OREGON HEALTH & SCIENCE UNIVERSITY

2016 Trauma Program Report

Transforming Trauma Care

Summary

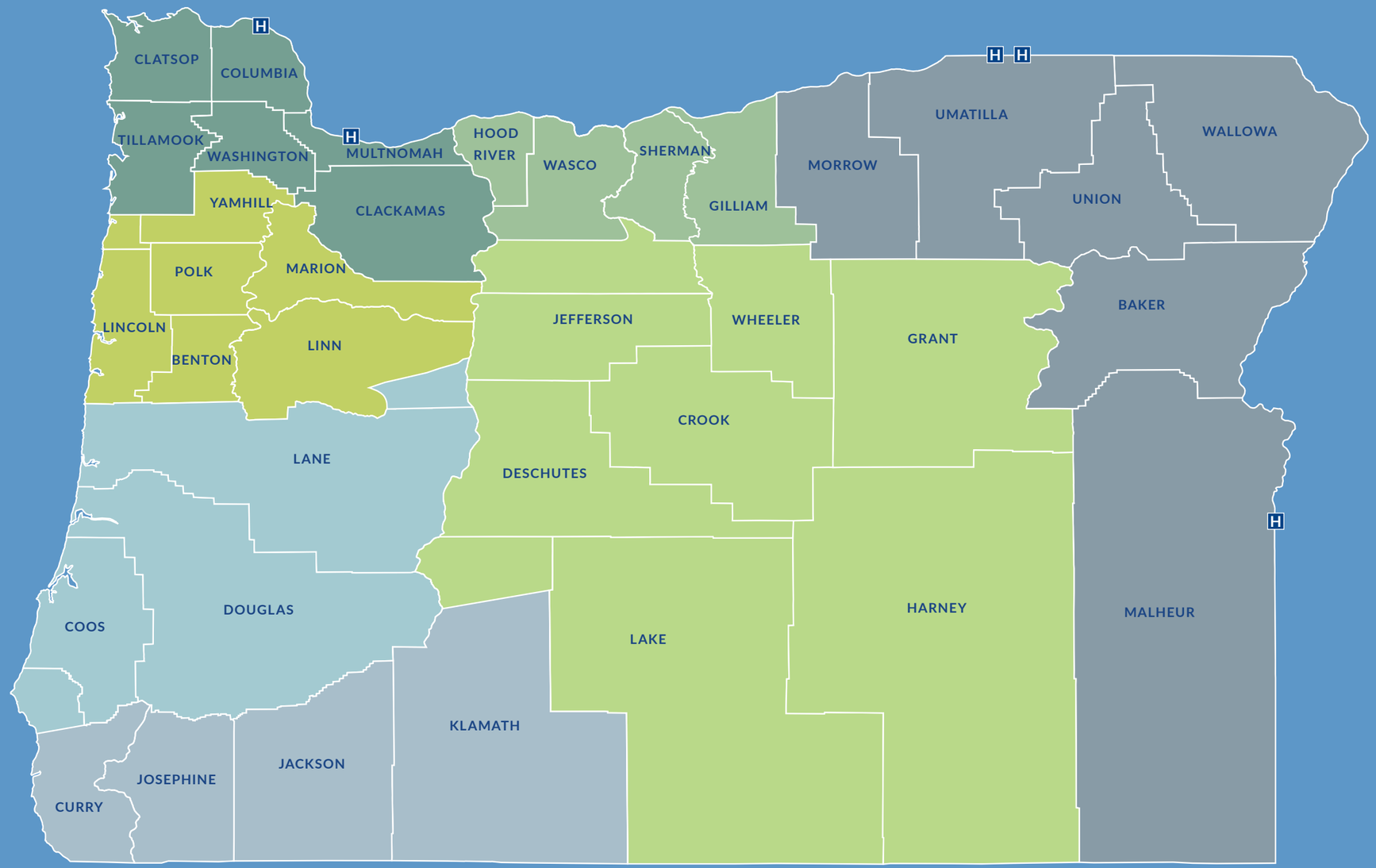
- In 2016, the Trauma Service at OHSU treated 3,003 patients.
- Of those patients, 1,959 (65 percent) were brought to OHSU directly from the scene of injury, and 1,044 (35 percent) were transferred from another hospital.
- The mean injury severity score of admitted patients was 12.2.
- The number of patients increased in every age group except for those aged 15–24 and 56–64.
- 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 38 research papers and receiving more than $8 million in new and continued funding.

The OHSU Trauma Service Team.

Table of contents

OHSU trauma system background

Oregon's area trauma advisory board regions



MAP COURTESY OF OREGON DHS: http://egov.oregon.gov/DHS/ph/ems/trauma/docs/hosp-map.pdf

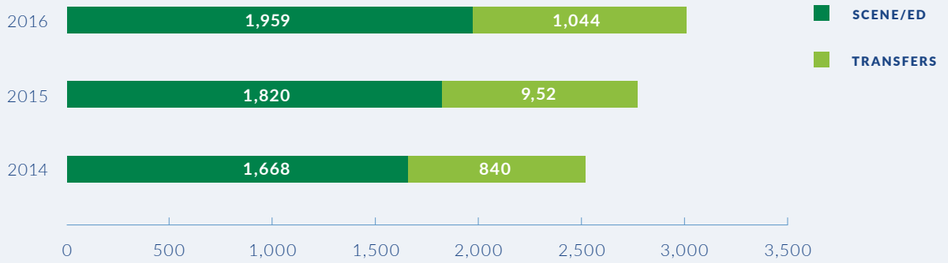
Oregon's statewide trauma system is based on landmark legislation. Statutory authority was passed in 1985 by the state legislature as ORS 431.607 – 431.633 under the leadership of the president of the Oregon Senate, John Kitzhaber, M.D., and signed into law by Governor Victor Atiyeh. With the implementation of the trauma system in May 1988, only two Oregon hospitals, OHSU and Legacy Emanuel Hospital, were designated as 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.

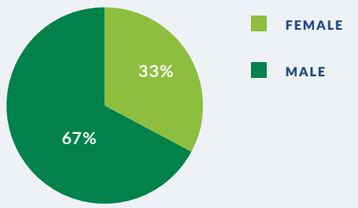
Trauma statistics

In 2016, the OHSU Trauma Program total patient volume increased by 234 patients from 2015, an 8 percent increase.

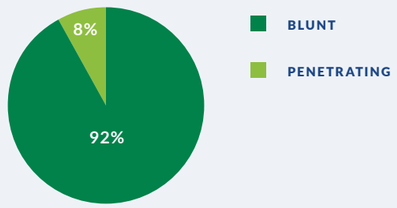
Patient volume 2014–2016



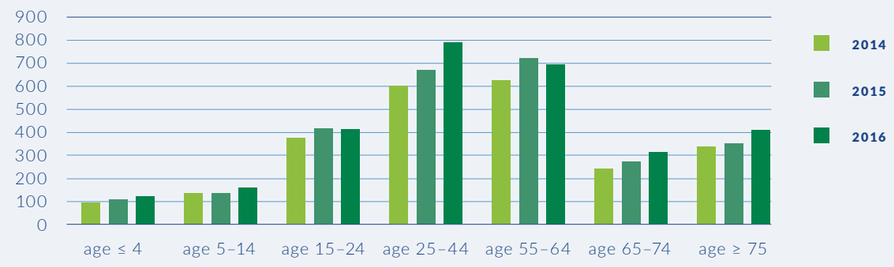
Gender distribution of patients treated by the OHSU trauma program



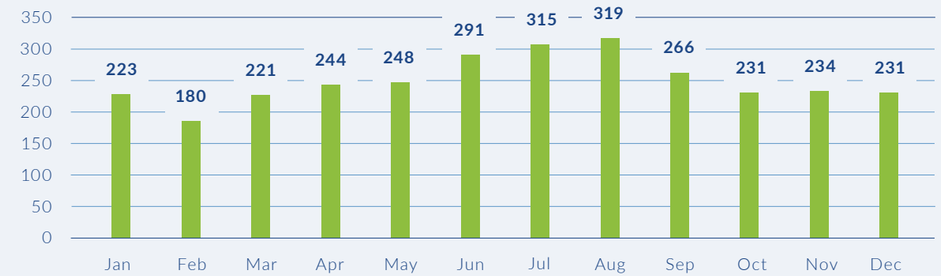
Patients treated by the OHSU Trauma Program: blunt versus penetrating injuries



