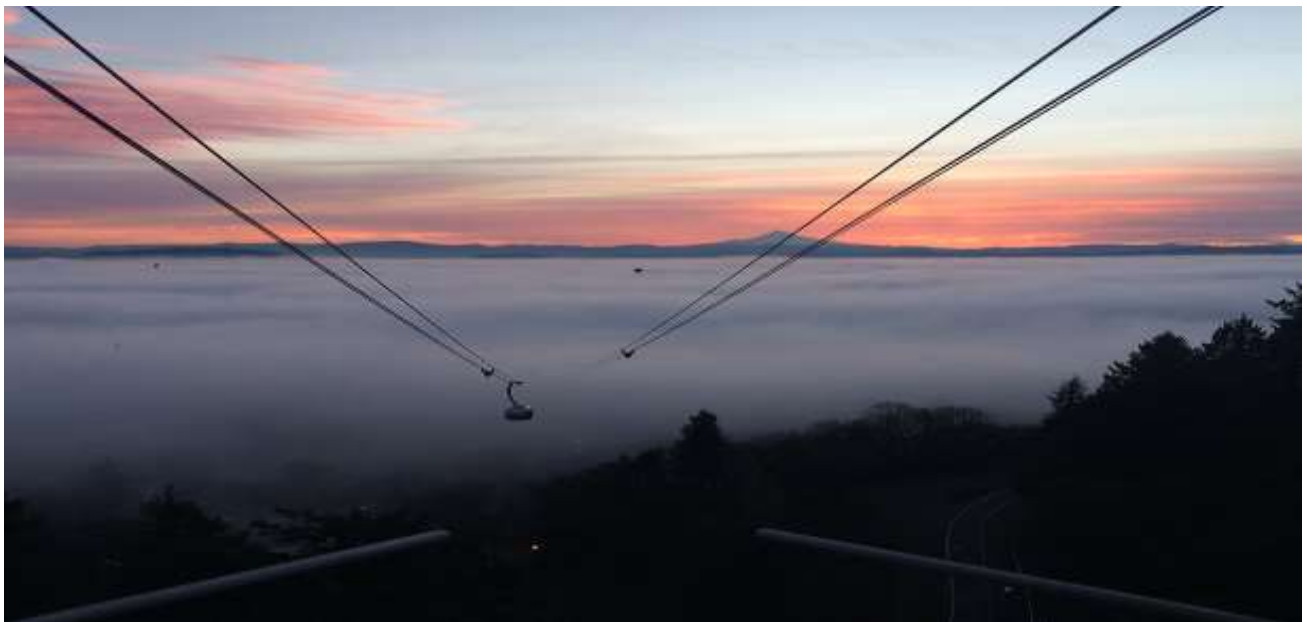




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2015 Trauma Program Report

Transforming Trauma Care



2015 Trauma Program Report

Summary

- *In 2015, the Trauma Service at OHSU treated 2757 patients.*
- *1807 patients (66 percent) were brought to OHSU directly from the scene of injury, and 952 (34 percent) were transferred from another hospital.*
- *The mean injury severity score of admitted patients was 15.3.*
- *The number of patients age 25-74 increased, while the number of patients older than 74 decreased.*
- *Injury Prevention: ThinkFirst and Matter of Balance Fall Prevention had another successful year, serving more than 36,000 community members.*
- *The Trauma Laboratory had another productive year, publishing 33 research papers and receiving more than \$2.3 million in new funding.*



The OHSU Trauma Team

Trauma Statistics

In 2015, the OHSU Trauma Program total patient volume increased by 277 patients from 2014, an 11 percent increase.

Figure 1. Patient Volume 2013 - 2015

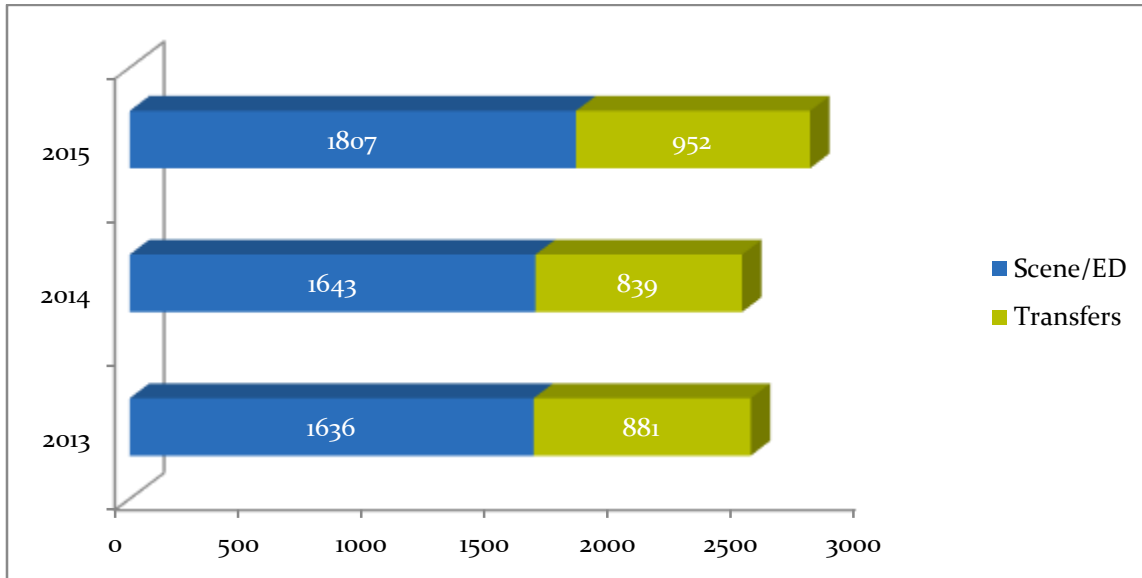


Figure 2. Gender Distribution of Patients Treated by the OHSU Trauma Program

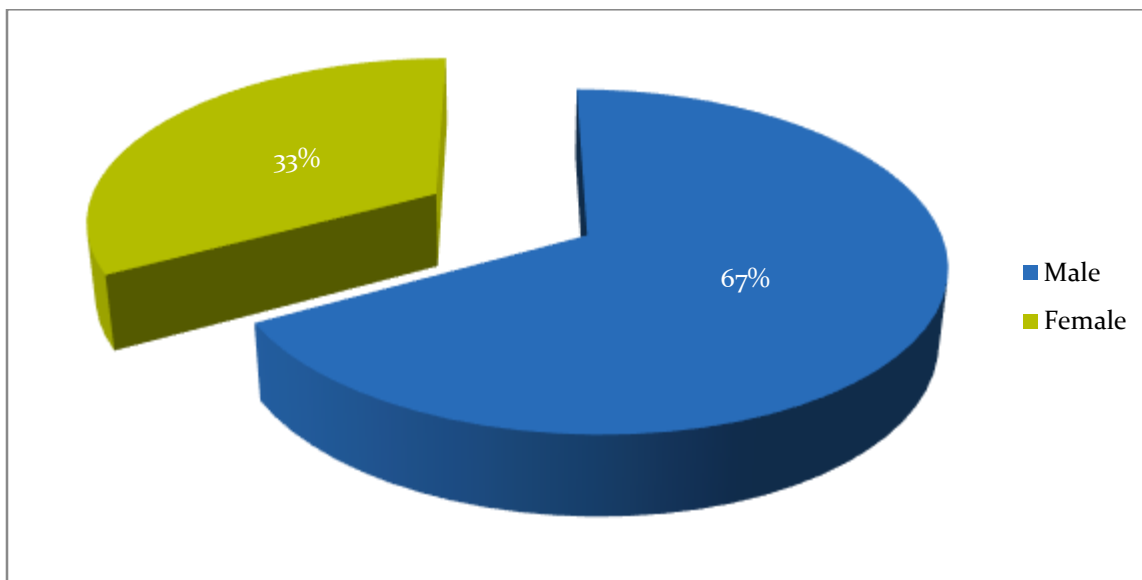


Figure 3. Patients Treated by the OHSU Trauma Program: Blunt versus Penetrating Injuries

