OREGON HEALTH & SCIENCE UNIVERSITY

2017 Trauma Program Report

Transforming Trauma Care

Summary

- In 2017, the Trauma Service at OHSU treated 2,885 patients.
- Of those, 1,774 patients (61.5 percent) were brought to OHSU directly from the scene of injury, and 1,111 (38.5 percent) were transferred from another hospital.
- The mean injury severity score of admitted patients was 12.5.
- Falls were the most common mechanism of injury for those at the extremes of age.
- Injury Prevention: ThinkFirst, Matter of Balance Fall Prevention and the Tom Sargent Safety Center had another successful year, serving thousands of community members.
- The Trauma Laboratory had another productive year, publishing 57 research papers and receiving more than $6 million in new and continued funding.

The OHSU trauma team.

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A patient story

On August 26, 2017, Jewell and her husband, Gary, were riding their Harley Davidson motorcycles on Highway 26 to Vernonia. When a car suddenly stopped to turn across traffic, Jewell lost control of her bike, laying it down. Gary ran to her side and found her unconscious and bleeding profusely. There happened to be a paramedic bystander on the scene who rapidly rendered aid. The Highway Patrol arrived within a few minutes, and Life Flight was dispatched to transport her to OHSU.

Jewell, who works in OHSU's Marketing Department, does not remember the week before the crash nor the weeks after it. She sustained a severe traumatic brain injury, grade V liver laceration, splenic laceration, and severe facial injuries. She was hospitalized for two weeks, and regained consciousness after the first several days.

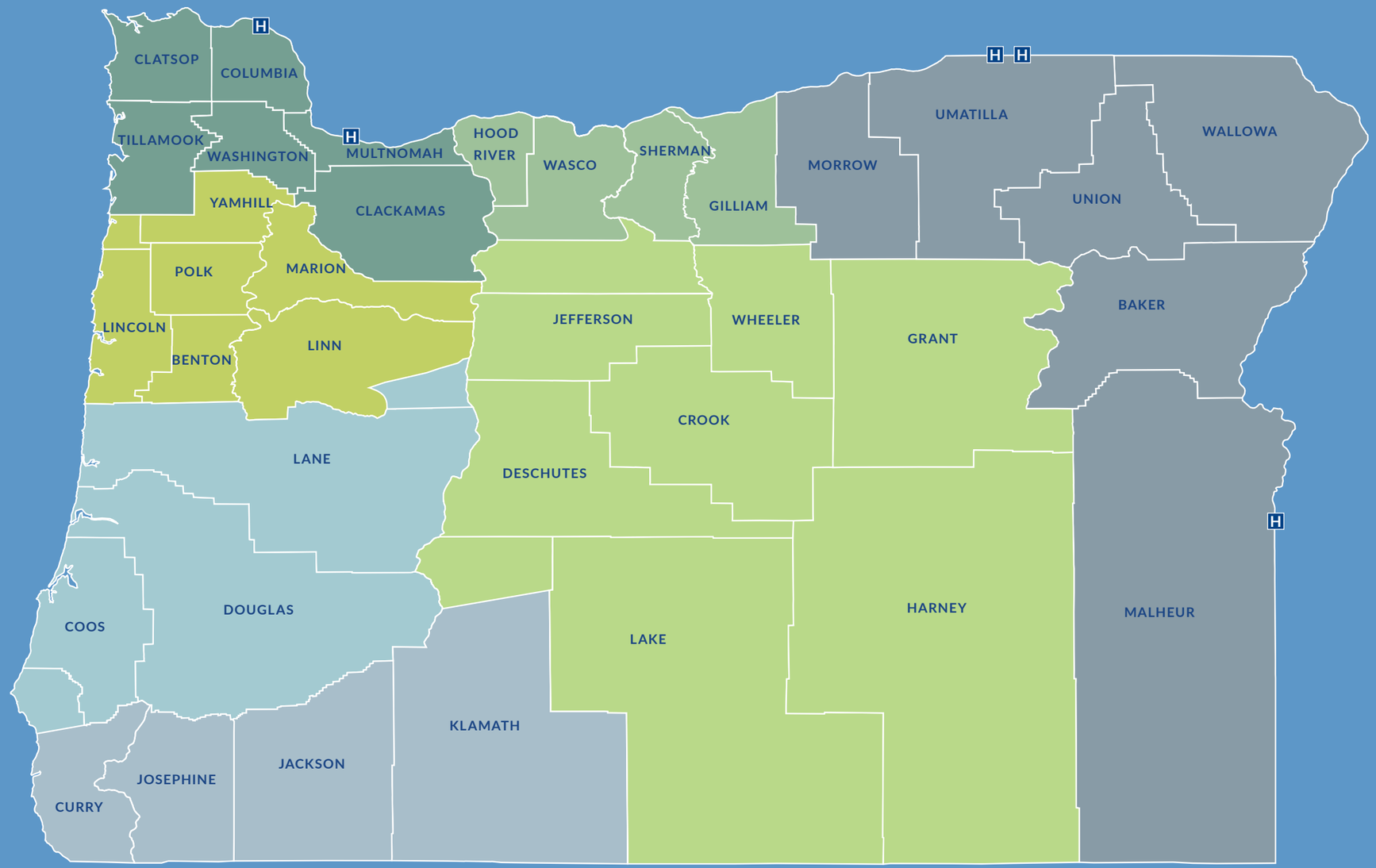
Jewell and her husband Gary say that recovery has been a long road. She was discharged to the Rehabilitation Institute of Oregon, where she continued her recovery under the care of a physical and rehabilitation medicine specialist.

