</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency medicine discretion</td>
<td>Emergency medicine discretion</td>
<td>Emergency medicine discretion</td>
</tr>
</tbody>
</table>

**Paramedic discretion:**
- MCC, ATV, bike crash
- Significant intrusion/impact
- Hostile environment (cold/heat)
- Preexisting medical issues
- Presence of intoxicants
- Pregnancy
Mechanism of Injury

Although motor vehicle crashes remain the most common mechanism of injury overall, falls are steadily increasing (Figure 11). Falls accounted for 38.7 percent of patient injuries in 2013, compared to 37 percent in 2012. Falls are also 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 Purposefully 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>1302</td>
<td>52</td>
</tr>
<tr>
<td>Face</td>
<td>427</td>
<td>17</td>
</tr>
<tr>
<td>Chest</td>
<td>632</td>
<td>25</td>
</tr>
<tr>
<td>Abdomen</td>
<td>374</td>
<td>15</td>
</tr>
<tr>
<td>Extremities, pelvis or both</td>
<td>783</td>
<td>31</td>
</tr>
<tr>
<td>External</td>
<td>2021</td>
<td>80</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

Nurse Emily Dennis cares for a patient in the Trauma ICU.
Emergency Observation Unit

Faculty from the Department of Emergency Medicine are responsible for managing patients with minor injuries admitted to the Observation Unit in the Emergency Department (ED OBS). Of the hundreds of trauma patients sent to the unit in 2013, 10 percent required subsequent hospital admission (Figure 14). This is a decrease from 12 percent in 2012. 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 2013, we admitted 1757 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 2013, 74 patients (2.9 percent) expired. Eight patients expired in the Emergency Department and 66 after hospital admission.

Figure 17. Total Deaths by Arrival Status

Life Flight landing at OHSU Hospital.
Motor vehicle collisions surpassed falls this year as the leading cause of death.
Care for Patients Older than 64

In 2013, the OHSU Trauma Team treated 551 patients older than 64, up from 477 in 2012, a 15 percent increase. Of these, 223 (41 percent) were transferred to OHSU from another hospital or clinic. Most of the transfer patients were injured in falls. Of the 551 injured patients, 470 (85 percent) required hospital admission. Twenty-five (4.5 percent) died from their injuries, a decrease from 9.4 percent in 2012. Figures 19-22 provide additional information regarding Trauma Team care for patients older than 64 at OHSU.

**Figure 19. Patient Volume, Age 65 and Older**

![Bar chart showing patient volume for ages 65 and older from 2011 to 2013.](chart19)

- **2013:** 551 patients
- **2012:** 477 patients
- **2011:** 460 patients

**Figure 20. Disposition from the Emergency Department, Patients 65 and Older**

- **OR:** 19
- **Home/Discharge:** 39
- **ED OBS:** 48
- **Ward:** 115
- **ICU:** 329

18 Transforming Trauma Care
Figure 21. Mechanism of Injury, Patients 65 and Older

Figure 22. Injury Severity Scores for Patients 65 and Older
Patients 14 Years and Younger

In 2013, the OHSU Trauma Team evaluated 266 patients aged 14 and younger. Of these, 177 (67 percent) were transferred to OHSU from hospitals around the Pacific Northwest. Patient disposition included 188 (71 percent) admitted to OHSU Doernbecher Children's Hospital: 98 (52 percent) to the ICU and 69 (37 percent) to the ward. Four children (1.5 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 23. Patient Volume, Age 14 and Younger

Figure 24. Disposition from the Emergency Department, Patients 14 and Younger
Figure 25. Mechanism of Injury, Patients 14 and Younger

The "other" category includes patients with sports-related injuries, those struck by a falling object and those with injuries accidentally inflicted by others.
Figure 26. Disposition After Admission, Patients 14 and Younger

OHSU Doernbecher Children's Hospital.
Figure 27. Arrival by Time of Day, Patients 14 and Younger

Figure 28. Volume by Quarter, Patients 14 and Younger

Figure 29. Injury Severity Scores for Patients 14 and Younger
2013 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. 2013 ThinkFirst Oregon Activity Summary

<table>
<thead>
<tr>
<th>Total School Presentations</th>
<th>Students who participated in Injury Prevention Presentations</th>
<th>Educators provided with Injury Prevention Materials</th>
<th>Injury Prevention Community Events</th>
<th>Safety helmets provided and fitted correctly</th>
<th>Students who answered Presentation Assessment Questionnaire</th>
<th>Community Partnership Meetings</th>
<th>Community Members provided with Injury Prevention Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>118</td>
<td>22,470</td>
<td>776</td>
<td>3748</td>
<td>3748</td>
<td>852</td>
<td>54</td>
<td>46,282</td>
</tr>
</tbody>
</table>

OHSU ThinkFirst activity.
**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.