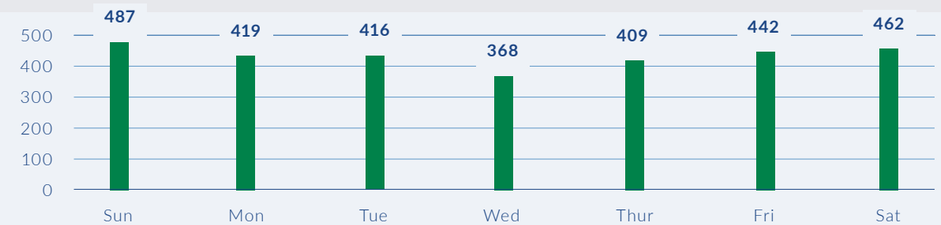
Age distribution of patients treated by the OHSU trauma program



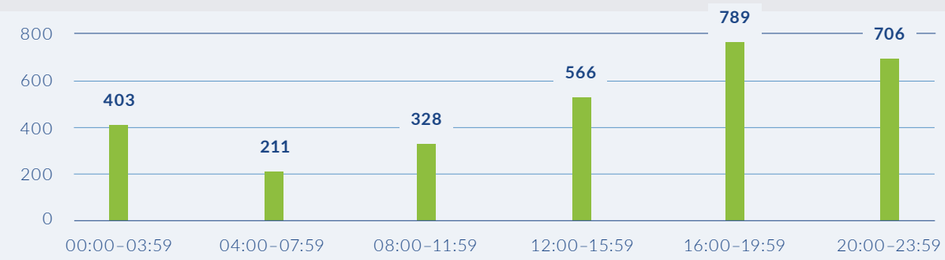
Distribution of patients by month



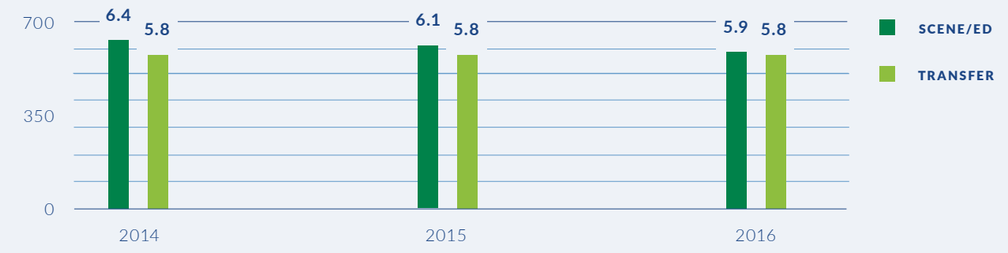
Distribution of patients by day of week



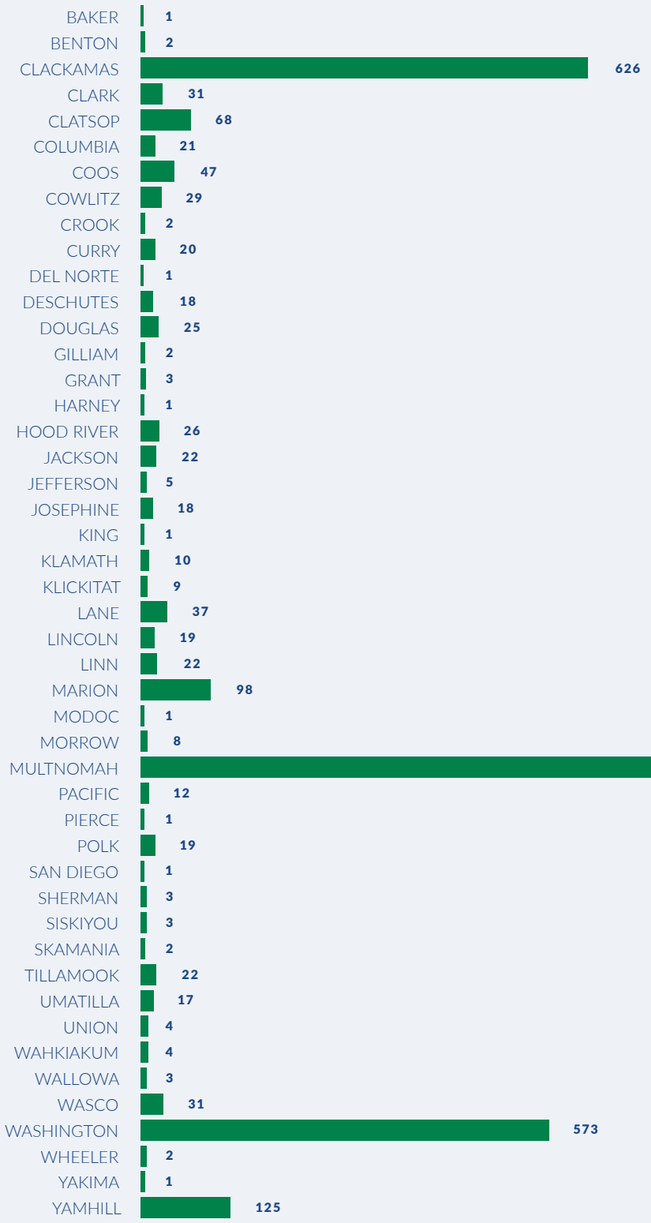
Distribution of patients by time of arrival



Total hospital length of stay of admitted patients



County of origin, patients treated by the OHSU trauma team



Trauma team response

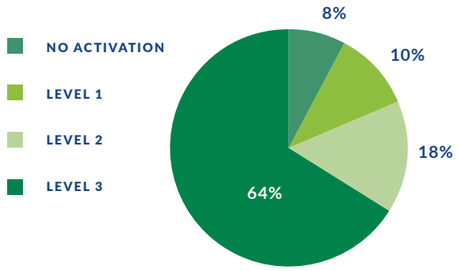
The OHSU Trauma Program uses a three-tiered system to evaluate injured patients. The level of activation is based on information provided by pre-hospital personnel (Tables I and II). In the Portland metropolitan area, paramedics evaluate patients at the scene of injury and enter them into the trauma 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.

OHSU trauma team configuration based on triage criteria

Level 1	Level 2	Level 3
Staff trauma surgeon	Staff trauma surgeon	
Staff anesthesiologist		
Staff ED physician	Staff ED physician	Staff ED physician
Trauma chief resident	Trauma chief resident	Trauma chief resident
Emergency medicine resident	Emergency medicine resident	Emergency medicine resident
Respiratory care practitioner	Respiratory care practitioner	Respiratory care practitioner
Primary trauma nurse	Primary trauma nurse	Primary trauma nurse
Trauma recording nurse		
Procedure nurse	Procedure nurse	Procedure nurse
Transportation aide		