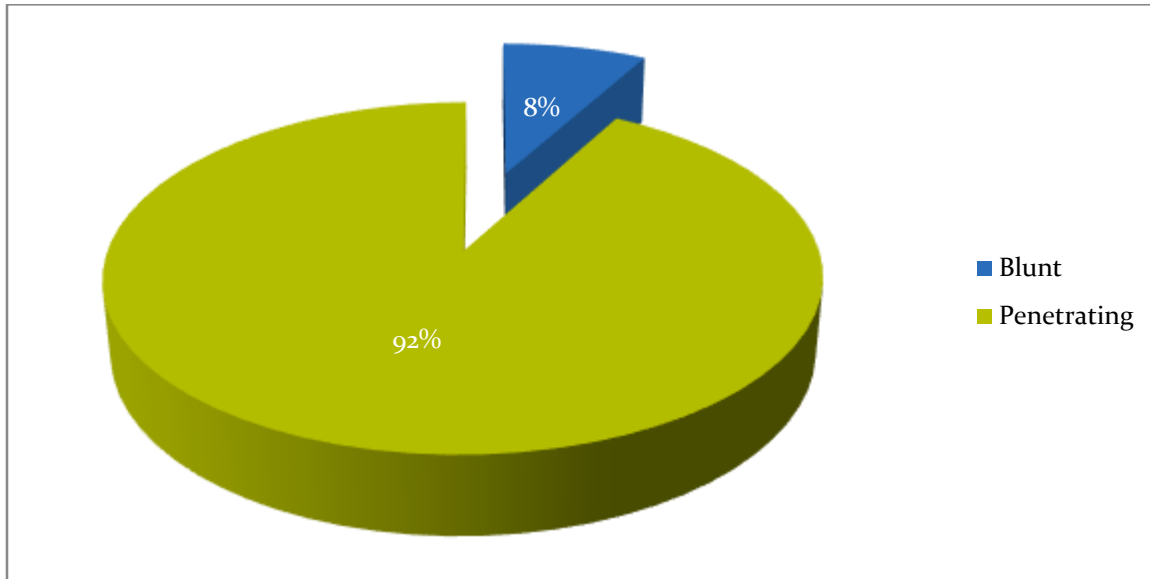
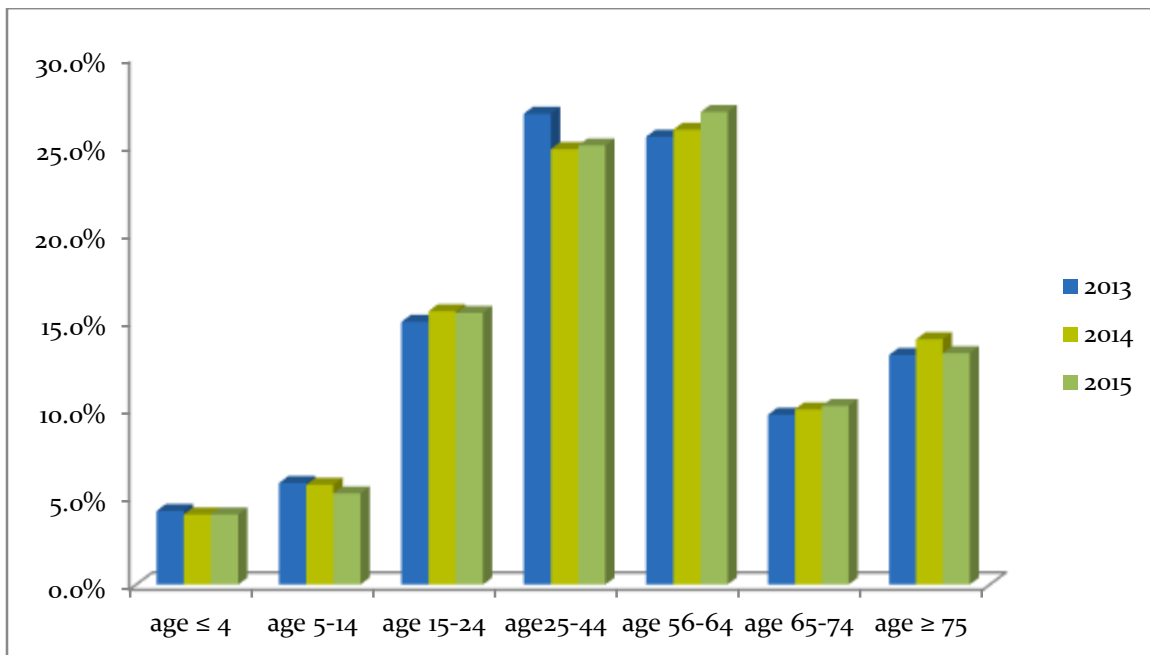


Figure 4. Age Distribution of Patients Treated by the OHSU Trauma Program



Month, Day and Time

Figure 5. Distribution of Patients by Month

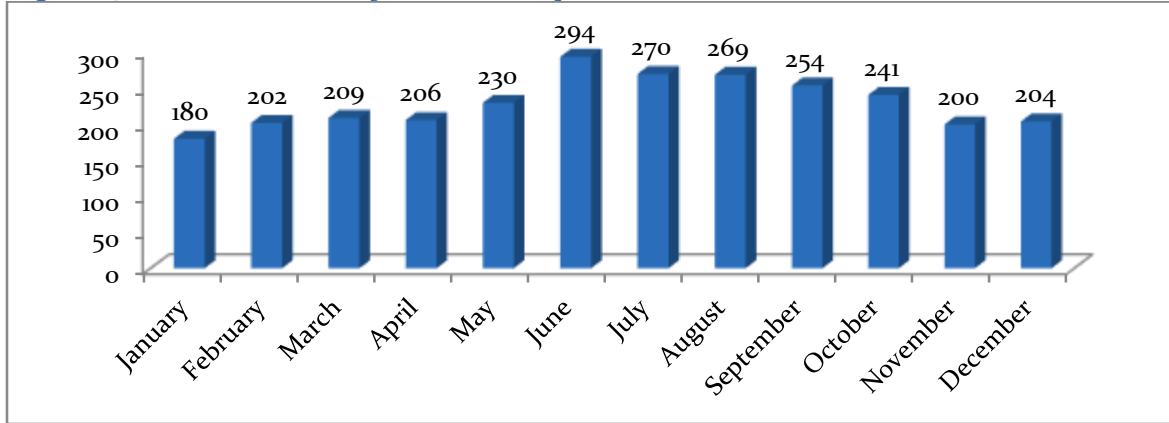


Figure 6. Distribution of Patients by Day of Week

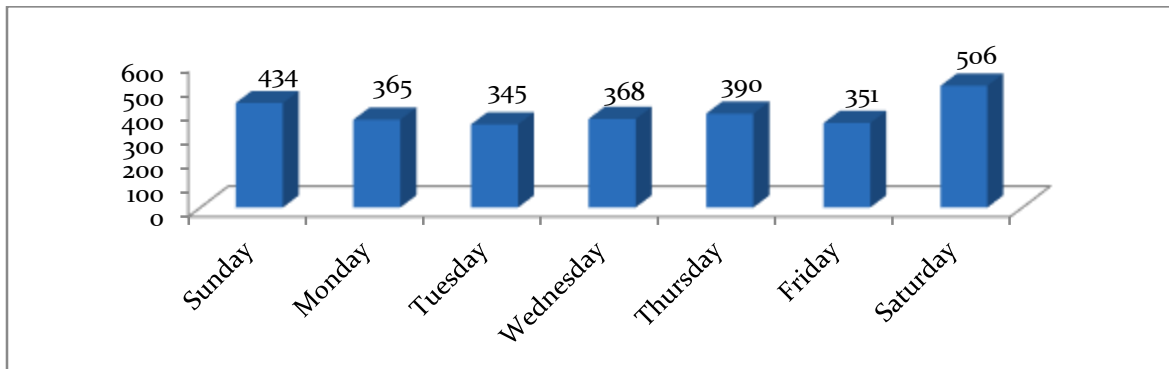
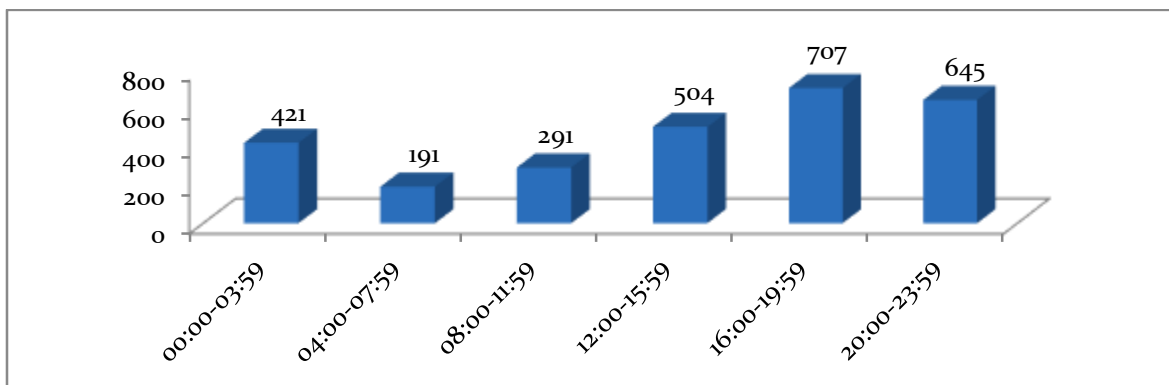
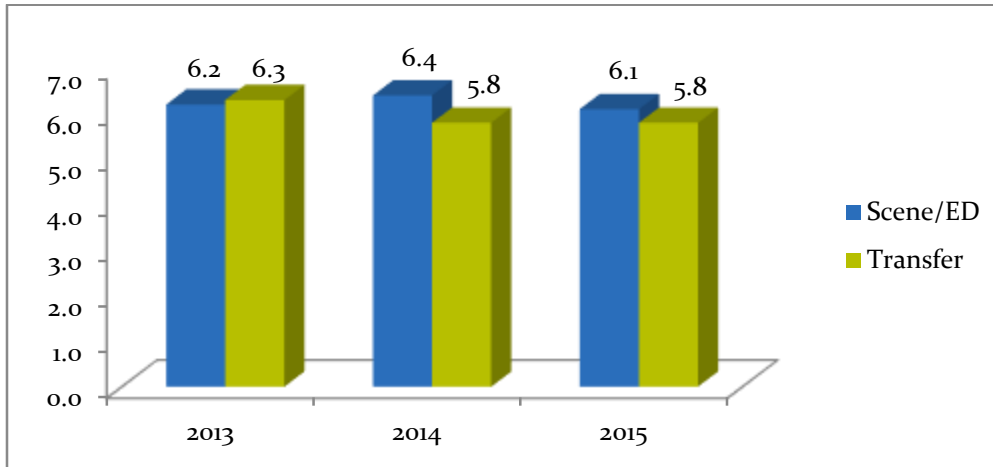


