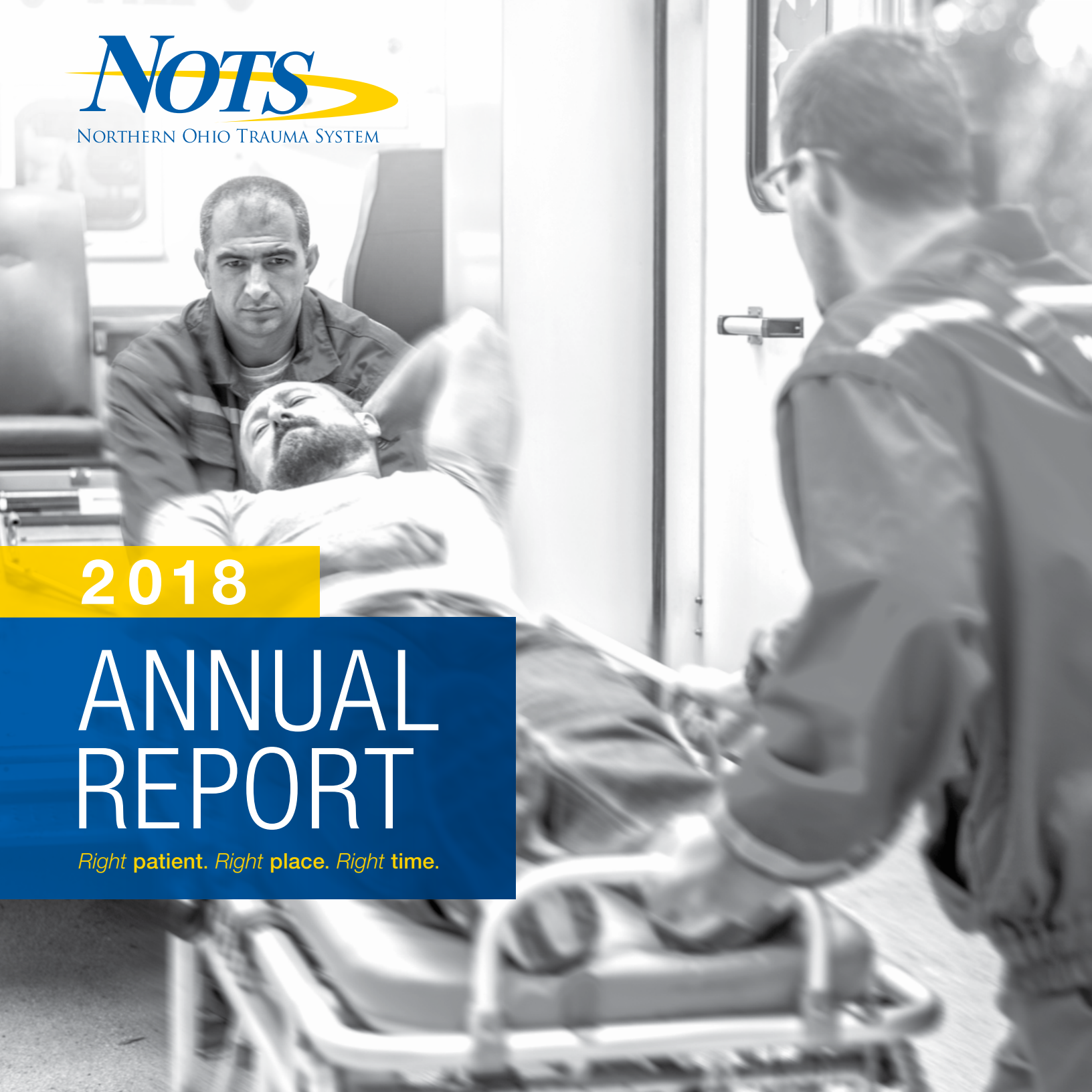
NOTS

NORTHERN OHIO TRAUMA SYSTEM



2018 ANNUAL REPORT

Right **patient.** *Right* **place.** *Right* **time.**

TABLE OF CONTENTS

NOTS STAFF

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MD, MS, FACS
Medical Director

