2011 Trauma Program Report

Transforming Trauma Care

OHSU Trauma Team

800 648-6478
for Trauma Transfers and Trauma Transfer Consultations

PANDA
(Pediatric And Neonatal Doernbecher Ambulance)

888 667-2632
for Emergency Transport Consultation and Activation
Summary

- In 2011, the Trauma Service at OHSU treated 2567 patients. This is a 4.8% increase of 119 patients from 2010.
- 1721 (67%) were brought to OHSU directly from the scene of injury.
- 846 (33%) were transferred from another hospital for care of their injuries.
- Both pediatric and geriatric volume continued to increase.
- Injury Prevention: Think First Oregon reached 22,534 children and community members in their outreach efforts with the assistance of more than 125 volunteers.
- During another productive year, the Trauma Research Laboratory adopted the name of the Trauma Research Institute of Oregon. They were awarded two research grants and one sub-award. There were also thirty-five papers published and several presentations at major surgical meetings.

The OHSU Trauma Team
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 G. Atiyeh. With the implementation of the trauma system in May of 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 meeting the criteria for severe injury are transported to one of the two designated Level I trauma centers.

Oregon’s statewide trauma system was implemented between 1987 and 1991. Published research comparing inter-hospital transfer practices before and after implementation of the trauma system show improvement in rapid transfer of critically injured patients to Level 1 and 2 trauma centers as well as improved outcomes.

Trauma Statistics

In 2011, our overall volume increased by 119 patients, or 4.8%.

Figure 1: Volume

![Bar chart showing volume increase from 2009 to 2011.]

Figure 2: Gender Distribution

![Pie chart showing gender distribution with 67% male and 33% female.]
Figure 3: Blunt versus Penetrating

Blunt: 92%
Penetrating: 8%

Figure 4: Age Distribution

Age distribution over the years 2009, 2010, and 2011.
Month, Day and Time

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
Length of Stay

Figure 8: Total Hospital Length of Stay

![Graph showing hospital length of stay from 2009 to 2011 with data points for Scene/ED and Transfers]

Trauma Rounds in the ICU
Trauma Team Response

OHSU has a three-level response in the Emergency Department to evaluate the injured patient, based on information provided by pre-hospital personnel (Table I and II). In the Portland metropolitan area, paramedics evaluate the patient at the scene of injury and enter patients into the trauma system if they conclude the patient meets established triage criteria for being seriously injured. In 2004, OHSU implemented a three-tier system and each year we’ve noted a high proportion of the injured patients fall into the Level 2 or 3 category (Figure 9). Our analyses indicate patients can be effectively and efficiently treated with a limited team response, saving our full trauma team activations for those truly critically injured patients.

Figure 9: Trauma Team Response
Table I and II below describe the team configuration and the triage criteria.

### Table I: Team Composition

<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>Staff Trauma Surgeon</td>
</tr>
<tr>
<td>Staff Anesthesiologist</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>ED Technician</td>
<td>ED Technician</td>
</tr>
<tr>
<td>Transportation Aide</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table II: 3-Tier 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></td>
<td></td>
</tr>
<tr>
<td>Systolic BP &lt; 90 (&gt;11 years to adult)</td>
<td>Penetrating injury to head, neck or torso</td>
<td>Extrication &gt; 20 minutes</td>
</tr>
<tr>
<td>Systolic BP &lt; 80 (5-11 years)</td>
<td>Crush injury to torso or upper thigh</td>
<td>Rollover motor vehicle crash</td>
</tr>
<tr>
<td>Systolic BP &lt; 60 (0-2 years)</td>
<td>Amputation proximal to wrist or ankle</td>
<td>Ejection from motor vehicle</td>
</tr>
<tr>
<td>Immediate need for Operating Room</td>
<td>Pelvic instability</td>
<td>Auto vs. pedestrian &gt; 5 mph</td>
</tr>
<tr>
<td>OR Patients receiving blood transfusion to maintain blood pressure &gt;90</td>
<td>Paralysis</td>
<td>Special considerations age &lt; 5</td>
</tr>
</tbody>
</table>

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

Emergency Medicine Discretion

Emergency Medicine Discretion
Mechanism of Injury

Although motor vehicle crashes remain the most common mechanism of injury overall, falls are steadily increasing (Figure 10). Falls comprised 37% of the injuries in 2011, compared to 36% in 2010. Falls are the number one most frequent mechanism of injury in both pediatrics and geriatrics. In response, our injury prevention team has started a fall-prevention program – Matter of Balance.