ED = EMERGENCY DEPARTMENT

OHSU trauma team response by level of activation



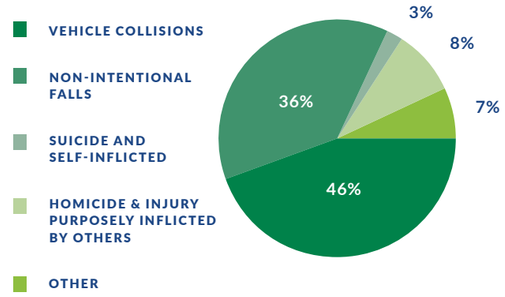
Three-tiered response triage criteria

Level 1 Criteria	Level 2 Criteria	Level 3 Criteria
Physiologic	**Anatomic**	**Mechanism of Injury**
GCS < 9 and not intubated	Intubated patient	Fall > 20 feet
Inadequate airway/need for emergency airway control or presence of supraglottic airway (KING, combitube, etc.)	Two or more long-bone fractures	Death in same passenger compartment
Shock, defined as: Systolic BP < 90 (> 11 years to adult) Systolic BP < 80 (5–11 years) Systolic BP < 70 (2–4 years) Systolic BP < 60 (0–2 years)	Penetrating injury to head, neck or torso	Extrication > 20 minutes
Immediate need for operating room or planned direct admission to the operating room	Crush injury to torso or upper thigh	Rollover motor vehicle crash
Patients receiving blood transfusion to maintain blood pressure > 90	Amputation proximal to wrist or ankle	Ejection from motor vehicle
	Pelvic instability	Auto vs. pedestrian > 5 mph
	Paralysis	Special considerations, age < 5
	Flail chest	**Paramedic discretion:** MCC, ATV, bicycle crash Significant intrusion/impact Hostile environment (cold/heat) Preexisting medical issues Presence of intoxicants Pregnancy
	Presence of a tourniquet	
	Respirations > 22 (age ≥ 15) AND suspected blunt chest injury	
Emergency medicine discretion	Emergency medicine discretion	Emergency medicine discretion

Mechanism of Injury

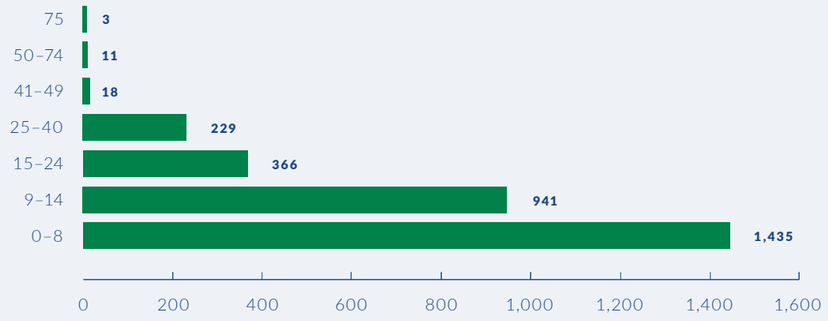
Although motor vehicle crashes remain the most common mechanism of injury overall, falls continue to be a significant source of trauma. Falls continue to be the leading mechanism of injury for older adults.

Causes of injury for patients seen by the OHSU trauma team



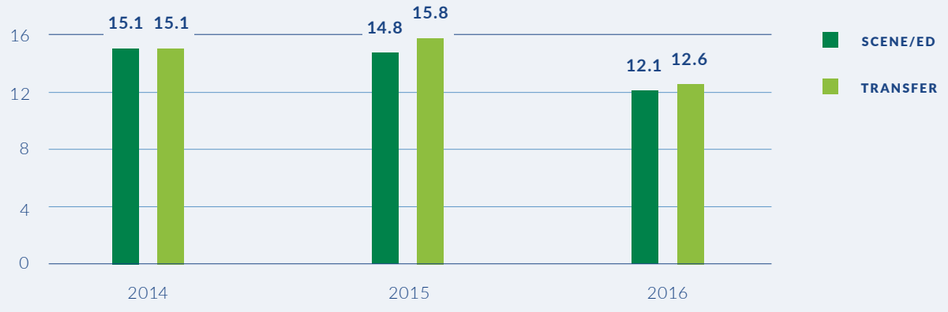
Injury severity scores for patients treated by OHSU trauma team

Injury Severity Score is an estimate of the overall severity of the patient's injuries. Scores can range from 0 to 75. An ISS of 15 or more denotes a serious injury (see Appendix A).



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.



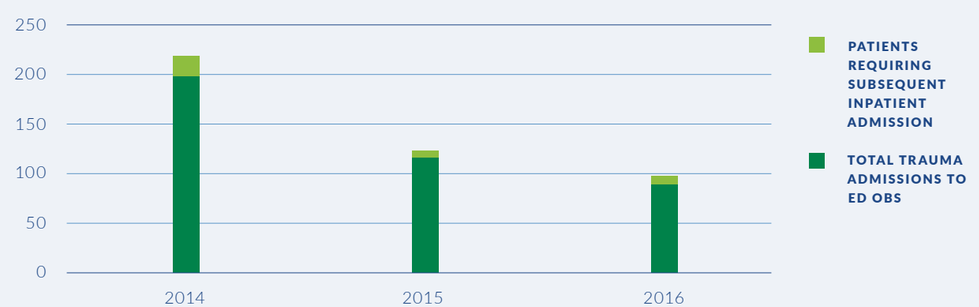
Disposition and outcome for patients treated by OHSU trauma team

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 2016, 12 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, which requires more intensive service and care. The ED OBS unit continues to be an effective way to ensure efficient use of inpatient beds while providing quality medical care for injured patients.

Physician assistants Kristy Aghayan and Mindy Hamilton review patient care in the ICU.

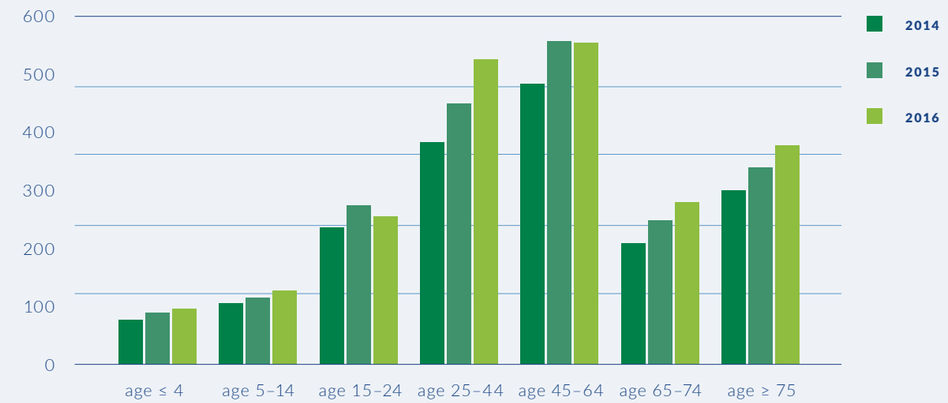
Number of patients sent to Emergency Observation Unit



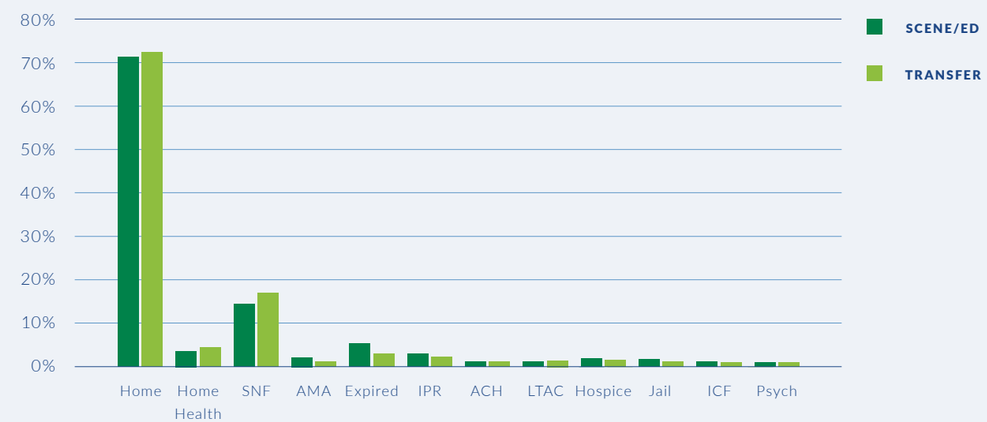
Hospital admissions via OHSU trauma program

In 2016, we admitted 2,179 patients (73 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).

Patients requiring hospitalization after trauma team care



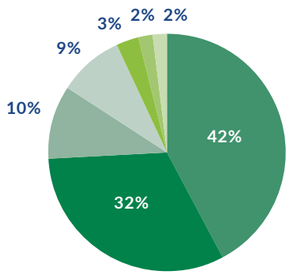
Disposition of admitted patients after hospital discharge



Mortality

In 2016, 93 patients (3.1 percent) expired. Eleven patients expired in the Emergency Department and 82 after hospital admission.