In February, 2018, Jewell was able to return to work for 20 hours per week. She will progress to full-time by October, 2018. She reports some memory and word finding problems; but, overall she has had nearly a full recovery. Although recovery from brain injury is a slow, incremental process, Jewell and her husband have been well supported by family, friends, colleagues, and the trauma team at OHSU.

Jewell and trauma surgeon Mitch Sally.

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 1 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 1 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 2017, the OHSU Trauma Program total patient volume decreased by 118 patients from 2016, although the number of transferred patients increased.

Figure 1 | **Patient volume 2015–2017**

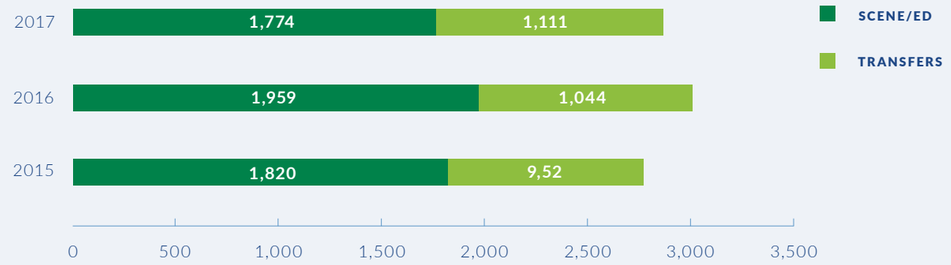


Figure 2 | **Gender distribution of patients treated by the OHSU trauma program**

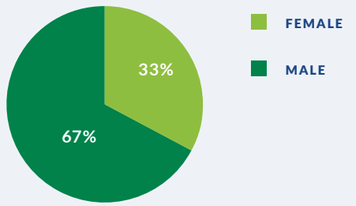


Figure 3 | **Patients treated by the OHSU trauma program: blunt versus penetrating injuries**

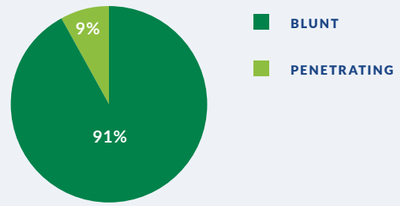


Figure 4 | **Age distribution of patients treated by the OHSU trauma program**

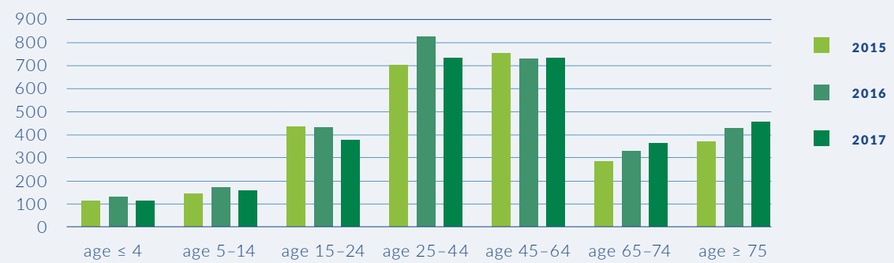


Figure 5 | **Incidence by age of patients treated by the OHSU trauma program**

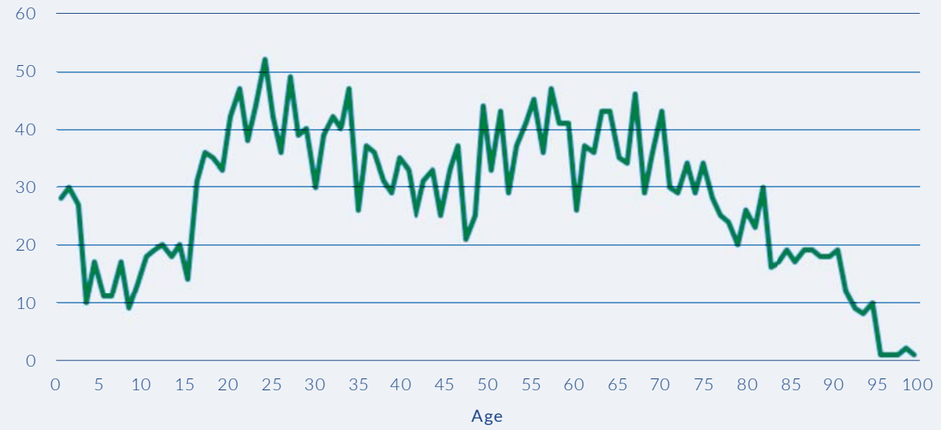


Figure 6 | **Incidence by age and gender of patients treated by the OHSU trauma program**