Figure 10: Causes of Injury
Body Region of Injury & 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. 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 &amp; Neck</td>
<td>1324</td>
<td>51.6</td>
</tr>
<tr>
<td>Face</td>
<td>418</td>
<td>16.3</td>
</tr>
<tr>
<td>Chest</td>
<td>541</td>
<td>21.1</td>
</tr>
<tr>
<td>Abdomen</td>
<td>387</td>
<td>15.1</td>
</tr>
<tr>
<td>Extremities &amp;/or Pelvis</td>
<td>787</td>
<td>30.7</td>
</tr>
<tr>
<td>External</td>
<td>1975</td>
<td>76.9</td>
</tr>
</tbody>
</table>

Figure 11: Injury Severity Scores for All Patients
Figure 12: Mean Injury Severity Score
Disposition & Outcome

Emergency Observation Unit

Faculty from the Department of Emergency Medicine are responsible for managing patients with minor injuries admitted to the Observation Unit (ED OBS), located within the Emergency Department. Among the hundreds of trauma patients sent to ED OBS in 2011, nine percent subsequently required hospital admission (Figure 13). The ED OBS is an effective strategy for assuring efficient use of inpatient hospital beds while maintaining quality medical care for injured patients.

Figure 13: Emergency Observation Unit
Hospital Admission

1800 (70%) of our patients are admitted into the hospital (Figure 14). Those patients in the age extremes, very young and very old, are more likely to require hospital admission. Most of these patients are able to return home after admission (Figure 15).

Figure 14: Patients requiring Hospitalization

Figure 15: Inpatient Disposition Distribution in Percentages
Mortality

Seventy-eight patients (3%) expired in 2011. Eight patients expired in the Emergency Department and seventy patients expired after hospital admission.

Figure 16: Mortality – Transfer versus Scene/ED patients
Figure 17: Cause of Death

Dr. Watters rounds in the ICU
Geriatric Patients – age over 64 years

In 2011, 460 patients over the age of 64 were treated as trauma system patients at OHSU (up from 440 in 2010). One hundred seventy-five (38%) were transferred to OHSU from another hospital or clinic. The preponderance of these were due to falls. Of the 460 injured patients, 376 (82%) required hospital admission. Thirty-four geriatric patients died as a result of their injuries (7.4%), down from 8.4% in 2010. Figures 18-20 provide additional information regarding geriatric trauma at OHSU.

Figure 18: Geriatric Volume
Figure 19: Disposition from the Emergency Department for Geriatric Population

Figure 20: Geriatric Mechanism of Injury
Pediatric Patients – age under 16 years

In 2011, there were 332 pediatric patients evaluated as trauma system patients. Two hundred six (62%) were transferred to OHSU from hospitals throughout the northwest. Of the 332 injured children, 240 (72%) required admission to OHSU Doernbecher Children’s Hospital. 175 (31%) were admitted to the ICU and eighty-two (25%) were admitted to the ward. Six (1.8%) children died as a result of their trauma. As with the geriatric population, the leading mechanism of injury for children was falls.

Figure 21: Pediatric Volume

[Bar graph showing pediatric volume from 2009 to 2011]

Figure 22: Disposition from the Emergency Department for Pediatric Patients

[Bar graph showing disposition from the ED for 2011]
Figure 23: Pediatric Mechanism of Injury

- Vehicle Collisions: 33.7%
- Non-intentional Falls: 47.0%
- Mishaps Due to Natural & Environmental Factors: 1.8%
- Mishaps by Submersion, Suffocation & Foreign Body: 1.2%
- Other: 12.7%
- Suicide & Self-inflicted Injury: 0.6%
- Homicide & Injury Purposely Inflicted by Others: 2.7%
- Injury Undetermined Intentional/non-intentional: 0.3%
Figure 24: Pediatric Disposition after Admission

Figure 25: Arrival of Pediatric Patients by Time of Day
Figure 26: Pediatric Volume by Quarter

OHSU Doernbecher Children’s Hospital
Injury Prevention

Table IV below describes the activity of the ThinkFirst Oregon team and their injury prevention efforts. The mission of ThinkFirst is to reduce the incidence of brain, spinal cord, and other traumatic injuries and fatalities by providing education to youth, parents, and community members throughout Oregon.

Table IV: ThinkFirst Oregon Activity Summary July 1, 2011- June 30, 2012

<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>13</td>
<td>4070</td>
<td>286</td>
<td>25</td>
<td>6</td>
<td>6</td>
<td>810</td>
<td>8</td>
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<tr>
<td>Quarter 2</td>
<td>14</td>
<td>3304</td>
<td>302</td>
<td>8</td>
<td>5</td>
<td>8</td>
<td>384</td>
<td>2</td>
</tr>
<tr>
<td>Quarter 3</td>
<td>2</td>
<td>259</td>
<td>104</td>
<td>8</td>
<td>14</td>
<td>24</td>
<td>1423</td>
<td>1</td>
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<tr>
<td>Quarter 4</td>
<td>12</td>
<td>9486</td>
<td>728</td>
<td>70</td>
<td>15</td>
<td>32</td>
<td>2798</td>
<td>3</td>
</tr>
<tr>
<td>Year to date</td>
<td>41</td>
<td>17119</td>
<td>1420</td>
<td>111</td>
<td>40</td>
<td>70</td>
<td>5415</td>
<td>14</td>
</tr>
</tbody>
</table>
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: Matter of Balance Activity Summary 2011**

<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>11/9/2010-1/17/2011</td>
<td>Matter of Balance</td>
<td>Senior Fall Prevention</td>
<td>16</td>
<td>Rock Creek Retirement Center</td>
<td>9</td>
</tr>
</tbody>
</table>
Performance Improvement and Patient Safety