Trauma nurses Dan Ferrante and Kate Deem discuss patient care on the trauma ward.

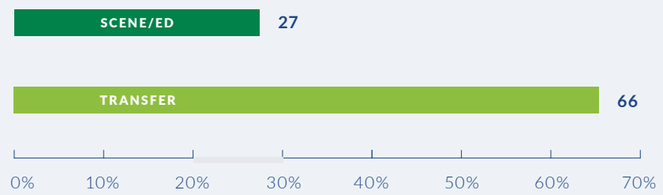


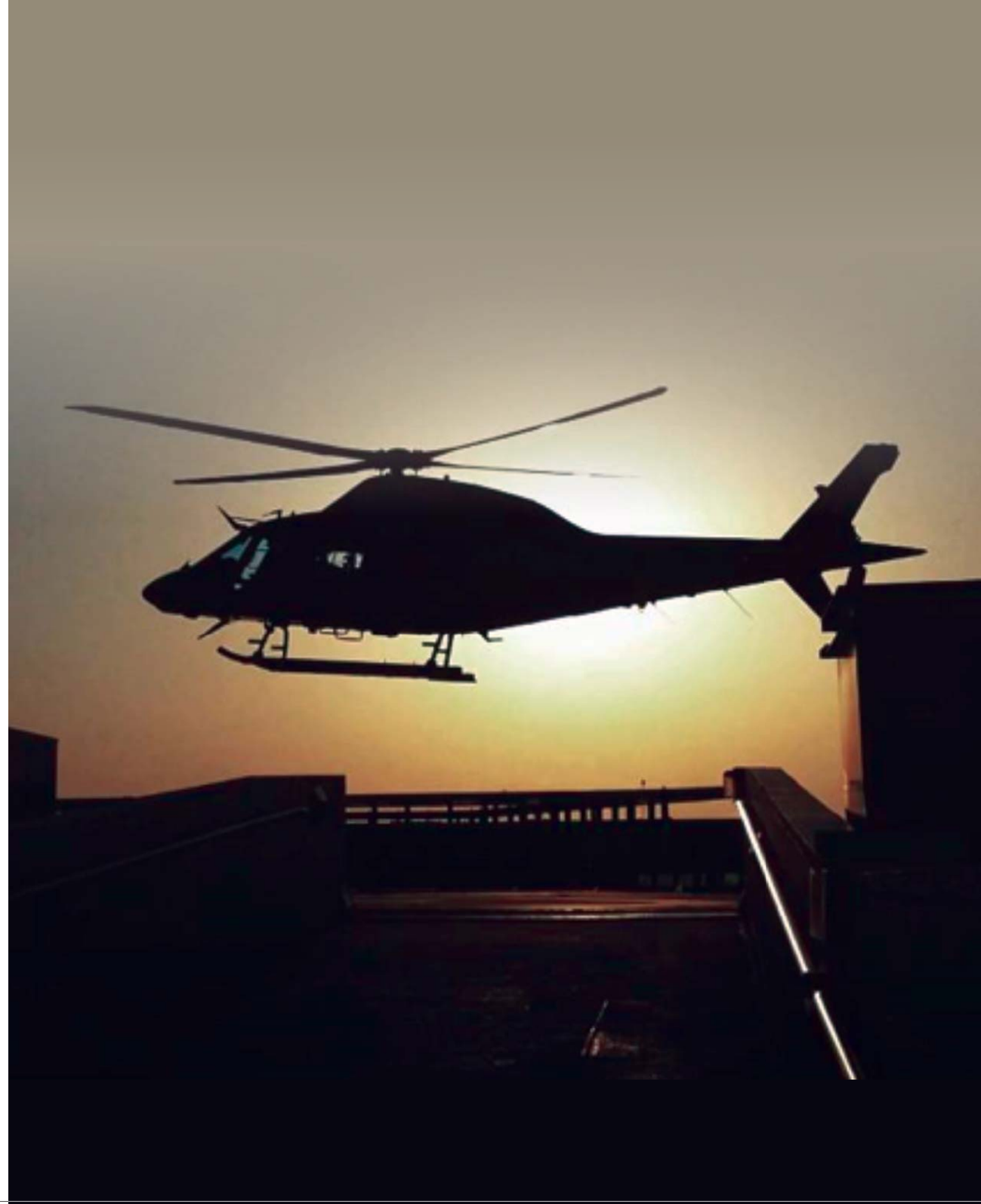
Cause of death

Deaths from vehicle collisions surpassed those from falls this year.

- FALLS
- VEHICLE COLLISIONS
- HOMICIDE
- OTHER
- SUICIDE
- LEGAL INTERVENTION
- SUBMERSION OR SUFFOCATION

Total deaths by arrival status



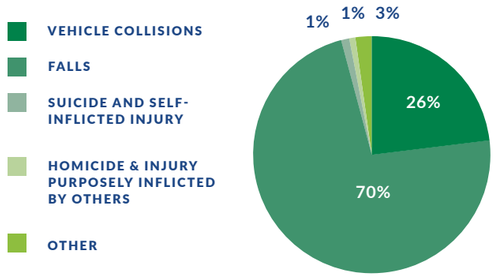


Care for patients older than 64

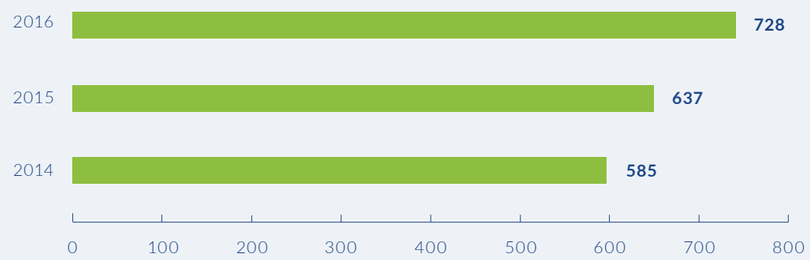
In 2016, the OHSU Trauma Team treated 728 patients older than 64, a 14 percent increase. Of these, 346 (48 percent) were transferred to OHSU from another hospital or clinic. Most of the transfer patients were injured in falls. Of the 728 injured patients, 629 (86 percent) required hospital admission.

Figures 19–22 provide additional information regarding Trauma Team care for patients older than 64 at OHSU.