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**Table V. 2013 Matter of Balance Activity Summary**

<table>
<thead>
<tr>
<th>Number of Matter of Balance Classes Taught</th>
<th>Total Number of Attendees</th>
<th>Number of Coaches Trained to Teach Matter of Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>120</td>
<td>36</td>
</tr>
</tbody>
</table>

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*Matter of Balance participant with Trauma Prevention Coordinator Kayt Zundel.*
Martin Schreiber, M.D., Chief of Trauma
Speaking topics: Transfusion, Resuscitation, What you Need to know about DVTs, Lessons Learned in the War on Terror, Modern Methods of Hemorrhage Control, Blast Injury, Novel Blood Products, Modulation of Coagulation, Thromboelastometry and Trauma

Bruce Ham, M.D.
Speaking topics: Rural Trauma Team Development Course, Rural Trauma, Rib Fractures

Laszlo Kiraly, M.D.
Speaking topics: Trauma Surgery, Critical Care, Resuscitation

Richard Mullins, M.D.
Speaking topics: Top 10 Trauma Papers of the Year, Top Five Trauma Papers of the Decade, Diagnosis and Treatment of Patient with Rhabdomyolysis, Lessons Learned in the War on Terror, A Brief Review of U.S. Military Surgery, Geriatric Trauma

Susan Rowell, M.D.
Speaking topics: Traumatic Brain Injury, Tranexamic Acid in Trauma

Mitch Sally, M.D.
Speaking topics: Inflammation and Response to Injury, Organ Donation, Mechanical Ventilation

Phil Van, M.D.
Speaking topics: Trauma Surgery, Critical Care, Resuscitation

Jennifer Watters, M.D.
Speaking topics: Trauma Surgery, Critical Care, Resuscitation
Trauma Nursing Faculty

Lynn Eastes, M.S., R.N., A.C.N.P.-B.C.
Trauma Program Manager

Pam Bilyeu, B.S.N., R.N., C.C.M.
Trauma Coordinator

Tracy Neidetcher, M.S.N., M.B.A., R.N.
Manager, Trauma Intensive Care Unit

Anne Larkin, M.S.N., R.N., N.E.-B.C., R.N.C.
Manager, Trauma Acute Care Unit

Janie Johnson, B.S.N., R.N.
Manager, Emergency Department

Nicole Kirker, A.C.N.P.
Trauma Nurse Practitioner

Mike Kolesnikov, F.N.P.-C.
Trauma Nurse Practitioner

Rose Milano, A.C.N.P.
Trauma Nurse Practitioner

Rebecca Garcia, F.N.P.
Acute Care Surgery Nurse Practitioner
In 2013, the Trauma Research Institute of Oregon (TRIO) continued its research in the areas of transfusion and coagulation under the direction of Martin Schreiber, M.D.. TRIO was awarded $9.28M for new and continued projects. Dr. Schreiber and Dr. Susan Rowell along with the Resuscitation Outcomes Consortium (ROC) in Seattle, Washington, were awarded $8.5M from the Department of Defense to evaluate pre-hospital use of tranexamic acid in traumatic brain injured patients. This multicenter trial will compare the effects of two dosing regimens of TXA with placebo on long-term neurologic outcomes. Other funding for Dr. Schreiber in 2013 included:

1. $593,356 from the U.S. Army to evaluate lyophilized plasma with three different concentrations of ascorbic acid to reduce inflammation and DNA damage following trauma
2. $113,275 from the National Institute of Nursing Research at NIH to identify biomarkers in trauma patients who may be at risk for post-traumatic stress disorder
3. $55,587 from Arsenal Medical, Inc. to confirm the correct dose of self-expanding intraperitoneal foam to be used to treat non-compressible, intra-abdominal hemorrhage.

Additionally, Belinda McCully, Ph.D., who joined TRIO in 2012 as a post-doctoral fellow, was awarded $20,000 from the Medical Research Foundation of Oregon to study the effects of obesity on cardiac function and baroreflex following traumatic hemorrhage in a rat model.

Several awards were won by Dr. McCully and the surgical residents based on the research projects each worked on while in the TRIO laboratory:

- Young Investigator Award – American Physiological Society- Belinda McCully, Ph.D.
- 2nd place Clinical Research Paper – ACS COT Annual Conference – David Hampton, M.D.
- Best Paper Portland Surgical Society – Scott Louis, M.D.
- Baker-Mosely Award for Excellence in Clinical Research – Scott Louis, M.D.
- Best Basic Science Paper, Region X COT – Sean McCully, M.D.
- Best Clinical Science Paper, Region X COT – Kelly Fair, M.D.
- Raymond H. Alexander Resident Paper 26th Annual EAST Meeting – Tim Lee, M.D.
- School of Medicine Alumni Association Resident Paper of the Year – Sean McCully, M.D.
- 2nd place Best Resident Presentation PCSA 84th Annual Meeting – Scott Louis, M.D.

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


34. del Junco DJ, Fox EE, Camp EA, Rahbar MH, and Holcomb JB on behalf of the PROMMTT Study Group, Houston, Texas. Seven deadly sins in trauma outcomes research: An epidemiologic post mortem for major causes of bias. The Journal of Trauma and Acute Care Surgery. 2013:75:Number 1:July Supplement 2013:S97-S103.


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 five 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.
**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.