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Trauma Program Manager

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Trauma Coordinator

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Tod Baker
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Violence/Injury Prevention Coordinator

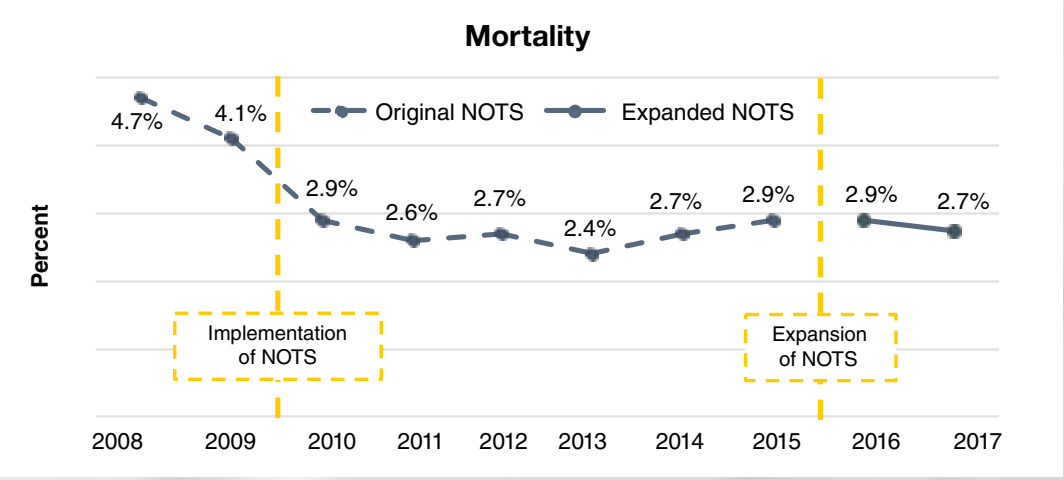
Brian Young, MD
NOTS Research Resident

Throughout this report, you will see graphs that look across many years of NOTS data. To demonstrate the expansion of NOTS in 2016, these graphs contain a dotted line (representing "original NOTS") and a solid line (representing "expanded NOTS"). The hospitals included in the dotted line are: Fairview Hospital Cleveland Clinic, Hillcrest Hospital Cleveland Clinic, and MetroHealth Medical Center. The solid line includes, in addition to these three hospitals: Akron General Cleveland Clinic, Southwest General Health Center, University Hospitals Cleveland Medical Center, University Hospitals Rainbow Babies and Children's Hospitals, University Hospitals Geauga, University Hospitals Portage, and University Hospitals St. John Medical Center.

NOTS

MISSION STATEMENT

To provide the highest **quality of care** to patients across the region by rigorously evaluating and improving outcomes, optimizing resources, and providing education utilizing a collaborative approach with hospitals, emergency medical services and the public health services.



EXECUTIVE SUMMARY

It has been an honor to have served as Medical Director of NOTS for the past eight years. The time has come to pass on the NOTS baton to the next Medical Director, Dr. Matthew Walsh from the Cleveland Clinic. Dr. Walsh has been an active part of NOTS on the Advisory Board. Since starting NOTS, we have grown substantially and showed tremendous improvement in saving lives. We need to continue to demonstrate improvement.

NOTS is continually evolving, and we now have a full year as a collaboration between University Hospitals, Cleveland Clinic, The MetroHealth System, and Southwest General. We continue to mature and focus on collaboration to fulfill our mission:

TO PROVIDE THE HIGHEST QUALITY OF CARE TO TRAUMA PATIENTS ACROSS THE REGION BY RIGOROUSLY EVALUATING AND IMPROVING OUTCOMES, OPTIMIZING RESOURCES, AND PROVIDING EDUCATION ACROSS THE REGION UTILIZING A COLLABORATIVE APPROACH WITH HOSPITALS, EMERGENCY MEDICAL SERVICES, AND THE PUBLIC HEALTH SERVICES.

