2010 Trauma Program Report

Transforming Trauma Care
2010 Trauma Program Report

Summary

- In 2010, the Trauma Service at OHSU treated 2465 patients. This is an increase of 108 patients from 2009.
- 1630 (66%) were brought to OHSU directly from the scene of injury.
- 835 (34%) were transferred from another hospital for care of their injuries.
- Both pediatric and geriatric volume continues to increase.
- Injury Prevention: Think First Oregon distributed more than 1600 helmets and reached 35,911 children and community members in their outreach efforts.
- During another productive year for the Trauma Research Lab, they were awarded four research grants, gave presentations at 10 meetings, and had 14 journal publications.
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. Research studies before and after the statewide trauma system was implemented have indicated important and beneficial effects of the trauma system on inter-hospital transfer practices. Not only were more seriously injured patients transferred to the Level I and Level II trauma centers in the state, but these transfers were accomplished more quickly, resulting in injured patients receiving definitive treatments in a more timely manner.
Trauma Statistics

*In 2010, our overall volume increased by 108 patients.*

**Figure 1: Volume**

**Figure 2: Gender Distribution**
Figure 3: Blunt versus Penetrating

Figure 4: Age Distribution
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 in Days
Trauma Team Response

OHSU has a three-level response in the Emergency Department to evaluate the injured patient, based on information provided by the 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 used to determine the trauma team response to the ED.
### 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></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>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><strong>Physiologic</strong></td>
<td><strong>Anatomic</strong></td>
<td><strong>Mechanism of Injury</strong></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>Paramedic discretion:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCC, ATV, bike crash</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Significant intrusion/impact</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hostile environment (cold/heat)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Preexisting medical issues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Presence of intoxicants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pregnancy</td>
</tr>
</tbody>
</table>

Emergency Medicine Discretion | 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 36% of the injuries in 2010, compared to 35% in 2009 and 29% in 2008. Falls are the number one most frequent mechanism of injury in both pediatrics and geriatrics (Figures 17 and 19). 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>1311</td>
<td>53.2</td>
</tr>
<tr>
<td>Face</td>
<td>418</td>
<td>17.0</td>
</tr>
<tr>
<td>Chest</td>
<td>549</td>
<td>22.3</td>
</tr>
<tr>
<td>Abdomen</td>
<td>354</td>
<td>14.4</td>
</tr>
<tr>
<td>Extremities &amp;/or Pelvis</td>
<td>693</td>
<td>28.1</td>
</tr>
<tr>
<td>External</td>
<td>1880</td>
<td>76.3</td>
</tr>
</tbody>
</table>

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

![Bar chart showing mean injury severity scores for different years and settings.](chart_image)
Disposition & Outcome

Emergency Observation Unit

The faculty from the Department of Emergency Medicine is 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 2010, twelve 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

1623 (66%) 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 Hospital Admission

Figure 15: Inpatient Disposition Distribution in Percentages
Mortality

Eighty nine patients (3.6%) expired in 2010. Fourteen patients expired in the Emergency Department and 75 patients expired after hospital admission.

There was no significant difference in deaths for those 2010 admitted field and transfer patients when compared to 2008 and 2009 patients.

Figure 16: Mortality – Transfer versus Scene/ED patients

Helmet fitting at the Bike Rodeo
Figure 17: Overall Mortality by Mechanism of Injury

- Vehicle Collisions (E800-E848)
- Non-intentional falls (E880-E888)
- Mishaps due to natural & environmental factors (E900-E909)
- Mishaps by submersion, suffocation & foreign body (E910-E915)
- Other occurrences (E916-E928)
- Suicide & self-inflicted injury (E950-E959)
- Homicide & injury purposely inflicted by others (E960-E969)
- Legal intervention (E970-E978)
- Injury undetermined intentional/non-intentional (E980-E989)
Geriatric Patients - age over 64 years

In 2010, 451 patients over the age of 64 were treated as trauma system patients at OHSU (up from 370 in 2009). One hundred eighty seven (41%) were transferred to OHSU from another hospital or clinic. Of the 451 injured patients, 372 (82%) required hospital admission. Thirty-eight geriatric patients died as a result of their injuries (8.4%), up from 5.9% in 2009. 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

![Disposition from the Emergency Department for Geriatric Population](image1)

Figure 20: Geriatric Mechanism of Injury

![Geriatric Mechanism of Injury](image2)
Pediatric Patients - age under 16 years

In 2010, there were 328 pediatric patients evaluated as trauma system patients. One hundred ninety eight (60%) were transferred to OHSU from hospitals throughout the northwest. Of the 328 injured children, two hundred five (63%) required admission to OHSU Doernbecher Children’s Hospital. Sixty-six children were admitted to the ED Observation Unit and eight subsequently required inpatient admission (12%). Nine children died as a result of their trauma, three in the Emergency Department and six after hospital admission.