Figure 7. Distribution of Patients by Time of Arrival



Length of Stay

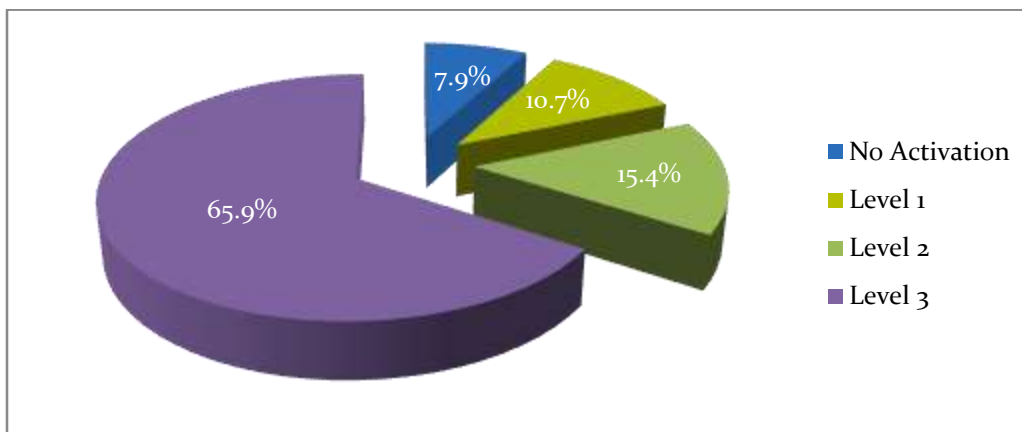
Figure 9. Total Hospital Length of Stay of Admitted Patients



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. 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. 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

Figure 10. OHSU Trauma Team Response by Level of Activation



Mechanism of Injury

Although motor vehicle crashes remain the most common mechanism of injury overall, falls continue to be a significant source of trauma. Falls continue to be the leading mechanism of injury for both children and older adults, and the leading cause of death.

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

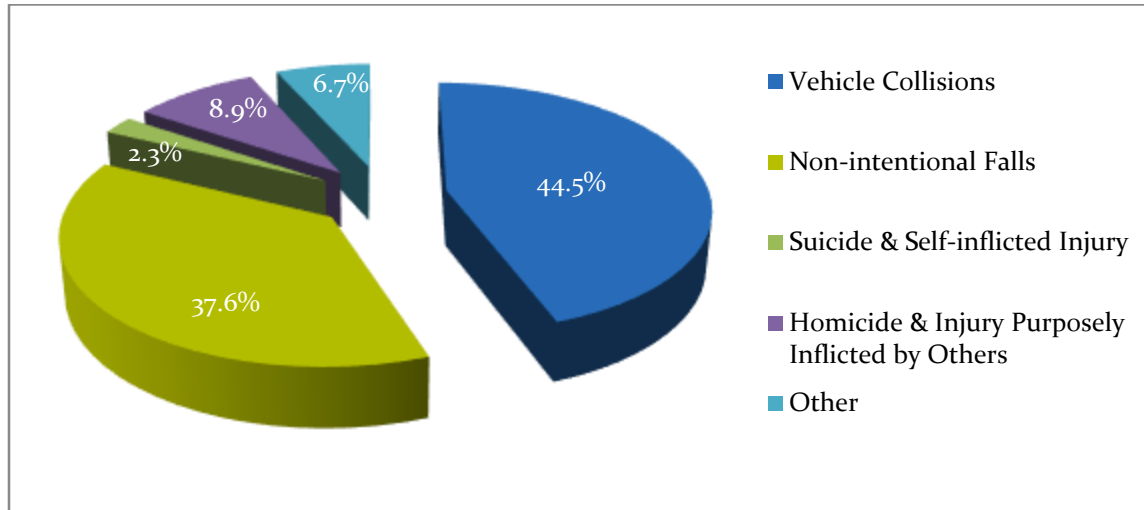


Figure 12: Injury Severity Scores for Patients Treated by OHSU Trauma Team

Injury Severity Score is an estimate of the overall severity of the patient's injuries. Scores can range from one to 75. An ISS of 15 or more denotes a serious injury.

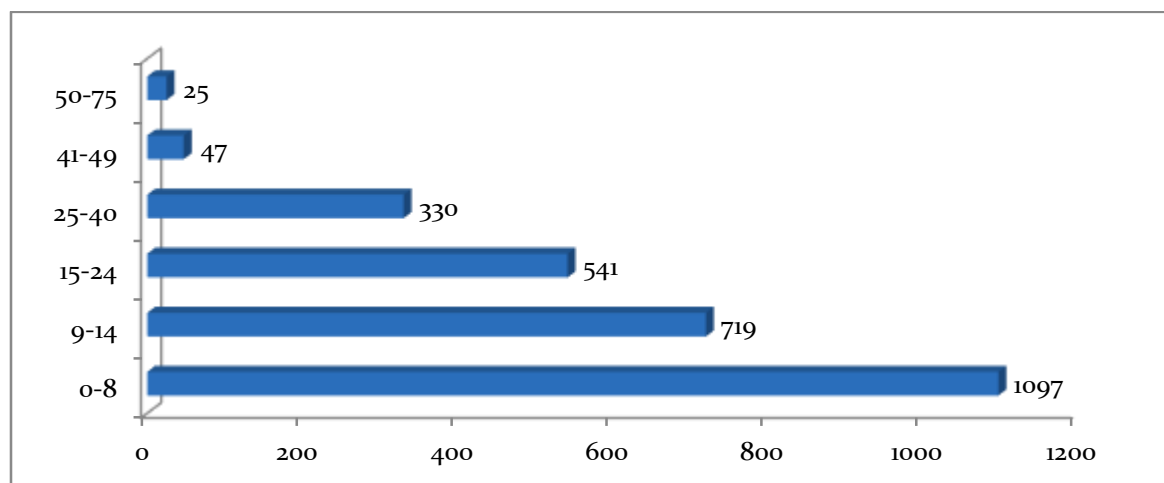
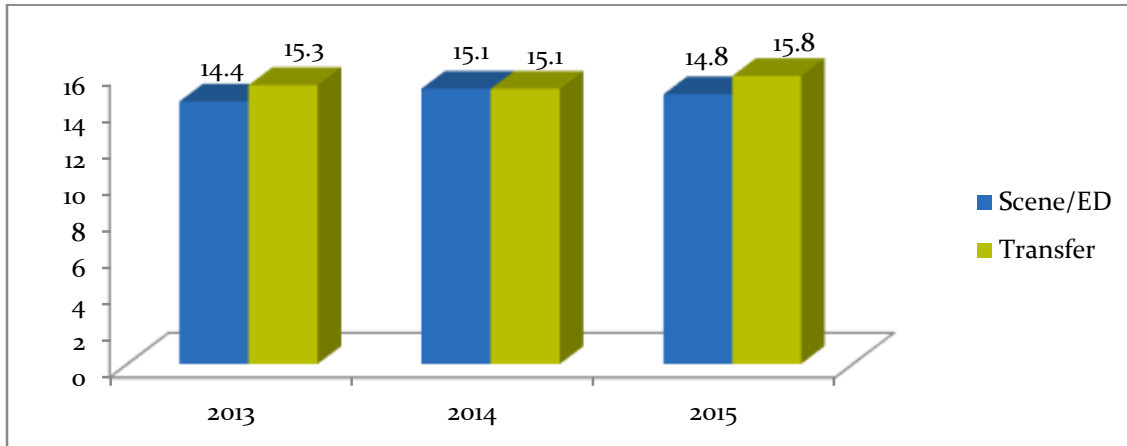


Figure 13. Mean Injury Severity Score of Patients Admitted to OHSU Hospital

Patients transferred in from other hospitals are more injured on average than those admitted directly from the scene.

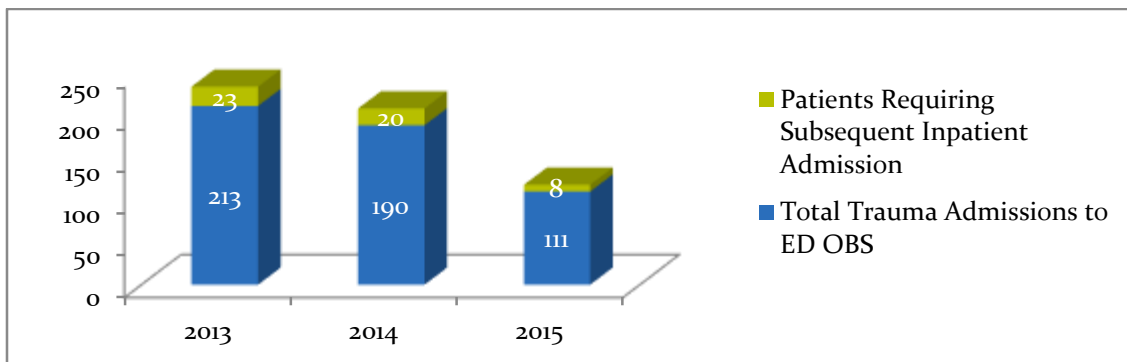


Disposition and Outcome for Patients Treated by OHSU Trauma Team

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. Of the hundreds of trauma patients sent to ED OBS in 2015, seven percent required subsequent hospital admission (Figure 14). The decrease in OBS unit usage for trauma patients is likely due to the increase in the elderly trauma population, who require more intensive service and care. The ED OBS unit continues to be 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



Hospital Admissions via OHSU Trauma Program

In 2015, we admitted 2053 patients (74 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).