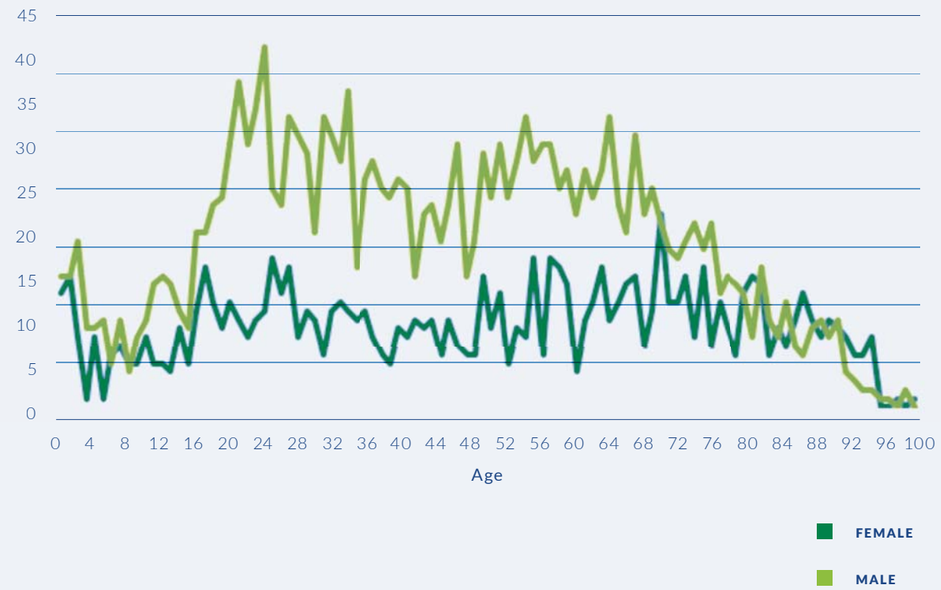


Figure 7 | **Distribution of patients by month**

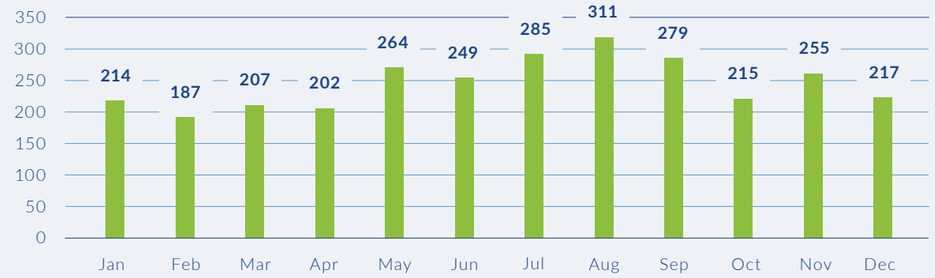


Figure 8 | **Distribution of patients by day of week**

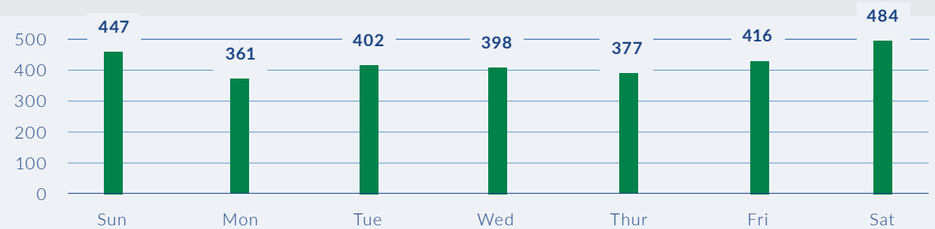


Figure 9 | **Distribution of patients by time of arrival**

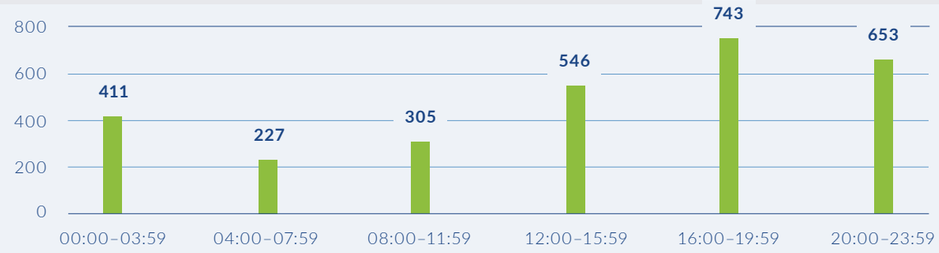
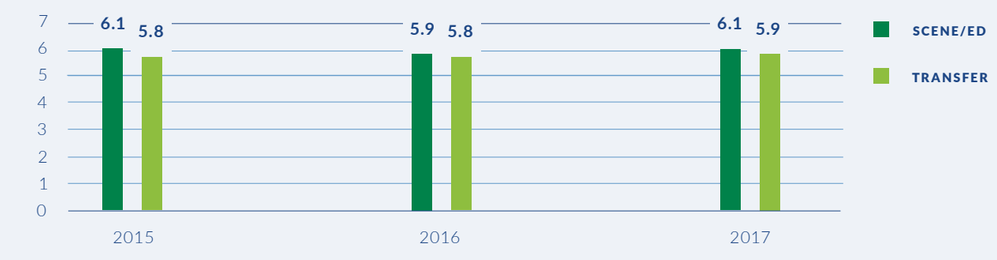


Figure 10 | **Total hospital length of stay of admitted patients**



Trauma team response

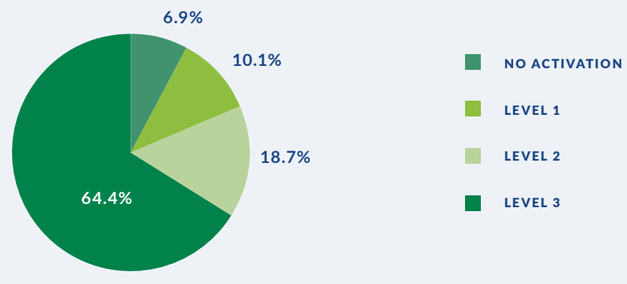
The OHSU Trauma Program uses a three-tiered system to evaluate injured patients. The level of activation is based on information provided by pre-hospital personnel (Table I). In the Portland metropolitan area, paramedics evaluate patients at the scene of injury and enter them into the trauma system if 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 11). Our analyses indicate patients can be safely and efficiently treated with a limited team response, saving our full trauma team activations for those truly critically injured patients.

Table I | **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

Figure 11 | **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 are the leading mechanism of injury for those at the extremes of age.