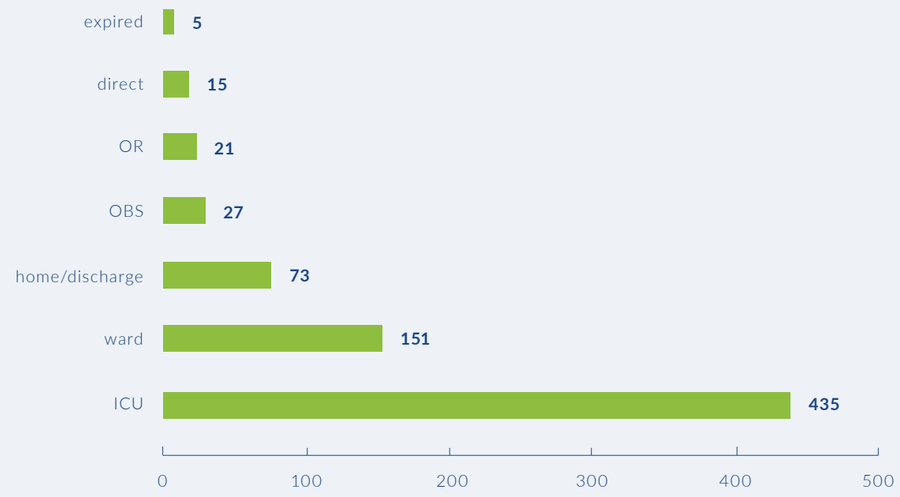
Mechanism of injury, age 65 and older



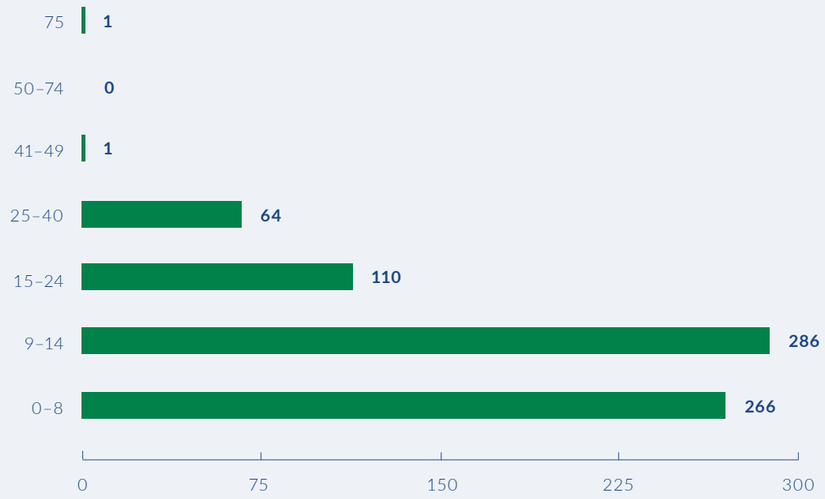
Patient volume, age 65 and older



Distribution from the emergency department, patients 65 and older



Injury severity scores for patients 65 and older

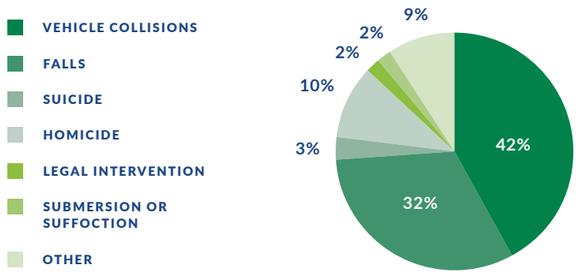


Patients 14 years and younger

Pediatric neurosurgeon Dr. Nathan Selden in the Doernbecher operating room.

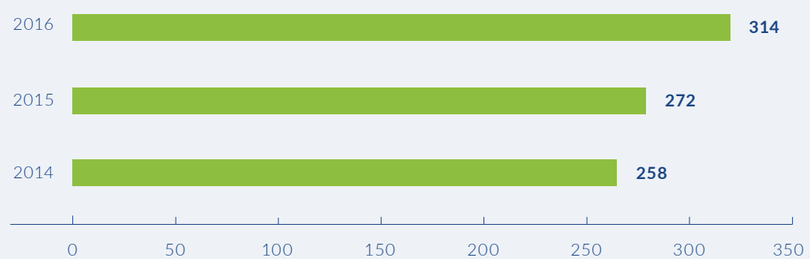
In 2016, the OHSU Trauma Team evaluated 314 patients aged 14 and younger. Of these, 202 (64 percent) were transferred to OHSU from hospitals around the Pacific Northwest. Patient disposition included 232 (74 percent) admitted to OHSU Doernbecher Children's Hospital: 96 (31 percent) to the ICU, 96 (31 percent) to the ward, 27 (9 percent) to the OR, and 13 (4 percent) as direct admissions. Six children (1.9 percent) died as a result of their injuries.

Mechanism of injury, patients 14 and younger

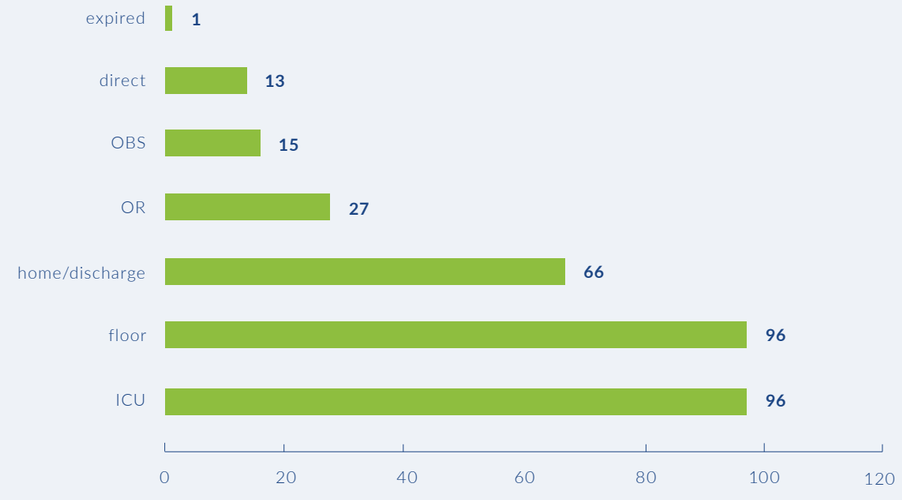


The "other" category includes patients with sports-related injuries, those struck by a falling object and those with injuries accidentally inflicted by others.

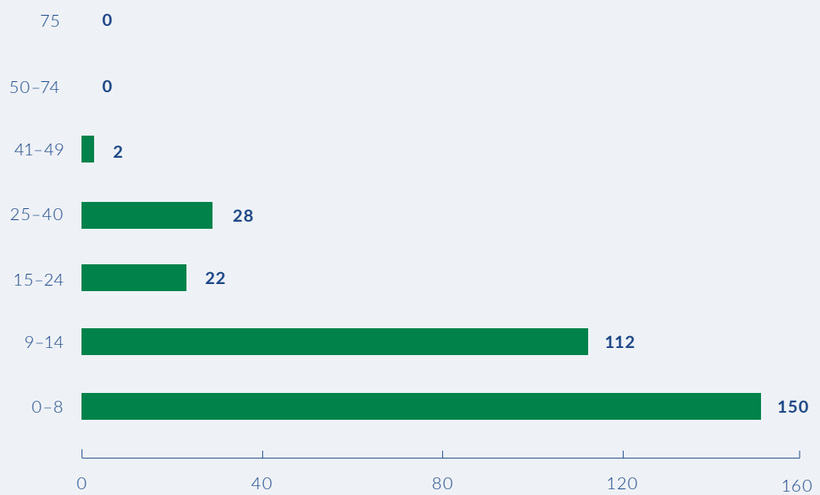
Patient volume, patients 14 and younger



Disposition from the emergency department, patients 14 and younger



Injury severity scores for patients 14 and younger

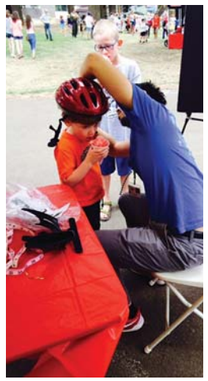


2016 injury prevention activities

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.

2016 ThinkFirst Oregon activity summary	
31	community events
7,023	number of students addressed at injury prevention seminars
29,847	number of community members served at community events
147	number of teachers provided with injury prevention materials
36,870	community members reached



OHSU ThinkFirst community events.

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.

2016 Matter of Balance activity summary	
165	number of people attending 2-hour Fall Prevention Seminar
142	number of people attending 8-week Matter of Balance class
18	number of people trained to teach fall prevention
307	community members reached

Matter of Balance graduates.