Figure 15. Patients Requiring Hospitalization after Trauma Team Care

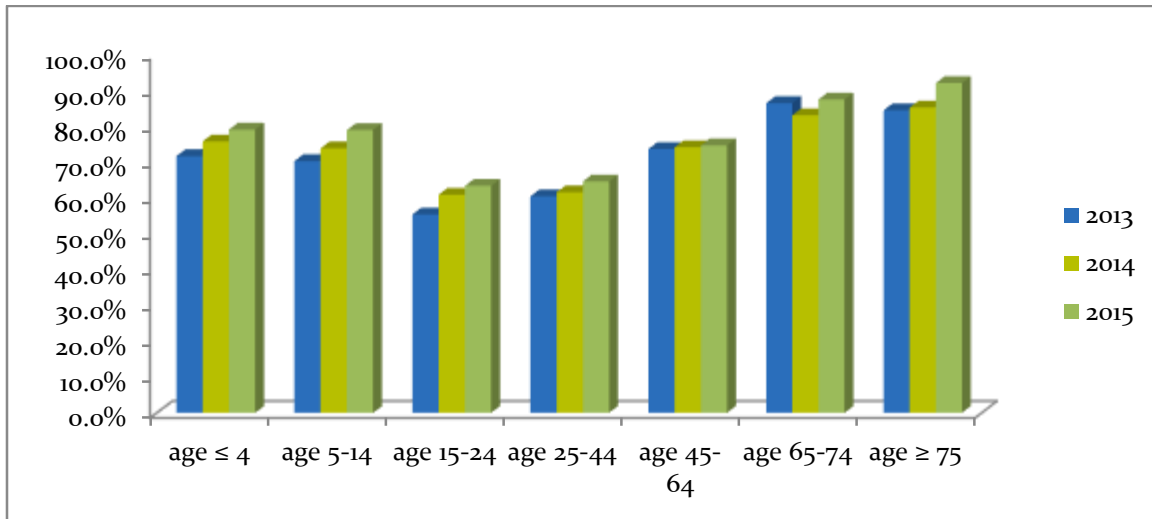
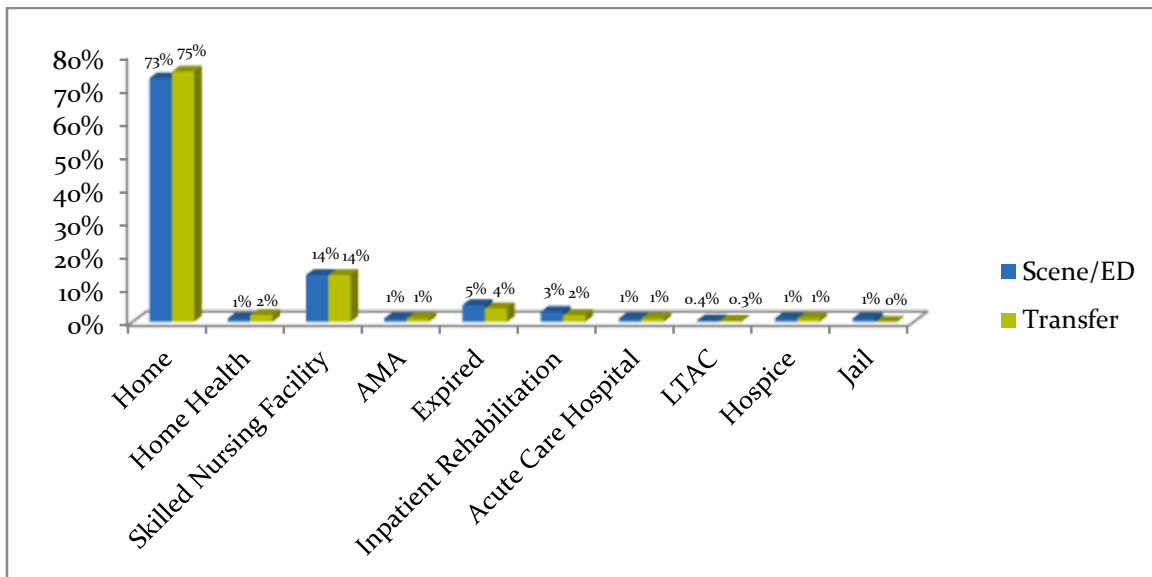


Figure 16. Disposition of Admitted Patients after Hospital Discharge



Mortality

In 2015, 102 patients (3.7 percent) expired. Eleven patients expired in the Emergency Department and 91 after hospital admission.

Figure 17. Total Deaths by Arrival Status

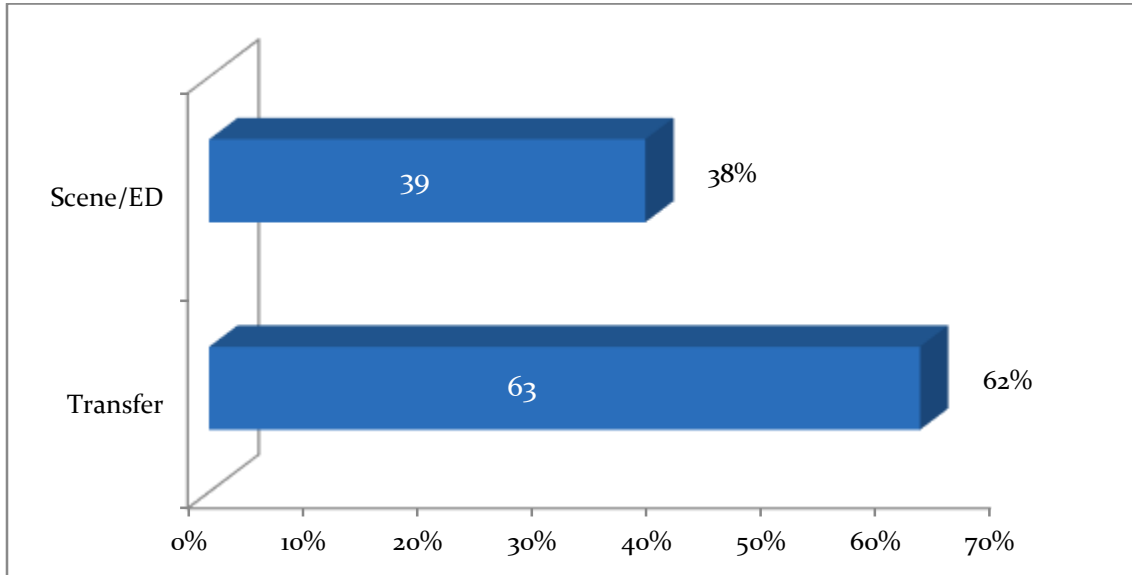
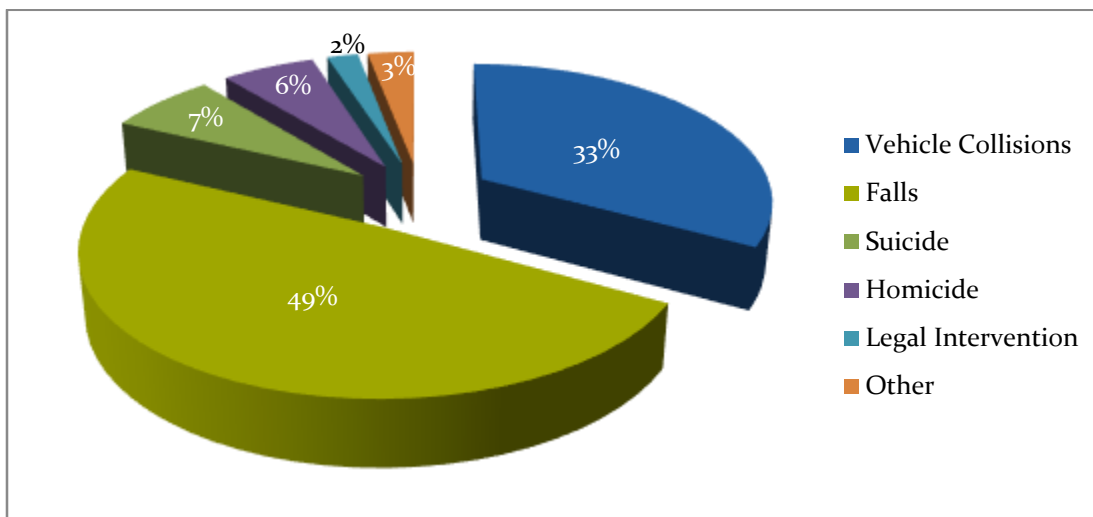


Figure 18. Cause of Death

Deaths from falls continued to surpass those from vehicle collisions this year.



Care for Patients Older than 64

In 2015, the OHSU Trauma Team treated 637 patients older than 64 in 2014, a 10% increase. Of these, 278 (44 percent) were transferred to OHSU from another hospital or clinic. Most of the transfer patients were injured in falls. Of the 637 injured patients, 573 (90 percent) required hospital admission.