Dr. Martin Schreiber leads rounds in the ICU with physician assistant Kristy Aghayan and pharmacist Cassie Barton

Figure 12 | **Causes of injury for patients seen by the OHSU trauma team**

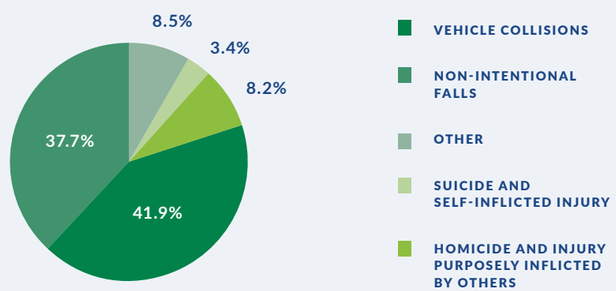


Figure 13 | **Incidents by injury cause and age group**

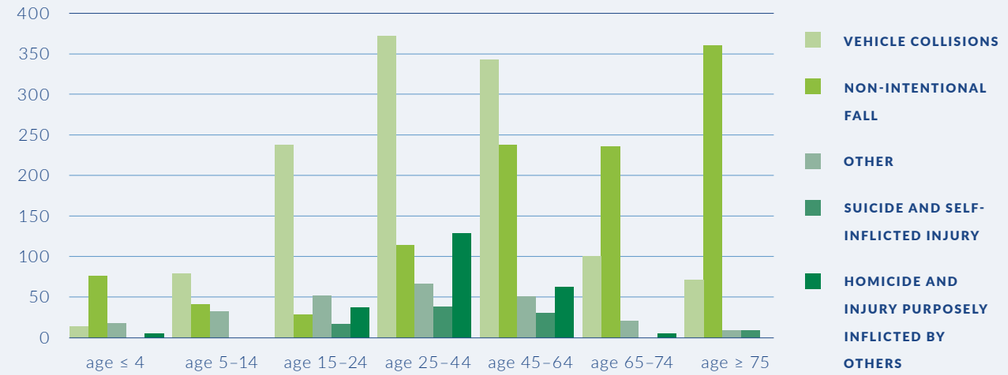
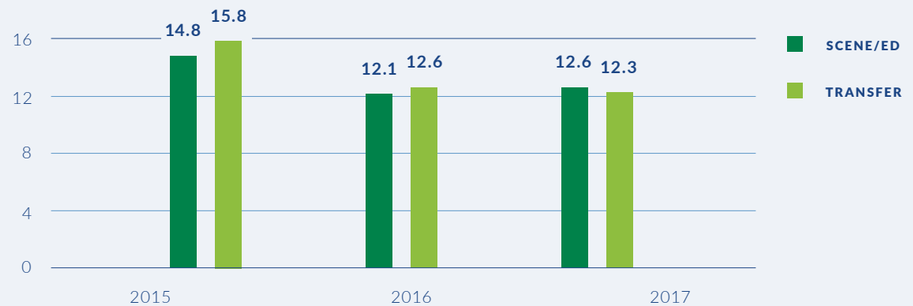


Figure 14 | **Mean injury severity score of patients admitted to OHSU hospital**

Patients transferred from other hospitals were slightly less injured, on average, than those admitted directly from the scene, representing a change from previous years. This decrease in ISS is attributed to the transition in 2016 to the newer coding (ICD-10) and injury scoring (AIS 05/08) systems we are using rather than an actual change in the patient characteristics.



Hospital admissions via OHSU trauma program

In 2017, we admitted 2,057 patients (71 percent) to OHSU Hospital (Figure 15). Elderly patients 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**

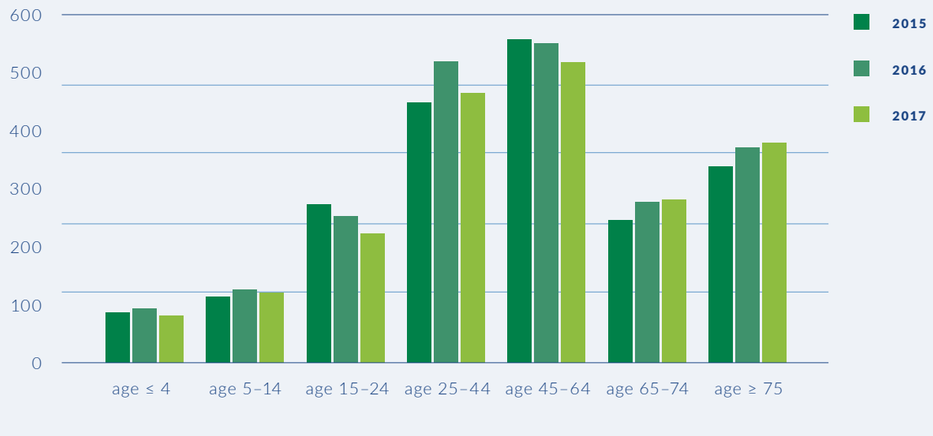
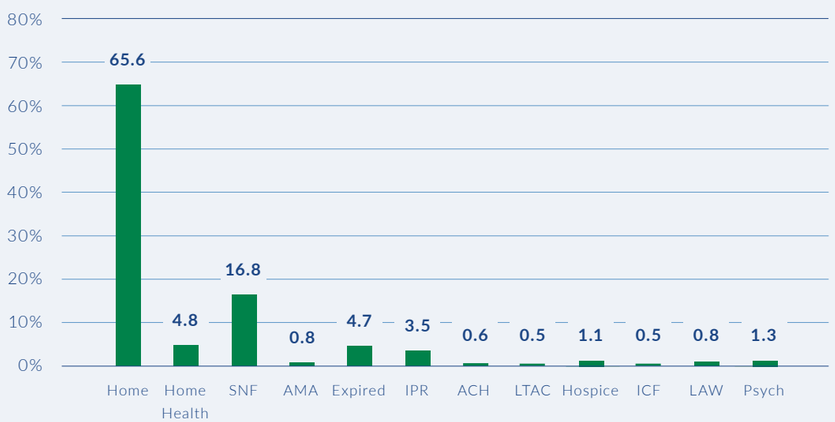