Figure 21: Pediatric Volume

Figure 22: Disposition from the Emergency Department for Pediatric Patients
Figure 23: Pediatric Mechanism of Injury

- Vehicle Collisions (E800-E848)
- Non-intentional falls (E880-E888)
- Mishaps due to natural & environmental factors (E900-E909)
- Mishaps by submersion, suffocation & foreign bod (E910-E915)
- Other occurrences (E916-E928)
- Suicide & self-inflicted injury (E950-E959)
- Homicide & injury purposely inflicted by others (E960-E969)
Figure 24: Pediatric Disposition after Admission

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

*Table IV below describes the activity of the Think First Oregon team and their injury prevention efforts.*

**Table IV ThinkFirst Oregon Activity Summary July 1, 2010 - June 30, 2011**

<table>
<thead>
<tr>
<th></th>
<th>Number of School ThinkFirst School Safety Presentations</th>
<th>School Presentations Number of Children Served</th>
<th>Presentations with Speaker who has a Traumatic Brain Injury</th>
<th>ThinkingFirst Community Events/Health Fairs</th>
<th>Number of school Children plus Community Members Served</th>
<th>Number of Community Safety Presentations &amp; Community Members Served During Community Events</th>
<th>Community Training and Injury Prevention Classes Taught</th>
<th>Number of Schools that Received Curriculum</th>
<th>Total Number of People Served plus Teachers</th>
<th>Number of Safety Helmets Distributed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter 1</td>
<td>14</td>
<td>956</td>
<td>7</td>
<td>7</td>
<td>8006</td>
<td>1605</td>
<td>0</td>
<td>34</td>
<td>5</td>
<td>8040</td>
</tr>
<tr>
<td>Quarter 2</td>
<td>618</td>
<td>4060</td>
<td>23</td>
<td>7</td>
<td>5580</td>
<td>416</td>
<td>1520</td>
<td>6</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>Quarter 3</td>
<td>31</td>
<td>898</td>
<td>21</td>
<td>11</td>
<td>5114</td>
<td>608</td>
<td>4249</td>
<td>27</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Quarter 4</td>
<td>59</td>
<td>2630</td>
<td>2</td>
<td>8</td>
<td>17211</td>
<td>300</td>
<td>14581</td>
<td>5</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Year to date</td>
<td>722</td>
<td>8544</td>
<td>53</td>
<td>33</td>
<td>35911</td>
<td>2929</td>
<td>27400</td>
<td>38</td>
<td>70</td>
<td>24</td>
</tr>
</tbody>
</table>
Research

In 2010, the Trauma Research Laboratory was awarded four research grants for human and animal trials. As Principal Investigator, Martin Schreiber, MD, was awarded three grants starting with $4.7 million from the United States Air Force to conduct a two-year, multi-center, clinical trial to evaluate the safety and efficacy of cryopreserved red blood cells (RBCs) for transfusion purposes in trauma patients. This is an expansion of last year’s award allowing the addition of five clinical sites to this study. The study aims to compare the use of cryopreserved RBCs to standard RBCs of different ages and the effects on tissue oxygenation during and after transfusion. Dr. Schreiber also received $946,400 from the U.S. Army Medical Research and Materiel Command to further study the efficacy and safety of lyophilized, or freeze-dried, plasma. Specifically, Dr. Schreiber’s group will evaluate the minimum amount of fluid and optimal type of fluid used to reconstitute the plasma for use for resuscitation purposes in a severe injury model in swine. Last, Dr. Schreiber received $98,817 from Haemonetics Corporation as part of a subcontract with University of Texas Health Science Center at Houston to evaluate the use of thrombelastography (TEG) to monitor changes in coagulopathy in trauma patients and to evaluate how the TEG results correlate with early blood product utilization.

Jennifer Watters, MD, received $40,000 from the Medical Research Foundation of Oregon to study the use of acupuncture to reduce the need for or the amount of medical sedation in trauma patients requiring mechanical ventilation. This one-year trial aims to demonstrate the possible use of acupuncture compared to sham acupuncture as an adjuvant to sedation therapy in the ICU. The reduced use of such medications as benzodiazepines, propofol, and narcotics may help to decrease side effects such as respiratory distress, arrhythmias, insomnia, over-sedation, and delirium experienced by some patients.

Four surgery residents won awards during 2010 at scientific meetings. ChitraSambasivan, MD, took second place in the Resident Competition at the Northwest Society of Colon & Rectal Surgeons in August. Philbert Van, MD, won three awards, the Karen Deveney Award for Clinical Science at the 63rd Annual Portland Surgical Society Scientific Meeting in May, the Baker-Mosley Award for Basic Science Research for the Oregon Chapter of the American College of Surgeons meeting in June, and the Basic Science Resident Paper at the American College of Surgeons Committee on Trauma Region X meeting in November. Also at the American College of Surgeons meeting, Nicholas Kunio, MD, won the Resident Abstract Competition in Clinical Research. Gordon Riha, MD, and Dr. Kunio won first and second place, respectively, at the Oregon Chapter of the Society of Critical Care Medicine for their poster presentations. Lastly, Jerome Differding, MPH, a Research Associate in the Division of
Transforming Trauma Care

Trauma, Critical Care and Acute Care Surgery won for his presentation at the North Pacific Surgical Association in November.

In addition to other presentations made at annual meetings for the American Association for the Surgery of Trauma, Pacific Coast Surgical Association, Shock Society, the American College of Surgery, and the Eastern Association for the Surgery of Trauma, 2010 was a productive year for journal publications for the Trauma Research Laboratory. These publications highlight the culmination of many studies conducted by our trauma faculty, surgical residents, and medical students:


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 unsurvivable 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.