This means developing protocols that are best for the patient and critically evaluating protocol compliance and outcomes. We must share data, share successes, and build on lessons learned collaboratively. We are continually trying to do better! NOTS has continued to reach out to truly be an inclusive system.

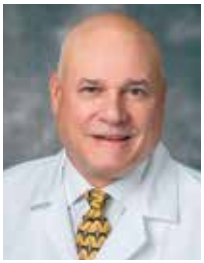
In closing, it is my hope that NOTS remains dedicated to the public and getting the right patient to the right place at the right time. It is crucial that we share data and critically evaluate ourselves with the goal to save more lives. Working together to create the best system is what is important. We will save more lives working together as part of a trauma team and system than we can as individuals.

Sincerely,

Jeffrey A. Claridge, MD, MS, FACS

ADULT LEVEL I TRAUMA HOSPITALS

University Hospitals



Glen Tinkoff, MD
System Chief of Trauma and Acute Care Surgery

"As the newest member of the Northern Ohio Trauma System, University Hospitals is proud to participate with our partners in this important regional collaboration whose mission is to assure quality trauma care and address the unique needs of injured patients while reducing the burden of trauma on the patients, families, and communities we serve."

Shannon Swader, BSN, RN
UH System Trauma Operations Manager

"I am honored to be part of a trauma network aiming to improve trauma care delivery and outcomes for those that are injured."

Sandy Daly-Crossley, MSN, RN, TCRN
Trauma Program Manager

"There are many reasons that providers chose the specialty of Trauma. For the team here at University Hospitals Cleveland Medical Center (UHCMC), one of the most common reasons our providers give is the concept of being part of the “team.” The Trauma team works together to resolve internal and external issues that are barriers to care of the injured patients. The Trauma team at UHCMC encompasses a broad spectrum of providers caring for patients across all spectrums of age, race and socioeconomic class whose goals include prevention of injury, improved patient outcomes and returning patients to their communities whole again."

Cleveland Clinic
Akron General

Emergencies are never planned. But when they do happen, patients at Cleveland Clinic Akron General are met by a responsive and caring staff of board-certified emergency physicians and other specially trained professionals – including nurses, technologists, social workers, and chaplains.

A Level I Trauma Center, as designated by the American College of Surgeons (ACS), Akron General offers the technology, expertise and staffing to treat all injuries regardless of severity. Operating rooms, diagnostic services and trauma specialists are on-call 24 hours a day.

All emergencies are about recovery, but it's especially important to trauma victims. More severe injuries may require additional or specialized medical attention, now and in the future. Akron General provides patients with comprehensive care from the time of injury all the way to recovery. This includes treatment while admitted and after discharge, such as therapy and rehabilitation.

Experienced rehab specialists offer inpatient and outpatient physical and occupational therapy for all trauma needs – whether it's gaining mobility of the hands, improving speech and hearing, or getting back to everyday activities. Through Cleveland Clinic Rehabilitation Hospital, Edwin Shaw, patients and their physicians also have access to a comprehensive, fully accredited hospital specializing in rehabilitation.

The trauma team includes:

- Pre-hospital providers
- Trauma surgeons
- Critical care intensivists
- Orthopedic, neurosurgical and cardiovascular surgeons
- Specially trained registered nurses
- Radiologists and radiology technologists
- Respiratory therapists
- Operating room personnel
- Rehabilitation specialists
- Social workers
- Spiritual care department

Farid Muakkassa, MD
Chief of Trauma Services

Sharon Wiita, BSN, RN, CEN
Trauma Program Manager

ADULT LEVEL I TRAUMA HOSPITALS

MetroHealth

Jeffrey A. Claridge, MD, MS, FACS
Trauma Medical Director

"I want to live my life to the fullest every day and try to make the best positive impact to society every day. There are so many amazing role models out there nationally that continually humble me, but I still want to do my part. My daily job as a trauma surgeon lets me make a big impact by trying to save lives. It is full of variety and difficult challenges. It can be emotionally draining, exhausting, and sad at times. I have had days where I have both laughed and cried. As a trauma surgeon, I am boarded in both general surgery and surgical critical care. On any given day I can take care of critically ill patients in the ICU, evaluate patients in the Emergency Department as part of the trauma team, and operate on trauma and emergency general surgery patients. Every day is different and full. I love it.