Figure 16 | **Disposition of admitted patients after hospital discharge**



Mortality

In 2017, 110 patients (3.8 percent) expired. One patient was dead on arrival, 12 patients expired in the Emergency Department and 97 died after hospital admission

Dr. Phil Van leads rounds on the trauma ward with charge nurse Aaron Skillings, Trauma Program manager/nurse practitioner, Lynn Eastes and case manager Tanya Avakyan

Nurse practitioner Michelle McClenathan discusses patient care with pharmacist Cody Sorenson and nurse Trevor Connell

Figure 17 | **Total deaths by arrival status**

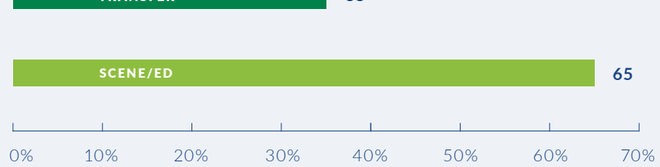
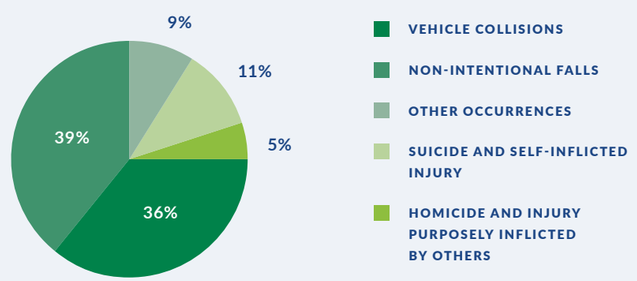


Figure 18 | **Cause of death**

Deaths from falls surpassed those from vehicle collisions this year.



Care for patients older than 64

In 2017, the OHSU Trauma Team treated 779 patients older than 64, a 7 percent increase. Of these, 354 (45 percent) were transferred to OHSU from another hospital or clinic. Most of the transfer patients were injured in falls. Of the 779 injured patients, 639 (82 percent) required hospital admission.

Figures 19-20 provide additional information regarding trauma team care for patients older than 64 at OHSU.

Figure 19 | **Patient volume, age 65 and older**

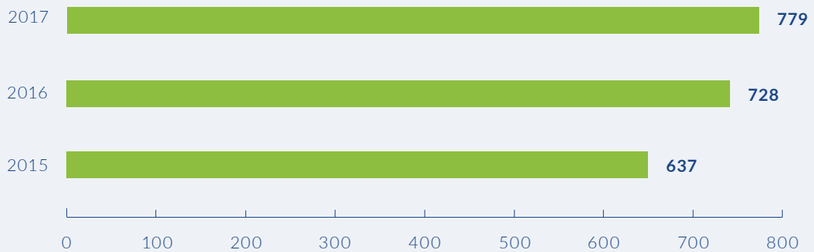
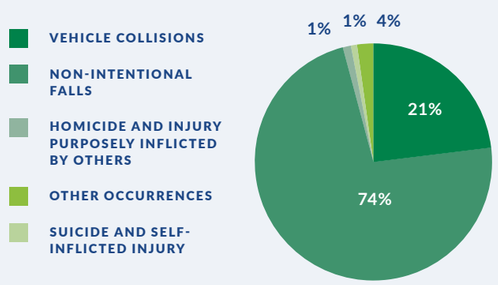


Figure 20 | **Mechanism of injury, age 65 and older**



Special focus: falls in adults over age 64

Falls are the most common cause of injury, and cause of death from injury, in older adults. According to the Centers for Disease Control, this year there will be more than 29 million falls in the United States among adults age 65 and older, leading to more than 3 million emergency room visits and 28,000 deaths. This will result in more than $31 billion in Medicare costs.

In 2017, the OHSU Trauma Team saw 575 older adults who were injured as the result of a fall. This is a 13 percent increase from the previous year and a 25 percent increase since 2015. Since 2015, 94 trauma patients over age 64 have died at OHSU as a result of a fall.

Figure 21 | **Fall volume, patients age 65 and older**

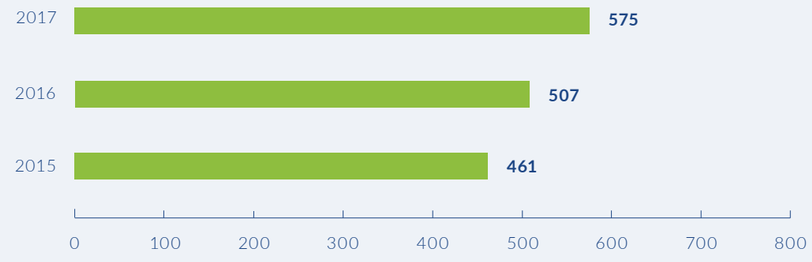


Figure 22 | **Fall volume by gender, patients 65 and older**

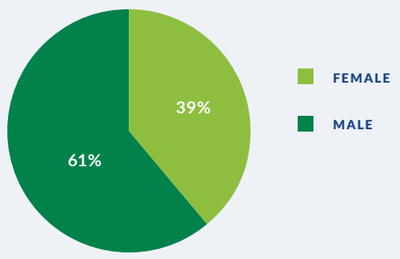
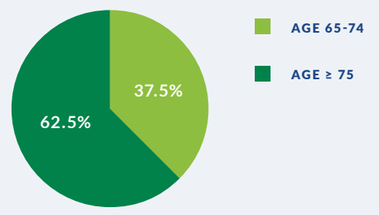


Figure 23 | **Fall volume by age**

Of those patients age 65 or older who fell, the majority were age 75 or older.