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

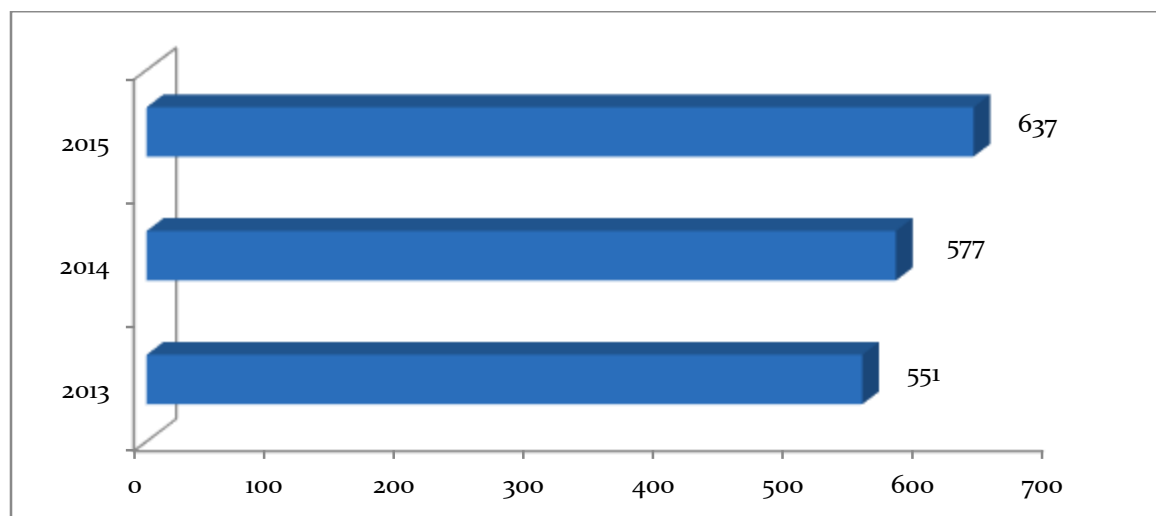


Figure 20. Disposition from the Emergency Department, Patients 65 and Older

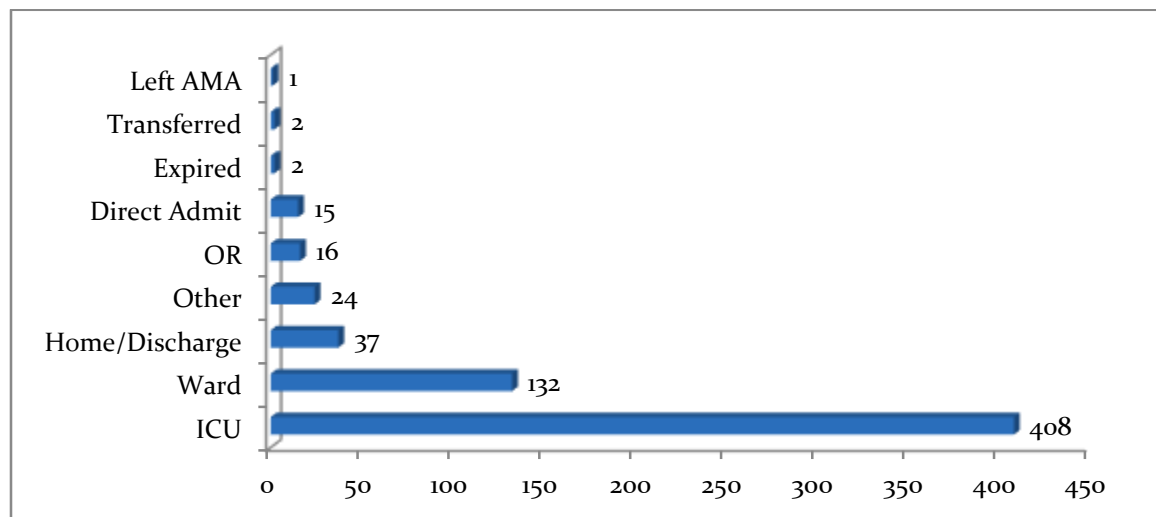


Figure 21. Mechanism of Injury, Patients 65 and Older

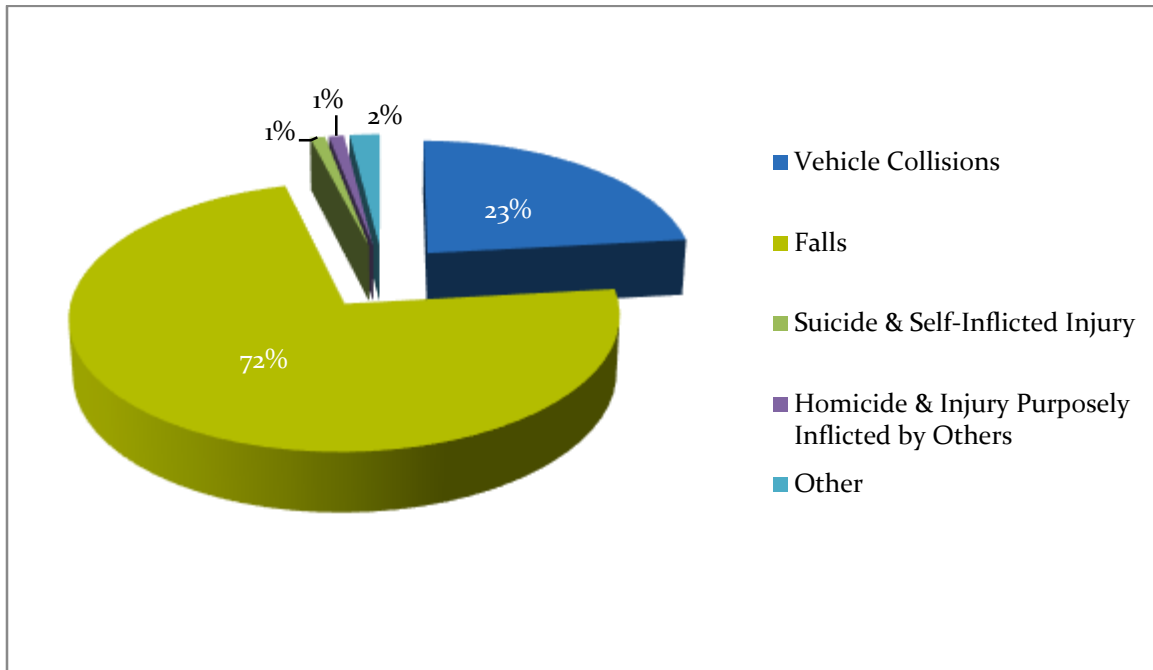
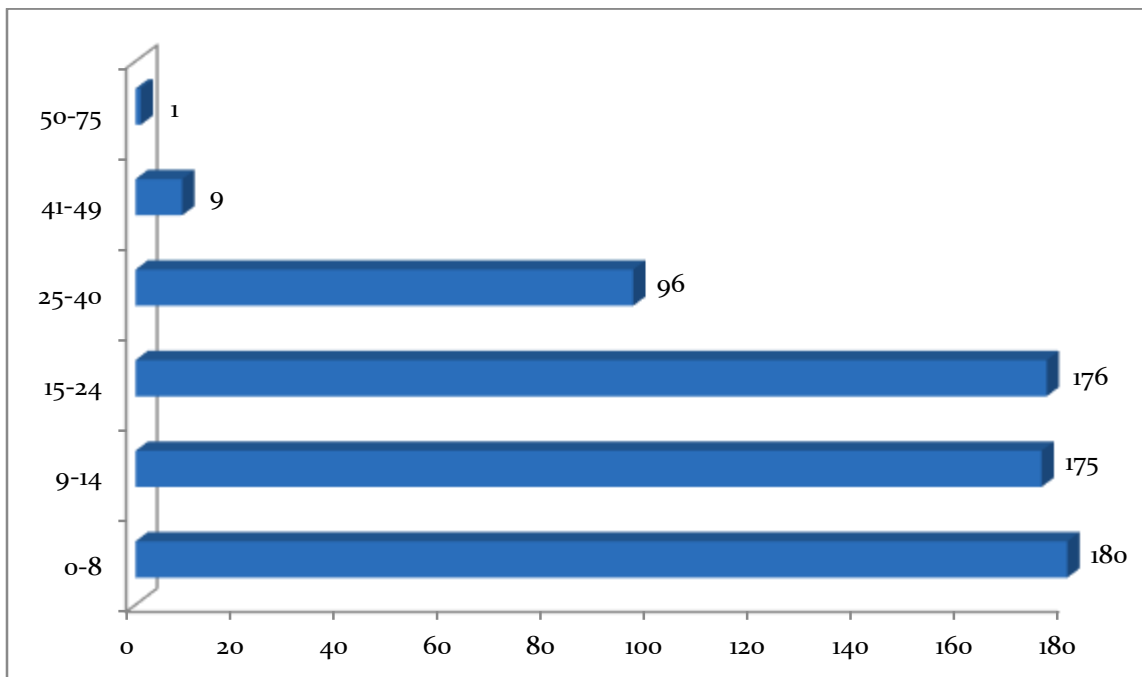