Trauma Faculty

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

Karen Brasel, M.D.
SPEAKING TOPICS: POST-TRAUMATIC STRESS DISORDER, ETHICS IN TRAUMA

Albert Chi, M.D.
SPEAKING TOPICS: TARGETED MUSCLE REINNERVATION AND ADVANCED PROSTHETICS

Bruce Ham, M.D.
SPEAKING TOPICS: RURAL TRAUMA TEAM DEVELOPMENT COURSE, RURAL TRAUMA, RIB FRACTURES

Laszlo Kiraly, M.D.
SPEAKING TOPICS: SURGICAL NUTRITION, EDUCATION OF MEDICAL STUDENTS AND RESIDENTS

Darren Malinoski, M.D.
SPEAKING TOPICS: GENERAL TRAUMA, ORGAN DONATION

Richard Mullins, M.D.
SPEAKING TOPICS: TOP 10 TRAUMA PAPERS OF THE YEAR; TOP FIVE TRAUMA PAPERS OF THE DECADE; DIAGNOSIS AND TREATMENT OF PATIENTS 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: MILITARY TRAUMA CARE, GENERAL TRAUMA

Jennifer Watters, M.D.
SPEAKING TOPICS: CRITICAL CARE, GENERAL TRAUMA

David Zonies, M.D.
SPEAKING TOPICS: ECMO, MILITARY TRAUMA CARE, ADVANCED VENTILATOR MANAGEMENT

Trauma Advanced Practice Providers

Kristy Aghayan
TRAUMA PHYSICIAN ASSISTANT

Alanna Birner
TRAUMA NURSE PRACTITIONER

Staci Colovos
TRAUMA NURSE PRACTITIONER

Laura Dillon
TRAUMA PHYSICIAN ASSISTANT

Mindy Hamilton
TRAUMA PHYSICIAN ASSISTANT

Jessica Jurkovich
TRAUMA NURSE PRACTITIONER

Nicole Kirker
TRAUMA NURSE PRACTITIONER

Ryan McMahon
TRAUMA PHYSICIAN ASSISTANT

Rose Milano
TRAUMA NURSE PRACTITIONER

Scott Sherry
EMERGENCY GENERAL SURGERY PHYSICIAN ASSISTANT

Jake Wheeler
TRAUMA PHYSICIAN ASSISTANT

Pediatric Trauma Faculty

Kenneth Azarow, M.D., F.A.C.S., F.A.A.P.

Marilyn Butler, M.D.

Elizabeth Fialkowski, M.D.

Cynthia Gingalewski, M.D.

Nick Hamilton, M.D

Margo Hendrickson, M.D.

Mubeen Jafri, M.D.

Sanjay Krishnaswami, M.D.

Andrew Zigman, M.D.

Trauma Nursing Faculty

Lynn Eastes, M.S., R.N., A.C.N.P.-B.C.
TRAUMA PROGRAM MANAGER

Pam Bilyeu, M.N., R.N., T.C.R.N
TRAUMA COORDINATOR

Anne Larkin, M.S.N., R.N., N.E.-B.C., R.N.C.
NURSE MANAGER, TRAUMA ACUTE CARE UNIT

Desi McCue, B.S.N., R.N.
NURSE MANAGER, EMERGENCY DEPARTMENT

Denise Langley, R.N., B.S.N., MBA-M, C.E.N., C.P.E.N.
NURSE MANAGER, PEDIATRIC EMERGENCY DEPARTMENT

Maureen O'Hara, B.S.N., M.P.H.:HA, R.N.
NURSE MANAGER, PEDIATRIC INTERMEDIATE CARE UNIT

Paula Bennett, R.N., M.S.N., M.H.A., A.C.M.
NURSE MANAGER, PEDIATRIC ACUTE UNITS

Lori Moss, B.S.N., R.N., C.C.R.N..
PEDIATRIC TRAUMA PROGRAM MANAGER

Research

In 2016, under the directorship of Martin Schreiber, M.D., the Trauma Research Laboratory received $8,029,182 in new and continued funding from the federal government and private industry. Newly funded areas of research include the use of stem cells for the prevention of ARDS, novel interventions for non-compressible torso hemorrhage and prothrombin complex concentrate for control of hepatic hemorrhage.

The Department of Defense (DOD) awarded the University of Pittsburg in collaboration with OHSU and the University of Colorado up to $90 million to conduct research in trauma for the next five to 10 years. The first task is designed to develop a network of trauma centers to conduct detailed research into injury care. The LITES (Linking Investigations in Trauma and Emergency Services) Network will lead the way in improving care for both civilians and military personnel following traumatic injury.

Dr. Schreiber and Belinda McCully, M.D., were awarded a DOD grant to evaluate the use of mesenchymal stem cells to prevent acute respiratory distress syndrome (ARDS). This will be a three-year project that will involve collaborations with University of California at San Francisco. The project will help determine if IV infusion of mesenchymal stem cells given after injury might help prevent the development of ARDS, in addition to identifying the mechanism of how these stem cells might decrease inflammation, vascular leak, and hypercoagulability.

Miriam Treggiari, M.D., and David Zonies, M.D., received funding to assess whether blood pressure manipulation in spinal cord injury patients will improve long-term neurological and functional outcomes. This multicenter, randomized, controlled clinical trial is also funded by the DOD and will be carried out at five hospitals across the U.S.

Esther Choo, M.D., and Karen Brasel, M.D., received funding from the Insurance Institute for Highway Safety to examine the prevalence, patterns, and context of cannabis use among adults presenting to the Emergency Department following a motor vehicle collision (MVC) and to estimate the relative risk of MVC after cannabis use, with and without alcohol.

Albert Chi, M.D., joined the Division of Trauma, Critical Care & Acute Care Surgery in August as associate professor from John Hopkins University. He will serve as medical director of the new Targeted Muscle Reinnervation Program at OHSU. His research interests are in targeted muscle reinnervation for upper extremity amputees, evaluation of modular prosthetic limb using motor and sensory capabilities, and human/computer interface for spinal cord injury patients using eye control and robotics.

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

1. *Contemporary thromboprophylaxis of trauma patients.* Van PY, Schreiber MA. Curr Opin Crit Care. 2016 Dec;22(6):607-612. PMID: 27749357
2. *Should Family Presence Be Allowed During Cardiopulmonary Resuscitation?* Brasel KJ, Entwistle JW 3rd, Sade RM. Ann Thorac Surg. 2016 Nov;102(5):1438-1443. doi: 10.1016/j.athoracsur.2016.02.011. PMID: 27772571
3. *Predicting the proportion of full-thickness involvement for any given burn size based on burn resuscitation volumes.* Liu NT, Salinas J, Fenrich CA, Serio-Melvin ML, Kramer GC, Driscoll IR, Schreiber MA, Cancio LC, Chung KK. J Trauma Acute Care Surg. 2016 Nov;81(5 Suppl 2 Proceedings of the 2015 Military Health System Research Symposium):S144-S149. PMID: 27768662
4. *Plasma Transfusion: History, Current Realities, and Novel Improvements.* Watson JJ, Pati S, Schreiber MA. Shock. 2016 Nov;46(5):468-479. PMID: 27380536
5. *Thrombelastography-Based Dosing of Enoxaparin for Thromboprophylaxis in Trauma and Surgical Patients: A Randomized Clinical Trial.* Connelly CR, Van PY, Hart KD, Louis SG, Fair KA, Erickson AS, Rick EA, Simeon EC, Bulger EM, Arbabi S, Holcomb JB, Moore LJ, Schreiber MA. JAMA Surg. 2016 Oct 19;151(10):e162069. doi: 10.1001/jamasurg.2016.2069. Epub 2016 Oct 19. PMID: 27487253
6. *Engaging Patients, Health Care Professionals, and Community Members to Improve Preoperative Decision Making for Older Adults Facing High-Risk Surgery.* Steffens NM, Tucholka JL, Nabozny MJ, Schmick AE, Brasel KJ, Schwarze ML. JAMA Surg. 2016 Oct 1;151(10):938-945. doi: 10.1001/jamasurg.2016.1308. PMID: 27368074
7. *Overseas organ donation during wartime operations: Benchmarking military performance against civilian practice.* Oh JS, Malinoski D, Martin KD, De La Cruz JS, Zonies D. Am J Surg. 2017 Feb 14. pii: S0002-9610(16)30636-5. doi: 10.1016/j.amjsurg.2017.01.024. [Epub ahead of print] PMID: 28233540
8. *Advanced extracorporeal therapy in trauma.* Zonies D, Merkel M. Curr Opin Crit Care. 2016 Dec;22(6):578-583. PMID: 27811560
9. *Early traumatic brain injury screen in 6594 inpatient combat casualties.* Connelly C, Martin K, Elterman J, Zonies D. Injury. 2017 Jan;48(1):64-69. doi: 10.1016/j.injury.2016.08.025. Epub 2016 Sep 7. PMID: 27639602
10. *Global, regional, and national disability-adjusted life-years (DALYs) for 315 diseases and injuries and healthy life expectancy (HALE), 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015.* GBD 2015 DALYs and HALE Collaborators. Lancet. 2016 Oct 8;388(10053):1603-1658. doi: 10.1016/S0140-6736(16)31460-X. PMID: 27733283
11. *Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015.* GBD 2015 Mortality and Causes of Death Collaborators. Lancet. 2016 Oct 8;388(10053):1459-1544. doi: 10.1016/S0140-6736(16)31012-1. PMID: 27733281