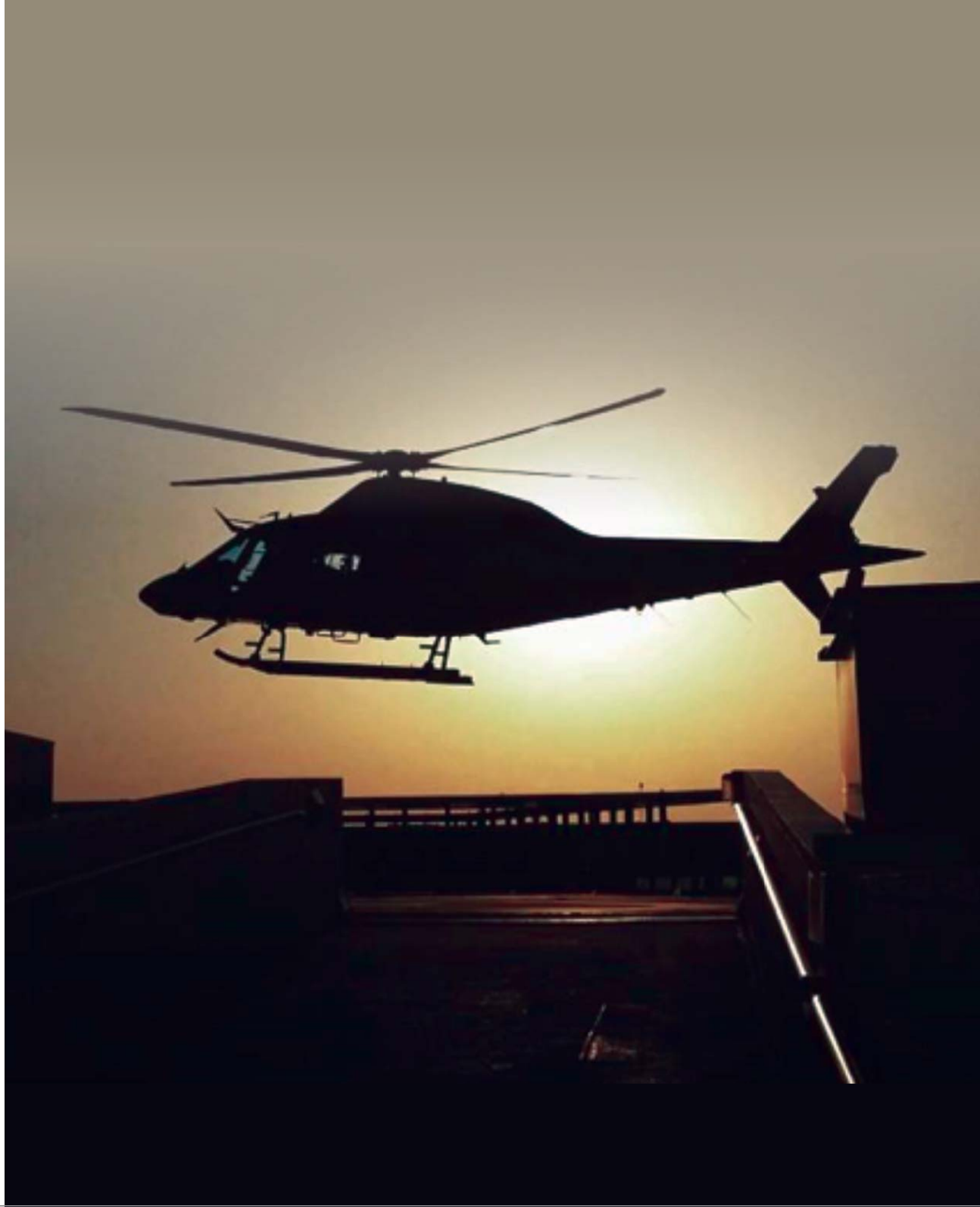


Fall prevention

OHSU offers the Matter of Balance course, which is 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. The goals of the course are to reduce fear of falling, increase activity levels, reduce fall risk factors in the environment and increase strength and balance. OHSU also offers a two-hour fall prevention seminar for those unable to commit to an eight-week course.

Table II | **Fall prevention activities**

Activity	Number of participants
Fall prevention seminar participants	173
Matter of Balance course participants	94
Coach training participants	8
Events and fall prevention collaboration	682
Community members reached	**957**



Care for patients 14 years and younger

Following visits from the American College of Surgeons, OHSU Doernbecher Children's Hospital is now verified as a Level 1 pediatric trauma center and a Level 1 site for children's surgery. This makes us one of only five pediatric hospitals in the country to earn both distinctions.

In 2017, the OHSU trauma team evaluated 277 patients aged 14 and younger. Of these, 186 (67 percent) were transferred to OHSU from hospitals around the Pacific Northwest. Patient disposition included 209 (76 percent) admitted to Doernbecher Children's Hospital: 78 (28 percent) to the ICU, 98 (35 percent) to the ward, 20 (7 percent) to the OR, and 12 (4 percent) as direct admissions. Five children (1.8 percent) died as a result of their injuries.