Adult Performance Improvement

As a part of OHSU Performance Improvement and Patient Safety (PIPS), patient care and quality is 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, delay in diagnosis and falls in the hospital. As a part of the effort to improve quality and patient safety, OHSU has implemented Rapid Safety Rounds. The purpose of these interdisciplinary rounds is to decrease falls and increase peer to peer communication by comprehensively looking at, and discussing, a high-risk fall patient biweekly. The trauma ward Professional Practice Leader leads the discussion on each patient to increase accountability and transfer of knowledge. Participants include the pharmacist, case manager, nursing unit manager, professional practice leader and the bedside nurse. When rounds started in the summer of 2011 the fall rate on the trauma ward was 5.41 falls per 1000 patient care days. By December of 2011 the rate had dropped to 2.0 falls per 1000 patient care days.

Figure 27: Adult Fall Rate Measured in Falls per 1000 Patient Care Days
Pediatric Performance Improvement

In 2010 the Trauma Program revised its pediatric cervical spine clearance policy in an effort to decrease radiation exposure in children. CT scanning is responsible for 97% of ionizing radiation exposure in pediatric trauma patients and increases the risk of fatal cancers. The new policy allows for the clearance of the cervical spine based on clinical exam if the child is at least three years old and communicative. If there is an abnormal clinical exam or the child is less than three years old, plain films are obtained. If the plain films are normal the spine is cleared. If the plain films are abnormal, neurosurgery is consulted.

Since the creation of this policy in the number of CT scans and CT angiography ordered in the pediatric population has decreased dramatically.

Figure 28: CT scan use in the pediatric population
Despite hundreds of school presentations and thousands of helmets distributed, getting children to wear helmets and seatbelts remains a challenge. Below is a comparison between pediatric patients using safety devices (helmets and seatbelts) in 2007 and 2011. The OHSU Trauma Program remains committed to injury prevention in children.

Figure 29: Use of seatbelts and helmets in the pediatric population
**Research**

In 2011, the Trauma Research Laboratory adopted the name of the Trauma Research Institute of Oregon and was awarded two research grants and a sub-award. Dr. Martin Schreiber was awarded funding by the National Trauma Institute to further investigate the use of thrombelastography (TEG) in prescribing enoxaparin dosing. The hypothesis is that TEG-guided enoxaparin dosing will be superior to standard dosing in the prevention of thromboembolic events. The sub-award was awarded by the University of Texas Health Science Center at Houston as part of a 12-center study funded by the National Institutes of Health and the Department of Defense to evaluate of blood product ratios in massive transfusions for trauma patients. The Pragmatic, Randomized Optimal Platelets and Plasma Ratios will compare the use of 1:1:1 to 1:1:2 of platelet:plasma:red blood cells in trauma patients predicted to require a massive transfusion. Additionally, Dr. Susan Rowell received funding from the American Association for the Surgery of Trauma to evaluate the use of TEG in predicting or characterizing the severity of traumatic head injuries.

These publications highlight the culmination of the many studies and reviews conducted by our trauma faculty, surgical residents, and medical students:


18. Barbosa RR, Rowell SE, Diggs BS, Schreiber MA and the Trauma Outcomes Group. Profoundly Abnormal Initial Physiologic and Biochemical Data cannot be Used to
Transforming Trauma Care


Appendix A

The AIS system is used to generate the Injury Severity Score or ISS. ISS has a single value between one and 75 that assigns a numerical value corresponding to a patient’s total severity of injury. The ISS is calculated using the highest AIS score from as many as three of the six body regions. ISS is the sum of the squared highest three AIS scores from three separate body regions. ISS is useful in making risk-adjusted comparisons between groups of patients. For example, based upon 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 a Level I trauma center to have enough experience to be fully competent, the trauma center should admit more than 1,200 trauma patients each year, and 240 of these patients should have an ISS greater than 15.
Glossary of Terms

**Abbreviated Injury Scale (AIS)** 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: head and neck; face; chest; abdomen and pelvic contents; limbs including the bony pelvis; and external.

**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 in conjunction with ICD-9-CM scores to provide a more detailed analysis of the mechanism of injury.

**Glasgow Coma Scale (GCS)** 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 3 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 (LOS-HOSP)** 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 the operation; these patients are considered to have a one-day length of stay.

**International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)** assigns a specific number to a disease or condition experienced by a patient. For example, a spleen injury with a capsular tear is coded as 865.02, and Parkinson’s disease is coded as 332.0.
Injury Severity Score (ISS) 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 infers an ISS of 75, usually an un-survivable injury. An ISS of 15 or more is considered a serious injury.

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

Past Medical History (PMH) is noted in the Trauma Registry when patients are known to have cardiovascular disease, diabetes, renal or liver disease, are pregnant, have respiratory disease, immunologic disease, or are post-splenectomy or undergoing therapy. An “other” category is included and may indicate a history of chronic alcohol, drug abuse or other relevant conditions.