12. *Measuring the health-related Sustainable Development Goals in 188 countries: a baseline analysis from the Global Burden of Disease Study 2015.* GBD 2015 SDG Collaborators. Lancet. 2016 Oct 8;388(10053):1813-1850. doi: 10.1016/S0140-6736(16)31467-2. Epub 2016 Sep 21. PMID: 27665228

13. *Why We Move: Social Mobility Behaviors of Non-Disabled and Disabled Children across Childcare Contexts.* Logan SW, Ross SM, Schreiber MA, Feldner HA, Lobo MA, Catena MA, MacDonald M, Galloway JC. Front Public Health. 2016 Sep 21;4:204. eCollection 2016. PMID: 27709110

14. *Western Trauma Association Critical Decisions in Trauma: Management of pelvic fracture with hemodynamic instability-2016 updates.* Tran TL, Brasel KJ, Karmy-Jones R, Rowell S, Schreiber MA, Shatz DV, Albrecht RM, Cohen MJ, DeMoya MA, Biffl WL, Moore EE, Namias N. J Trauma Acute Care Surg. 2016 Dec;81(6):1171-1174. PMID: 27537512

15. *Long-Term Nutrition: A Clinician's Guide to Successful Long-Term Enteral Access in Adults.* Bechtold ML, Mir FA, Boumitri C, Palmer LB, Evans DC, Kiraly LN, Nguyen DL. Nutr Clin Pract. 2016 Sep 22. pii: 0884533616670103. [Epub ahead of print] Review. PMID: 27660070

16. *Teaching communication and supporting autonomy with a team-based operative simulator.* Cook MR, Deal SB, Scott JM, Moren AM, Kiraly LN. Am J Surg. 2016 Sep;212(3):552-6. doi: 10.1016/j.amjsurg.2016.03.011. Epub 2016 Jun 12. PMID: 27378354

17. *General surgery resident rotations in surgical critical care, trauma, and burns: what is optimal for residency training?* Napolitano LM, Biester TW, Jurkovich GJ, Buyske J, Malangoni MA, Lewis FR Jr; Members of the Trauma, Burns and Critical Care Board of the American Board of Surgery. Am J Surg. 2016 Oct;212(4):629-637. doi: 10.1016/j.amjsurg.2016.07.016. Epub 2016 Aug 13. PMID: 27634425

18. *Predicting the proportion of full thickness involvement for any given burn size based on burn resuscitation volumes.* Liu NT, Salinas J, Fenrich CA, Serio-Melvin ML, Kramer GC, Driscoll IR, Schreiber MA, Cancio LC, Chung KK. J Trauma Acute Care Surg. 2016 Jul 6. [Epub ahead of print] PMID: 27389139

19. *Pulmonary Emboli and Deep Vein Thromboses: Are They Always Part of the Same Disease Spectrum?* Gordon NT, Schreiber MA. Mil Med. 2016 May;181(5 Suppl):104-10. doi: 10.7205/MILMED-D-15-00156. PMID: 27168559

20. *The pragmatic randomized optimal platelet and plasma ratios trial: what does it mean for remote damage control resuscitation?* Yonge JD, Schreiber MA. Transfusion. 2016 Apr;56 Suppl 2:S149-56. doi: 10.1111/trf.13502. PMID: 27100751

21. *Dried plasma: state of the science and recent developments.* Pusateri AE, Given MB, Schreiber MA, Spinella PC, Pati S, Kozar RA, Khan A, Dacorta JA, Kupferer KR, Prat N, Pidcoke HF, Macdonald VW, Malloy WW, Sailliol A, Cap AP. Transfusion. 2016 Apr;56 Suppl 2:S128-39. doi: 10.1111/trf.13580. PMID: 27100749

22. *Performance improvement and patient safety program-guided quality improvement initiatives can significantly reduce computed tomography imaging in pediatric trauma patients.* Connelly CR, Yonge JD, Eastes LE, Bilyeu PE, Kemp Bohan PM, Schreiber MA, Azarow KS, Watters JM, Jafri MA. J Trauma Acute Care Surg. 2016 Aug;81(2):278-84. doi: 10.1097/TA.0000000000001071. PMID: 27032011

23. *Outcome Trends after US Military Concussive Traumatic Brain Injury.* Mac Donald CL, Johnson AM, Wierzechowski L, Kassner E, Stewart T, Nelson EC, Werner NJ, Adam OR, Rivet DJ, Flaherty SF, Oh JS, Zonies D, Fang R, Brody DL. J Neurotrauma. 2016 Jun 27. [Epub ahead of print] PMID: 27198861

24. *Rhabdomyolysis among critically ill combat casualties: Associations with acute kidney injury and mortality.* Stewart IJ, Faulk TI, Sosnov JA, Clemens MS, Elterman J, Ross JD, Howard JT, Fang R, Zonies DH, Chung KK. J Trauma Acute Care Surg. 2016 Mar;80(3):492-8. doi: 10.1097/TA.0000000000000933. PMID: 26670111

25. *A night float week in a surgical clerkship improves student team cohesion.* Connelly CR, Kemp Bohan PM, Cook MR, Moren AM, Schreiber MA, Kiraly LN. Am J Surg. 2016 May;211(5):913-8. doi: 10.1016/j.amjsurg.2016.01.011. Epub 2016 Feb 23. PMID: 26988619

26. *The Impact of Pre-Hospital Administration of Lactated Ringer's Solution versus Normal Saline in Patients with Traumatic Brain Injury.* Rowell SE, Fair KA, Barbosa RR, Watters JM, Bulger EM, Holcomb JB, Cohen MJ, Rahbar MH, Fox EE, Schreiber MA. J Neurotrauma. 2016 Jun 1;33(11):1054-9. doi: 10.1089/neu.2014.3478. Epub 2016 Feb 25. PMID: 26914721

27. *Amiodarone, Lidocaine, or Placebo in Out-of-Hospital Cardiac Arrest.* Kudenchuk PJ, Brown SP, Daya M, Rea T, Nichol G, Morrison LJ, Leroux B, Vaillancourt C, Wittwer L, Callaway CW, Christenson J, Egan D, Ornato JP, Weisfeldt ML, Stiell IG, Idris AH, Aufderheide TP, Dunford JV, Colella MR, Vilke GM, Brienza AM, Desvigne-Nickens P, Gray PC, Gray R, Seals N, Straight R, Dorian P; Resuscitation Outcomes Consortium Investigators. N Engl J Med. 2016 May 5;374(18):1711-22. doi: 10.1056/NEJMoa1514204. Epub 2016 Apr 4. PMID: 27043165

28. *A Geospatial Analysis of Severe Firearm Injuries Compared to Other Injury Mechanisms: Event Characteristics, Location, Timing, and Outcomes.* Newgard CD, Sanchez BJ, Bulger EM, Brasel KJ, Byers A, Buick JE, Sheehan KL, Guyette FX, King RV, Mena-Munoz J, Minei JP, Schmicker RH; ROC Investigators. Acad Emerg Med. 2016 May;23(5):554-65. doi: 10.1111/acem.12930. Epub 2016 Apr 15. PMID: 26836571

29. *Modulating the endotheliopathy of trauma: Factor concentrate versus fresh frozen plasma.* Pati S, Potter DR, Baimukanova G, Farrel DH, Holcomb JB, Schreiber MA. J Trauma Acute Care Surg. 2016 Apr;80(4):576-84; discussion 584-5. doi: 10.1097/TA.0000000000000961. PMID: 26808040

30. *Damage-control resuscitation and emergency laparotomy: Findings from the PROPPR study.* Undurraga Perl VJ, Leroux B, Cook MR, Watson J, Fair K, Martin DT, Kerby JD, Williams C, Inaba K, Wade CE, Cotton BA, Del Junco DJ, Fox EE, Scalea TM, Tilley BC, Holcomb JB, Schreiber MA; PROPPR Study Group. J Trauma Acute Care Surg. 2016 Apr;80(4):568-74; discussion 574-5. doi: 10.1097/TA.0000000000000960. PMID: 26808034