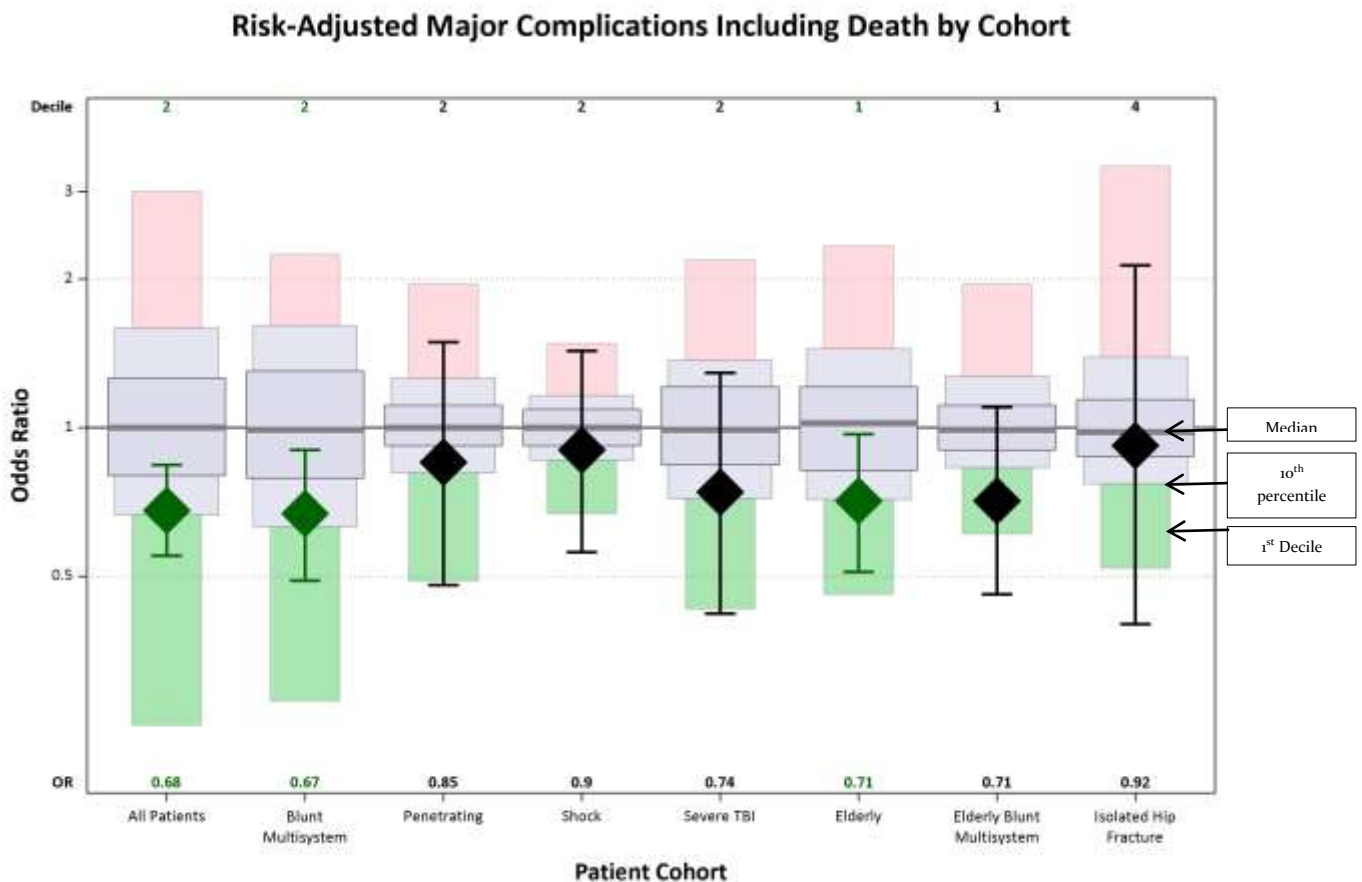
Figure 22. Injury Severity Scores for Patients 65 and Older



Trauma Quality Improvement Program

The American College of Surgeons Trauma Quality Improvement Program (TQIP) collects data from more than 350 participating trauma centers across the United States. The program uses risk-adjusted benchmarking to compare OHSU with other participating facilities. As patient characteristics and injury severity differ across trauma centers, the American College of Surgeons developed statistical models to estimate the outcomes for each hospital, adjusting for patient characteristics.

The chart below shows the risk of major complications and death of OHSU trauma patients for each injury category. The chart expresses the odds of complication and death in deciles. If the odds ratio is in the first decile, the risk of complications and death is lower than 90% of other hospitals. The 1st decile, 10th percentile, and median are noted for the chart below. As you can see, OHSU outperforms the majority of participating facilities in the risk of major complication and death in trauma patients.



Patients 14 Years and Younger

In 2015, the OHSU Trauma Team evaluated 268 patients aged 14 and younger. Of these, 188 (70 percent) were transferred to OHSU from hospitals around the Pacific Northwest. Patient disposition included 215 (80 percent) admitted to OHSU Doernbecher Children's Hospital: 110 (41 percent) to the ICU, 80 (30 percent) to the ward, 20 (8 percent) to the OR, and 3 (1 percent) as direct admissions. Two children (0.7 percent) died as a result of their injuries.

Figure 23. Patient Volume, Age 14 and Younger

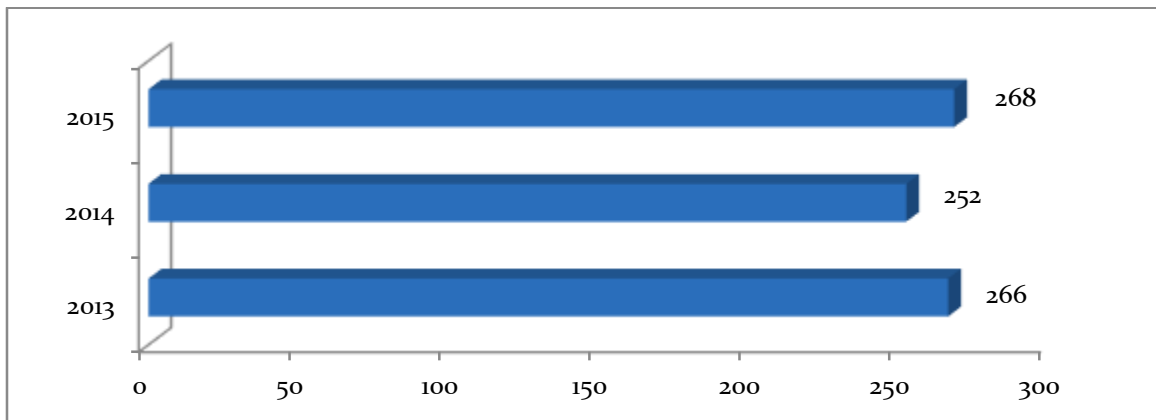


Figure 24. Disposition from the Emergency Department, Patients 14 and Younger

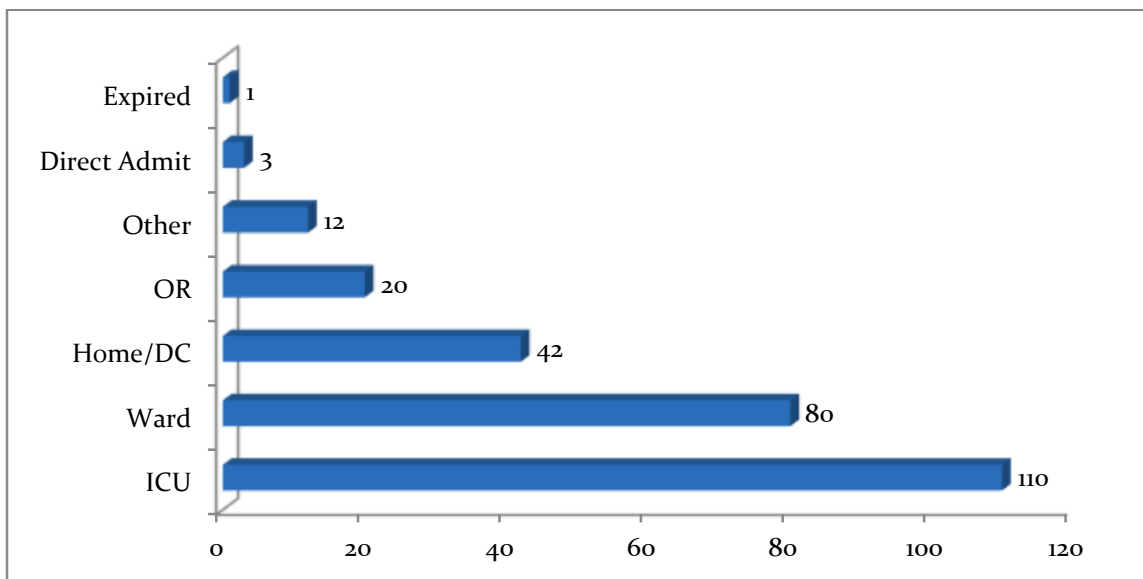
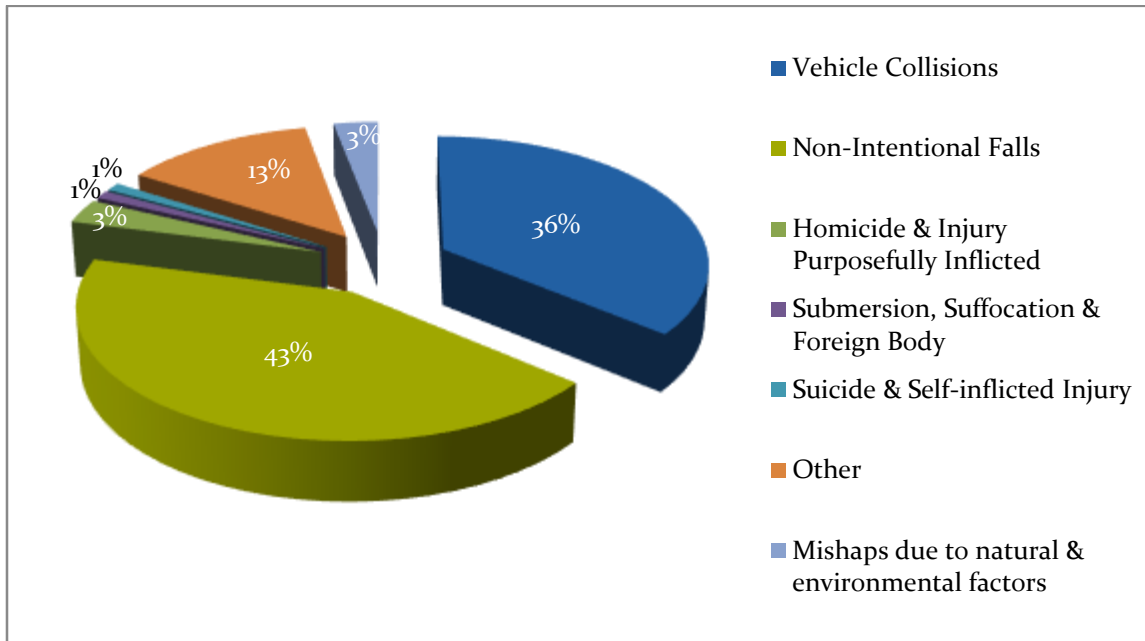
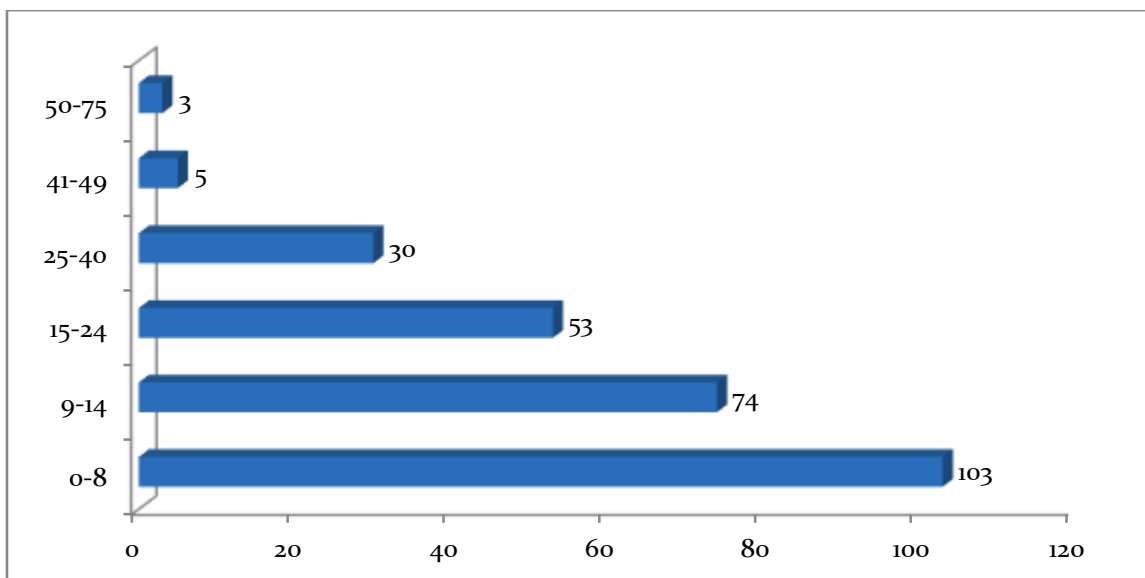