My training as a trauma surgeon has given me the ability to serve in leadership roles locally and nationally. This gives me the opportunity to contribute to changes at a larger level with the goal to improve trauma care across the region, state, and even nationally. It is a very rewarding and humbling job. My father was a skilled tradesman who taught me the value of working hard and doing your best. I started working with him when I was 5 years old at construction sites. He died when I was 15 years old and there isn't a day that goes by that I don't think about him. He taught me to work with my hands and mind, which I get the opportunity to do every day. He had no idea I would ever become a surgeon and I hope he would be proud of me. Thanks Dad.

Cristina Ragone, RN, BSN MPH
Trauma Program Manager

"I chose trauma nursing for the stereotypical reason: blood and guts are exciting and cool! However, I quickly understood trauma was so much more. I realized that injury prevention and rehabilitation were just as important, exciting, and cool as the blood, guts, and initial resuscitation of the patient. I learned that trauma truly is a disease and public health problem, and I wanted to be part of the solution. The care of a trauma patient requires the collaborative effort of so many disciplines. Being a part of such an amazing team and witnessing the whole continuum of trauma care is the coolest part of my job!"

ADULT LEVEL II TRAUMA HOSPITALS

Cleveland Clinic
Fairview Hospital

Cathleen Khandelwal, MD
Trauma Medical Director

"I am the Trauma Medical Director of Fairview Hospital, a Level 2 facility on the west side. Fairview is proud of its work with geriatric trauma patients, particularly those with rib fractures, and continues to strive for excellence in trauma care. I have always been fascinated by trauma patients since my first medical school experiences at Shock Trauma at the University of Maryland, and that fascination continues today."

Bernadette Szmigielski, RN, BSN
Trauma Program Manager

“There is no greater honor than to be able to help someone in their time of crisis. It’s not only for the patients, but their families as well. Your whole world can change in one moment or with one phone call. You don’t know what to expect, what to do, or what to ask. That is where we as trauma nurses come in. We hold your hand, we explain what will happen, we wipe your tears, and we cry with you. We WILL do EVERYTHING we can to SAVE your life and the lives of your loved ones. That is why I do what I do and I love what I do.”

Cleveland Clinic
Hillcrest Hospital

Tony R. Capizzani, MD, FACS
Trauma Medical Director

"As a trauma and emergency general surgery surgeon, you never know what you are going to get in your door. You need to be prepared for any traumatic injury; whether it be abdominal, extremity or vascular. To have this type of variety and surprise element to my job, it is what keeps me interested and it is what sparked my interest in trauma care."

Mary Anne Edwards, RN
Trauma Program Manager

"I have always thought of Emergency nursing as caring for those at one of their most vulnerable times. Trauma patients emulate that to the fullest.

I became the hospital’s first Trauma nurse registrar carrying a pager to respond to trauma activations in between rounding on in-house patients with the team and entering data into the registry. When the opportunity to become the trauma program manager came up, I felt I had a good knowledge base to take that next step, I have never regretted my decision. I feel I have a good working relationship with the trauma medical director as well as the rest of the team and my office staff is wonderful. I feel truly blessed."

ADULT LEVEL III TRAUMA HOSPITALS

University Hospitals
Geauga Medical Center

Chris Bohac, MD
Trauma Medical Director

"Completing my surgical residency impressed on me the importance of having a well-developed trauma program. Decreased quality of life and untimely mortalities caused by preventable injuries are greatly improved with high quality trauma care, that should be available to all communities. I am privileged to work with a team of clinicians that share the same philosophies and passion for time critical trauma interventions."