31. *Multicenter external validation of the Geriatric Trauma Outcome Score: A study by the Prognostic Assessment of Life and Limitations After Trauma in the Elderly (PALLIATE) consortium.* Cook AC, Joseph B, Inaba K, Nakonezny PA, Bruns BR, Kerby JD, Brasel KJ, Wolf SE, Cuschieri J, Paulk ME, Rhodes RL, Brakenridge SC, Phelan HA. J Trauma Acute Care Surg. 2016 Feb;80(2):204-9. doi: 10.1097/TA.0000000000000926. PMID: 26595708

32. *Aortic Hemostasis and Resuscitation: Preliminary Experiments Using Selective Aortic Arch Perfusion With Oxygenated Blood and Intra-aortic Calcium Coadministration in a Model of Hemorrhage-induced Traumatic Cardiac Arrest.* Manning JE, Ross JD, McCurdy SL, True NA. Acad Emerg Med. 2016 Feb;23(2):208-12. doi: 10.1111/acem.12863. Epub 2016 Jan 14. PMID: 26766760

33. *Relationship of a Mandated 1-Hour Evacuation Policy and Outcomes for Combat Casualties.* Martin MJ, Eckert MJ, Schreiber MA. JAMA. 2016 Jan 19;315(3):293-4. doi: 10.1001/jama.2015.18744. PMID: 26784777

34. *A Disease-Specific Hybrid Rotation Increases Opportunities for Deliberate Practice.* Cook MR, Graff-Baker AN, Moren AM, Brown S, Fair KA, Kiraly LN, De La Melena VT, Pommier SJ, Deveney KE. J Surg Educ. 2016 Jan-Feb;73(1):1-6. doi: 10.1016/j.jsurg.2015.09.005. Epub 2015 Oct 21. PMID: 26481268

35. *Investigating the relationship between weather and violence in Baltimore, Maryland, USA.* Michel SJ, Wang H, Selvarajah S, Canner JK, Murrill M, Chi A, Efron DT, Schneider EB. Injury. 2016 Jan;47(1):272-6. doi: 10.1016/j.injury.2015.07.006. Epub 2015 Jul 13. PMID: 26233631

36. *A Clinical Tool for the Prediction of Venous Thromboembolism in Pediatric Trauma Patients.* Connelly CR, Laird A, Barton JS, Fischer PE, Krishnaswami S, Schreiber MA, Zonies DH, Watters JM. JAMA Surg. 2016 Jan;151(1):50-7. doi: 10.1001/jamasurg.2015.2670. PMID: 26422678

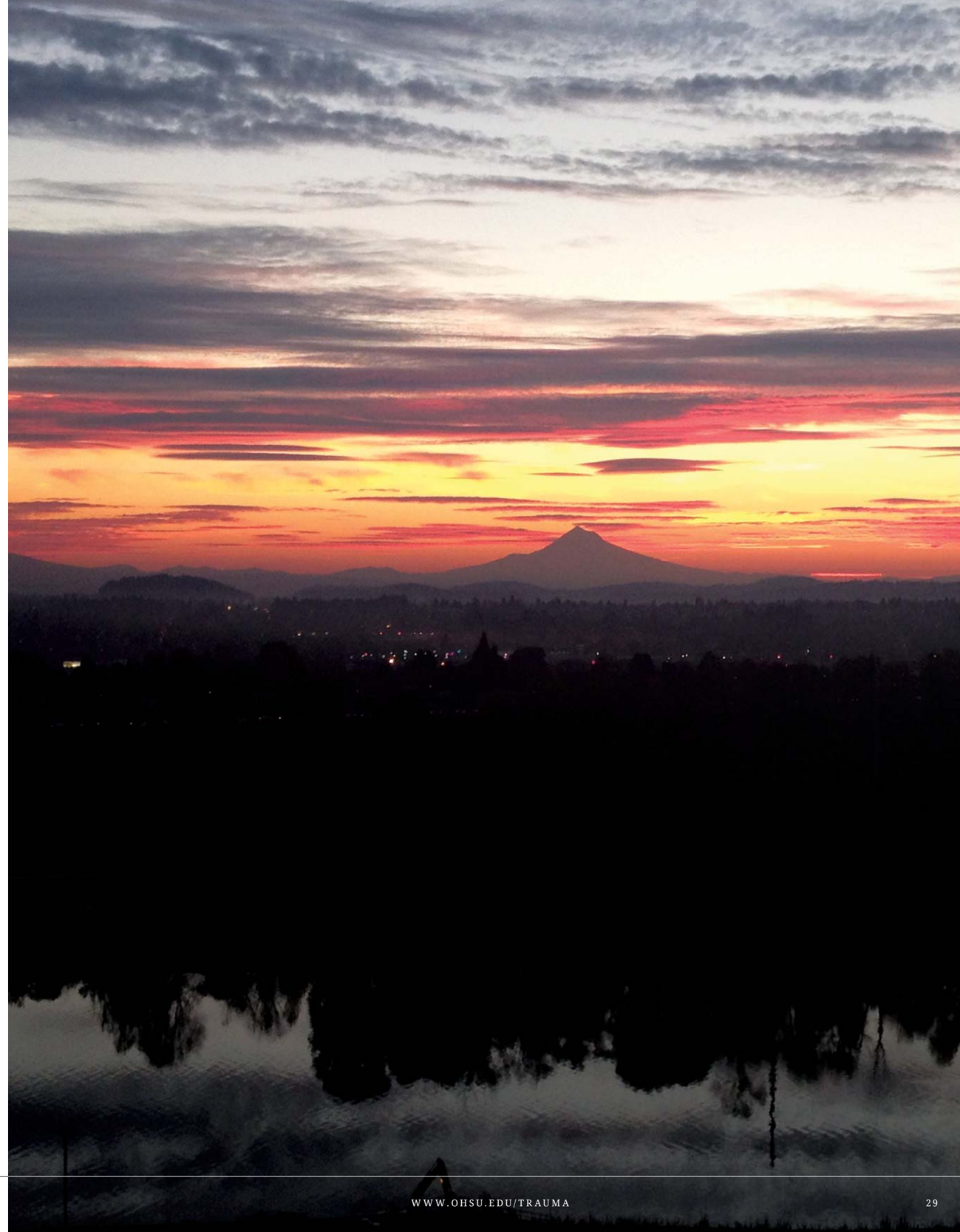
37. *Evaluation of a Consensus-Based Criterion Standard Definition of Trauma Center Need for Use in Field Triage Research.* Willenbring BD, Lerner EB, Brasel K, Cushman JT, Guse CE, Shah MN, Swor R. Prehosp Emerg Care. 2016;20(1):1-5. doi: 10.3109/10903127.2015.1056896. Epub 2015 Aug 13. PMID: 26270033

38. *Constructing High-stakes Surgical Decisions: It's Better to Die Trying.* Nabozny MJ, Kruser JM, Steffens NM, Brasel KJ, Campbell TC, Gaines ME, Schwarze ML. Ann Surg. 2016 Jan;263(1):64-70. doi: 10.1097/SLA.0000000000001081. PMID: 25563878

Appendix A

The Abbreviated Injury Scale is used to generate the Injury Severity Score. The ISS is a single value between 0 and 75 that corresponds to a patient's injury severity on the AIS. It is calculated using the highest AIS score from as many as three of the six body regions. The ISS is the sum of the squared highest three AIS scores from three separate body regions. It is useful in making risk-adjusted comparisons between groups of patients. For example, based on analysis of national trauma databases, it can be predicted that patients with an ISS of less than 15 have less than a 5 percent risk of death, and patients with an ISS greater than 40 have greater than 60 percent risk of death.

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



OHSU Trauma Program
Mail Code: L604
3181 S.W. Sam Jackson Park Road
Portland, OR 97239-3098
Tel: 503 494-6007
Fax: 503 494-4357
www.ohsu.edu/trauma

HCM 21438699 6/17