Figure 25. Mechanism of Injury, Patients 14 and Younger



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. Injury Severity Scores for Patients 14 and Younger



2015 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.

In 2015 OHSU ThinkFirst Oregon staff were selected by the ThinkFirst National Injury Prevention Foundation to receive the 2015 Outstanding Community Involvement Award. This competitive award was designed to recognize a chapter for conducting creative ThinkFirst injury prevention initiatives at the community level. In addition, Dr. Ed Neuwelt received the Distinguished Service Award for his contributions to injury prevention. Dr. Neuwelt has served as sponsoring physician for ThinkFirst Oregon for 29 consecutive years.

Table IV. 2015 ThinkFirst Oregon Activity Summary

Community events	33
Number of students addressed at injury prevention seminars	17,140
Number of community members served at community events	19,441
Number of teachers provided with injury prevention materials	200
Community members reached	36,781

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. 2015 Matter of Balance Activity Summary

Number of people attending 2-hour Fall Prevention Seminar	104
Number of people attending 8-week Matter of Balance class	84
Number of people trained to teach fall prevention	28
Community members reached	216

Research

In 2015, under the directorship of Dr. Martin Schreiber, the Trauma Research Laboratory received \$2,389,856 in new funding from the Federal government and private industry. Newly funded areas of research include evaluation of pharmacokinetics and biomarkers in patients with a traumatic brain injury. Ongoing research includes evaluation of the use of tranexamic acid for traumatic brain injury, evaluation of biomarkers to predict the development of PTSD, transfusions in trauma patients, and anti-thrombin III levels and thromboembolic events in trauma patients.

Drs. Schreiber and Susan Rowell continue to study *Pre-hospital Tranexamic (TXA) Acid Use for Traumatic Brain Injury* through the Resuscitation Outcomes Consortium which began enrolling subjects in May of 2015. Dr. Rowell was also awarded her first NIH R01 grant as supplemental funding to the larger study. Dr. Rowell and her co-investigators will evaluate the pharmacokinetics of TXA after infusion and attempt to identify biomarkers that may be used to predict the severity of injury to the brain or outcomes after a TBI.

Dr. Karen Brasel received funding from PCORI through the University of Wisconsin. The project is designed to strengthen the doctor-patient communication centered on the potential outcomes following high risk surgery. Dr. Brasel will begin enrolling surgeons in the spring of 2016 with patient enrollment to follow in June 2016.

Dr. Christopher Connelly received an Early Clinical Investigator award from the Medical Research Foundation of Oregon to assess changes in the endothelium following hemorrhagic shock in obese and non-obese rats. His study is designed to help explain differences in obese patients where endothelial function is impaired following trauma.

James D. Ross, PhD, joined the Division of Trauma, Critical Care & Acute Care Surgery in August as Associate Professor. He will continue the research he was previously working on at the 59th Medical Wing at the Wilford Hall Ambulatory Surgical Center and the Battlefield Health and Trauma Research Institute in San Antonio, Texas. For his first year, he brings \$1,426,686 of funding with him to OHSU. His research focuses on pre-hospital hemorrhage control and resuscitation, identification of therapeutic targets for modulation of the trauma-induced immune and inflammatory response, and multi-functional blood substitutes for use in austere medicine.

Every year surgical residents who are completing a research fellowship in the Trauma Research Lab receive awards for the excellent work they have completed or collaborated on. This last year, Dr. Christopher Connelly won the North Pacific Surgical Association

Resident Competition and the Portland Surgical Society Basic Science Award while Dr. Justin Watson won the American College of Surgeons Region X Committee on Trauma Resident Paper Competition.

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

1. Van PY, Schreiber MA. Hematologic Issues in the Geriatric Surgical Patient. *Surgical Clinics of North America*. 2015;95:129-138.
2. Hinson HE, Rowell S, Schreiber M. Clinical Evidence of Inflammation Driving Secondary Brain Injury: A Systematic Review. *Journal of Trauma and Acute Care Surgery*. 2015;78:184-191.
3. Cook MR, Louis SG, McCully SP, Stucke RS, Fabricant SP, Schreiber MA. Positive Blood Alcohol is Associated with Reduced DVT in Trauma. *Injury*. 2015;46:131-135.
4. Wright DW, Yeatts SD, Silbergleit R, Palesch YY, Hertzberg VS, Frankel M, Goldstein FC, Caveney AF, Howlett-Smith H, Bengelink EM, Manley GT, Merck LH, Janis LS, Barsan WG; NETT Investigators. Very early administration of progesterone for acute traumatic brain injury. *New England Journal of Medicine*. 2014;371:2457-2466.
5. Holcomb JB, Tille BC, Baraniuk S, Fox EE, Wade CE, Podbielske JM, del Junco DJ, Brasel KJ, Bulger EM, Callcut RA, Cohen MJ, Cotton BA, Fabian TC, Inaba K, Kerby JD, Muskat P, O'Keeffe T, Rizoli S, Robinson BR, Scalea TM, Schreiber MA, Stein DM, Weinberg JA, Callum JL, Hess JR, Matijevic N, Miller CN, Pittet JF, Hoyt DB, Pearson GD, Leroux B, van Belle G; PROPPR Study Group. Transfusion of Plasma, Platelets, and Red Blood Cells in a 1:1:1 vs a 1:1:2 Ratio and Mortality in Patients with Severe Trauma: The PROPPR Randomized Clinical Trial. *Journal of the American Medical Association*. 2015;313:471-482.
6. Schreiber MA, Meier EN, Tisherman SA, Kerby JD, Newgard CD, Brasel K, Egan D, Witham W, Williams C, Daya M, Beeson J, McCully BH, Wheeler S, Kannas D, May S, McKnight B, Hoyt DB; ROC Investigators. A Controlled Resuscitation Strategy is Feasible and Safe in Hypotensive Trauma Patients: Results of a Prospective Randomized Pilot Trial. *Journal of Trauma & Acute Care Surgery*. 2015;78:687-697.
7. Newgard CD, Meier EN, McKnight B, Drennan IR, Richardson D, Brasel K, Schreiber M, Kerby JD, Kannas D, Austin M, Bulger EM; ROC Investigators. Understanding traumatic shock: out-of-hospital hypotension with and without other physiologic compromise. *Journal of Trauma & Acute Care Surgery*. 2015;78:342-351.
8. McCully SP, Lee TH, McCully BH, Sands CL, Rick EA, Dean RK, Anderson NW, Hampton DA, Louis SG, Differding JA, Schreiber MA. Reconstitution Fluid Type does not Affect Pulmonary Inflammation or DNA Damage Following Infusion of Lyophilized Plasma. *Journal of Trauma and Acute Care Surgery*. 2015;78:231-239.