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

Figure 24 | **Patient volume, patients 14 and younger**

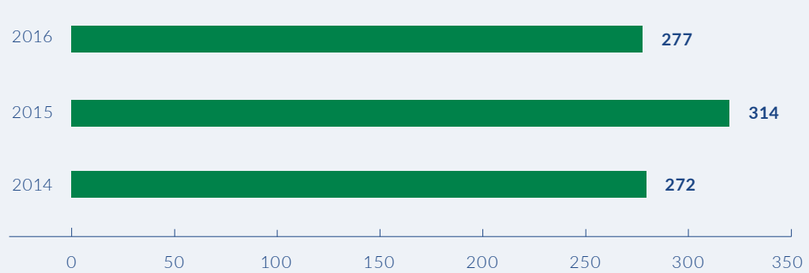
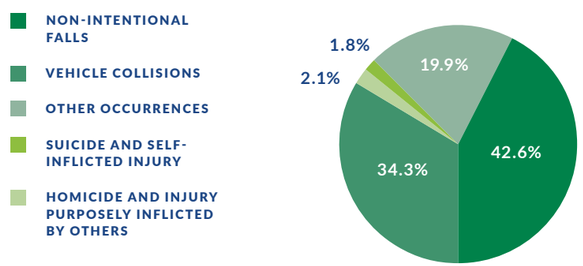


Figure 26 | **Mechanism of injury, patients 14 and younger**



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

Figure 25 | **Disposition from the Emergency Department, patients 14 and younger**

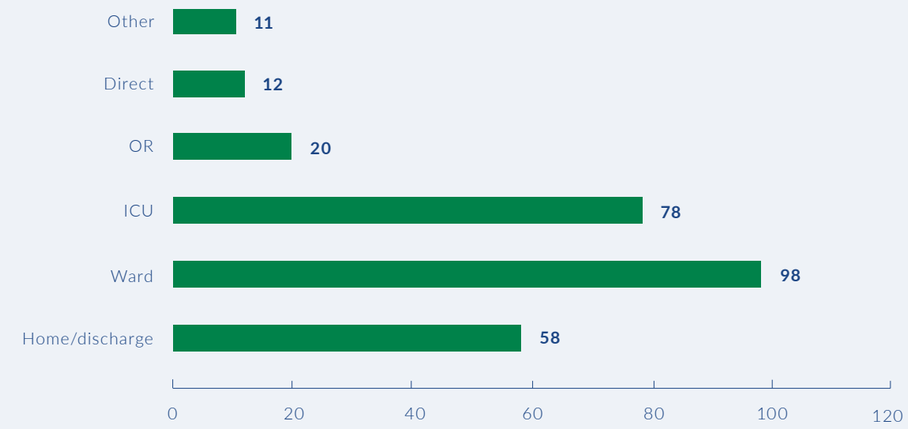
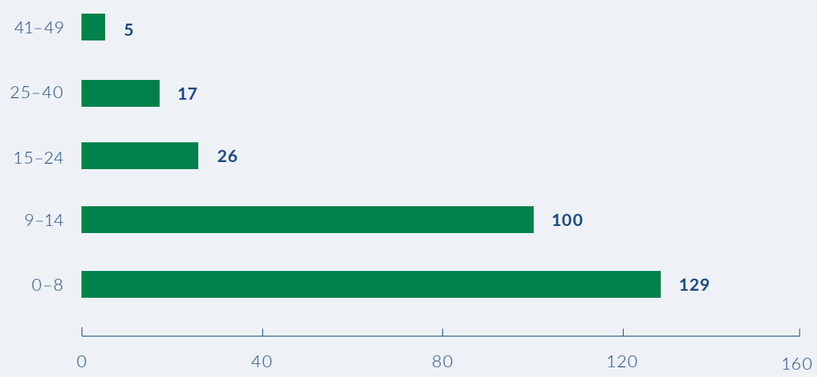


Figure 27 | **Injury severity scores for patients 14 and younger**



Pediatric injury prevention

ThinkFirst Oregon

ThinkFirst is an organization dedicated to reducing brain, spinal cord and other traumatic injuries and fatalities by educating youth, parents and community members across Oregon. ThinkFirst programs help students understand the importance and basic anatomy of the brain and spinal cord, and how a traumatic brain injury or spinal cord injury could permanently affect their lives.

Programs have been developed to provide age-appropriate injury prevention for students of all ages. ThinkFirst for Kids was developed in 1994 for grades 1 through 3. It provides information about the structure and function of the brain and spinal cord, motor vehicle and pedestrian safety, bicycle safety, water, playground, recreation, and sport safety as well as teaching about the dangers of weapons and conflict resolution skills.

ThinkFirst for Youth was launched in 2007 and includes presentations and classroom curricula for grades 4 through 8. Anatomy lessons and classroom activities help students develop a practical understanding of their bodies' abilities, limitations and vulnerability to injuries. Exercises build communication and conflict resolution skills, increasing self-confidence and students' ability to make safe choices when on their own or in the face of peer pressure.

In 2014, ThinkFirst about Concussion was made available for teen presentations. This program teaches teenagers to prevent, recognize and respond to concussion symptoms in the context of sports and recreation. It also teaches vehicle safety, how to prevent falls and avoid violence.

Tom Sargent Safety Center

The Doernbecher Tom Sargent Safety Center is dedicated to reducing preventable injuries in children throughout the Pacific Northwest by:

- Providing public and professional education and training.
- Increasing access to low-cost safety supplies and resources.
- Encouraging healthcare providers, families and community leaders to get involved in finding ways to reduce injury.
- Supporting safety-related advocacy in the Pacific Northwest.