9. Fair KA, Gordon NT, Barbosa RR, Rowell SE, Watters JM, Schreiber MA. Traumatic Diaphragmatic Injury in the American College of Surgeons National Trauma Data Bank: Anew Examination of a Rare Diagnosis. *American Journal of Surgery*. 2015;209:864-869.
10. Cook MR, Holcomb JB, Rahbar MH, Fox EE, Alarcon LH, Bulger EM, Brasel KJ, Schreiber MA; PROMMT Study Group. An Abdominal Computed tomography May be Safe in Selected Hypotensive Trauma Patients with Positive Focused Assessment with Sonography in Trauma Examination. *American Journal of Surgery*. 2015;209:834-840.
11. Cook MR, Fair KA, Burg J, Cattin L, Gee A, Arbabi S, Schreiber M; Northwest Trauma Research Collaboration. *American Journal of Surgery*. Cirrhosis Increases Mortality and Splenectomy Rates Following Splenic Injury. 2015;209:841-847.
12. Gordon N, Riha G, Billingsley K, Schreiber M. Malignancy does not Dictate the Hypercoagulable State Following Liver Resection. *American Journal of Surgery*. 2015;209:870-874.
13. Pommerening MJ, Goodman MD, Holcomb JB, Wade CE, Fox EE, Del Junco DJ, Brasel KJ, Bulger EM, Cohen MJ, Alarcon LH, Schreiber MA, Myers JG, Phelan HA, Muskat P, Rahbar M, Cotton BA; MPH on Behalf of the PROMMT Study Group. Clinical Gestalt and the Prediction of Massive Transfusion after Trauma. *Injury*. 2015;46:807-813.
14. Undurraga PV, Diggs B, Ham B, Schreiber M. Does Surgery Residency Prepare Residents to Work at Critical Access Hospitals. *American Journal of Surgery*. 2015;209:828-833.
15. Novak DJ, Bai Y, Cooke RK, Marques MB, Fontaine MJ, Gottschall JL, Carey PM, Scanlan RM, Fiebig EW, Shulman IA, Nelson JM, Flax S, Duncan V, Daniel-Johnson JA, Callum JL, Holcomb JB, Fox EE, Baraniuk S, Tilley BC, Schreiber MA, Inaba K, Rizoli S, Podbielski JM, Cotton BA, Hess JR; PROPPR Study Group. Making Thawed Universal Donor Plasma Available Rapidly for Massively Bleeding Trauma Patients; Experience from the Pragmatic, Randomized Optimal Platelets and Plasma Ratios (PROPPR) Trial. *Transfusion*. 2015;55:1331-1339.
16. Tisherman SA, Schmicker RH, Brasel KJ, Bulger EM, Kerby JD, Minei JP, Powell JL, Reiff DA, Rizoli SB, Schreiber MA. Detailed Description of all Deaths in both the Shock and Traumatic Brain Injury Hypertonic Saline Trials of the Resuscitation Outcomes Consortium. *Annals of Surgery*. 2015;261:586-590.
17. Mesar T, Martin D, Lawless R, Podbielski J, Cook M, Underwood S, Larentzakis A, Cotton B, Fagenholz P, Schreiber M, Holcomb JB, Marini J, Sharma U, Rago AP, King DR. Human Dose Confirmation for Self-expanding Intra-abdominal Foam: A Translational, Adaptive, Multicenter Trial in Recently Deceased Human Subjects. *Journal of Trauma and Acute Care Surgery*. 2015;79:39-49.

18. McCully SP, Martin DT, Cook MR, Gordon NT, McCully BH, Lee TH, Dean RK, Rick EA, Moren AM, Fair KA, Undurraga VJ, Watson KM, Anderson NW, Schreiber MA. Effect of Ascorbic Acid Concentrations on Hemodynamics and Inflammation Following Lyophilized Plasma Transfusion. *Journal of Trauma and Acute Care Surgery*. 2015;79:30-38.
19. Schroll R, Smith A, McSwain NE Jr, Myers J, Rocchi K, Inaba K, Siboni S, Vercruyse GA, Ibrahim-Zada I, Sperry JL, Martin-Gill C, Cannon JW, Holland SR, Schreiber MA, Lape D, Eastman AL, Stebbins CS, Ferrada P, Han J, Meade P, Duchesne JC. A Multi-institutional Analysis of Prehospital Tourniquet Use. *Journal of Trauma and Acute Care Surgery*. 2015;79:10-14.
20. Schreiber MA, McCully BH, Holcomb JB, Robinson BR, Minei JP, Stewart R, Kiraly L, Gordon NT, Martin DT, Rick EA, Dean RK, Wiles C, Anderson N, Sosnovske D, Houser B, Lape D, Cotton B, Gomaa D, Cripps MW, DeRosa M, Underwood SJ. Transfusion of Cryopreserved Packed Red Blood Cells is Safe and Effective after Trauma: A Prospective Randomized Trial. *Annals of Surgery*. 2015;262:426-433.
21. Andrusiek DL, Szydlo D, May S, Brasel KJ, Minei J, van Heest R, MacDonald R, Schreiber M. A Comparison of Invasive Airway Management and Rates of Pneumonia in Prehospital and Hospital Settings. *Prehospital Emergency Care*. 2015;19:475-481.
22. Pommerening MJ, Rahbar E, Minei K, Holcomb JB, Wade CE, Schreiber MA, Cohen MJ, Underwood SJ, Nelson M, Cotton BA. Splenectomy is Associated with Hypercoagulable Thrombelastography Values and Increased Risk of Thromboembolism. *Surgery*. 2015;158:618-626.
23. Moore SE, Decker A, Hubbard A, Callcut RA, Fox EE, Del Junco DJ, Holcomb JB, Rahbar MH, Wade CE, Schreiber MA, Alarcon LH, Brasel KJ, Bulger EM, Cotton BA, Muskat P, Myers JG, Phelan HA, Cohen MJ; PROMMT Study Group. *PloS One*. 2015;Aug 21;10(8):E0136438.
24. Elterman J, Zonies D, Stewart I, Fang R, Schreiber M. Rhabdomyolysis and Acute Kidney Injury in the Injured Warfighter. *Journal of Trauma and Acute Care Surgery*. 2015;79:S171-S174.
25. Gaskin D, Kroll NA, Ochs AA, Schreiber MA, Pandalai PK. Far Forward Anesthesia and Massive Blood Transfusion: Two Cases Revealing the Challenge of Damage Control Resuscitation in an Austere Environment. *AANA Journal*. 2015;83:337-343.
26. Barton CA, Johnson NB, Case J, Warden B, Hughes D, Zimmerman J, Roberti G, McMillan WD, Schreiber M. Risk of Thromboembolic Events after Protocolized Warfarin Reversal with 3-Factor Prothrombin Complex Concentrate and Factor VIIa. *American Journal of Emergency Medicine*. 2015;33:1562-1566.
27. Connelly CR, Schreiber MA. Endpoints in Resuscitation. *Current Opinion in Critical Care*. 2015;21:512-519.

28. Gaskin D, Kroll NA, Ochs AA, Schreiber MA, Pandalai PK. Far Forward Anesthesia and Massive Blood Transfusion: Two Cases Revealing the Challenge of Damage Control Resuscitation in an Austere Environment. *American Association of Nurse Anesthetists Journal*. 2015;83:337-343.
29. Moren AM, Hampton D, Diggs B, Kiraly L, Fox EE, Holcomb JB, Rahbar MH, Brasel KJ, Cohen MJ, Bulger EM, Schreiber MA, on Behalf of the PROMMT Study Group. Recursive Partitioning Identifies Greater Than 4 U of Packed Red Blood Cells per Hour as an Improved Massive Transfusion Definition. *Journal of Trauma and Acute Care Surgery*. 2015;79:920-924.
30. Biffl W, Moore EE, Feliciano DV, Albrecht RA, Croce M, Karmy-Jones R, Namias N, Rowell S, Schreiber M, Shatz DV, Brasel K. Western Trauma Association Critical Decisions in Trauma: Diagnosis and Management of Esophageal Injuries. *Journal of Trauma and Acute Care Surgery*. 2015;79:1089-1095.
31. Malhotra A, Biffl WL, Moore EE, Schreiber M, Albrecht RA, Cohen M, Croce M, Karmy-Jones R, Namias N, Rowell S, Shatz DV, Brasel KJ. Western Trauma Association Critical Decision in Trauma: Diagnosis and Management of Duodenal Injuries. *Journal of Trauma and Acute Care Surgery*. 2015;79:1096-1101.
32. Crawford JD, Allan KM, Patel KU, Hart KD, Schreiber MA, Azarbal AF, Liem TK, Mitchell EL, Moneta GL, Landry GJ. The Natural History of Indeterminate Blunt Cerebrovascular Injury. *JAMA Surgery*. 2015;150:841-847.
33. Connelly CR, Laird A, Barton JS, Fischer PE, Krishnaswami S, Schreiber MA, Zonies DH, Watters JW. A Clinical Tool for the Prediction of Venous Thromboembolism in Pediatric Trauma Patients. 2015;Sep 30. [Epub ahead of print].