A key part of its mission is partnering with other local, state and federal agencies to promote injury prevention education. As a part of this mission, it operates a Safety Resource Center that sells low-cost home safety supplies, sport helmets and sleep sacks. Educational materials to help keep children safe at home and on the go are also available. The center offers low-cost bike, multi-sport and ski helmets and will make sure the helmet is fitted properly. Families can also purchase low-cost home safety gates, electrical outlet covers, cabinet latches/locks, window stops and guards, and toilet locks. The center offers the ODOT grant to low income families that need a car seat. This requires the family to participate in installation and positioning education. Any community family can make an appointment at the safety center to learn how to install and properly use their car seat or they can attend a weekend event that the center supports. The Tom Sargent Safety Center has also partnered with Cribs for Kids to supply education and a low-cost Graco Pack-N-Play to any family that needs a safe place for their infant to sleep. All educational materials are available in English and Spanish and helmet and safe sleep materials come in multiple languages. Gun trigger locks are available through Project Child Safe.

Stop the bleed

The Stop the Bleed campaign raises awareness of life–saving strategies, provides public access to bleeding control tools, and empowers bystanders to act as immediate responders.

Massive bleeding from any cause, but particularly from an active shooter or explosive event where response is delayed, can result in death. Victims can die from uncontrolled bleeding, within five to ten minutes.

In the same way that the general public learns and performs CPR, the public can learn proper bleeding control techniques, including how to use their hands, dressings, and tourniquets. Anyone at the scene can act as an immediate responder and save lives if they know what to do.

In 2017 the OHSU Trauma Team taught Stop the Bleed to 937 individuals throughout the state. Of these, 505 were healthcare providers, who went on to become instructors with the ability to teach Stop the Bleed in their own communities.

OHSU trauma fellow Kelly Fair teaches Stop the Bleed at a public OHSU course.

Research

In 2017, the Trauma Research Laboratory received $6,507,954 in new research funding thanks to the efforts of Drs. Karen Brasel, Laszlo Kiraly, Darren Malinoski, Belinda McCully, James Ross, Susan Rowell, Martin Schreiber, and David Zonies. Areas of research include hemorrhage control, deep vein thrombosis prevention, donor outcomes, traumatic brain injury, spinal cord injury, acute respiratory distress syndrome (ARDS), and communications between surgeons and elderly patients following trauma or prior to high risk surgery.

Dr. Brasel continues to collaborate with colleagues at the University of Wisconsin-Madison. Her project in 2017 is looking at ways to improve communication between surgeons, patients and family members following trauma, so that patients and their families can make treatment decisions that are best for them.

Dr. Kiraly's work will evaluate the safety of observation versus treatment for pulmonary embolism and measures to prevent it. This is a multi-center study funded through the Department of Defense and National Trauma Institute.

Dr. Schreiber's lab is funded by the Department of Defense to study stem cell therapies in multiple trauma models in the lab and in trauma patients for the prevention of ARDS.

In 2017, two of our former residents returned to OHSU as faculty in the Division of Trauma, Critical Care and Acute Care Surgery. Arvin Gee, M.D, Ph.D., joined the group in April. Mackenzie Cook, M.D., M.P.H. joined in November. Both men completed a year of research in the Trauma Research Lab during their residency and will continue to conduct research at OHSU. Dr. Gee assumed duties as the Medical Director of Emergency General Surgery. Along with being the principal investigator on various industry-sponsored studies, he is evaluating the use of virtual reality to train or maintain skills for robotic-assisted surgeries. Dr. Cook's research area of interest is to develop a model for identifying trauma patients who are at high risk for poor outcomes following hospital discharge.

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

1. Vitko HA, Sekula LK, Schreiber MA. Probiotics for Trauma Patients: Should We Be Taking a Precautionary Approach. Journal of Trauma Nursing. 2017;24:46-62.
2. Watson JJ, Nielsen J, Hart K, Srikanth P, Yonge JD, Connelly CR, Kemp Bohan PM, Sosnovske H, Tilley BC, van Belle G, Cotton BA, O'Keeffe TS, Bulger EM, Brasel KJ, Holcomb JB, Schreiber MA. Damage Control Laparotomy Utilization Rates are Highly Variable Among Level 1 Trauma Centers: Pragmatic, Randomized Optimal Platelet and Plasma Ratios Findings. Journal of Trauma and Acute Care Surgery. 2017;82:481-488.
3. Schreiber MA, reviewer. *Selected Readings in General Surgery.* 2017:43(1):e1. http://web2.facs.org/SRGS_Connect/wysk/wysk0217.cfm. Accessed February 23, 2017. Review of: Singer GA, Riggi G, Karcutskie CA, et al. Anti-Xa-guided enoxaparin thromboprophylaxis reduces rate of deep venous thromboembolism in high-risk trauma patients.
4. Rowell SE, Biffl WL, Schreiber MA, Albrecht RA, Cohen MJ, DeMoya M, Karmy-Jones R, Moore EE, Namias N, Shatz DV, Moore FA, Brasel K. Western Trauma Association Critical Decisions in Trauma: Management of Adult Blunt Splenic Trauma – 2016 Updates. Journal of Trauma and Acute Care Surgery. 2017;82:787-793.
5. Davis BL, Martin MJ, Schreiber MA. Military Resuscitation: Lessons from Recent Battlefield Experience. Current Trauma Reports. 2017; May 18: DOI 10.1007/s40719-017-0088-9.
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SPEAKING TOPICS: TARGETED MUSCLE RE-INNERVATION AND ADVANCED PROSTHETICS

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