Deana Pace, BSN, RN, EMT-P
Trauma Program Manager

"I have always had an interest in taking care of patients with life-threatening emergencies. My background as a paramedic and emergency room nurse allowed me to work with a team of individuals who shared the same goal of providing optimal care to all injured patients. The versatility of trauma care has given me deeper insight and appreciation into identifying and improving health outcomes for the communities we serve at UH Geauga Medical Center."

University Hospitals
St. John Medical Center
A CATHOLIC HOSPITAL

Amani Munshi, MD
Trauma Medical Director

"I am excited to serve our community in my role as a general surgeon, and as the Trauma Medical Director here at our level 3 trauma center on the west side of Cleveland. We strive to provide excellent comprehensive care of all injured patients in their local community here, and are fortunate to be part of a larger system with access to subspecialists that our critically injured patients can be sent to if they require further care. We hope to work with all facilities in the area to further improve delivery of care and patient outcomes."

Maureen Traine, BSN, RN
Trauma Program Manager

"I am passionate in the care of the trauma patient to make a difference. This is accomplished by implementing best practice aimed at improving outcomes, education on injury prevention and collaborating in our region and state to limit injury in order to get people back to functioning and living their best quality of life."

University Hospitals
Portage Medical Center

Southwest General

John Gusz, MD, FACS
Trauma Medical Director

"As a previously deployed Army Surgeon, trauma has been a large part of my practice for years. Helping patients, often away from their homes, in unplanned encounters, offers opportunities for rewarding experiences. Advances in the field allow more injured people to return to a healthy, productive life."

Southwest General Health Center has a strong community presence as a Level III Trauma Center and is an important part of the Northern Ohio Trauma System. Southwest General participates in NOTS initiatives to improve the quality of care for patients and to help educate hospital staff and EMS personnel who provide high-quality pre-hospital services in their communities. Southwest General is proud to provide emergency medical control for Berea, Brook Park, Brunswick, Brunswick Hills, Cleveland Hopkins International Airport and Burke Lakefront Airport, Columbia Station, Middleburg Heights, NASA Glenn Research (Brook Park and Plum Brook), Olmsted Falls, Olmsted Township, and Strongsville.

Julie Warholic, RN, BSN
Trauma Program Manager

"Why did I choose trauma? I guess I have always been a bit of an “ambulance chaser.” I feel the need to help when someone is hurt, so choosing to be an ED / Trauma nurse just seemed to make sense. The most logical progression from there was to become a Trauma Program Manager. In this role, I am not only able to assist trauma patients directly, but also indirectly through process improvement, injury prevention and trauma care provider education."

Craig M. Eyman, DO, FACOS, FACS
Trauma Medical Director

Noreen Molek, APRN-CNP
Trauma Program Manager

PEDIATRIC LEVEL I TRAUMA HOSPITAL

University Hospitals

Rainbow Babies & Children's Hospital

Michael Dingeldein, MD
Pediatric Medical Director

"I became a pediatric surgeon because I love working with kids. I find it incredibly meaningful that a positive impact you have on a child could carry through for the next 80 years. Rainbow is a one of a kind institution that affords me the opportunity to work with a fantastic group of patients, staff, nurses, and physicians."

Lynn Horton, RN, BSN
Pediatric Trauma Program Manager

"I've been a nurse for 25 years (critical care and ED is my background). The trauma population has always been my favorite patients to work with. What I really like about the pediatric trauma population is their resiliency to injury."

PEDIATRIC LEVEL II TRAUMA HOSPITAL

MetroHealth

John Como, MD, MPH, FACS, FCCM
Pediatric Medical Director

"I became a trauma surgeon because I found taking care of injured patients both interesting and challenging. With prompt treatment, patients who might otherwise have died from their injuries are returned to their loved ones, with the potential to lead happy and productive lives."

Bridget Gill, RN, BSN
Pediatric Trauma Program Manager

"I have spent the majority of my nursing career working with burn and trauma patients, and have always enjoyed caring for our youngest and often most vulnerable patients. My current role enables me to affect pediatric trauma care by evaluating outcomes and implementing plans with a multidisciplinary team to ensure high quality care."

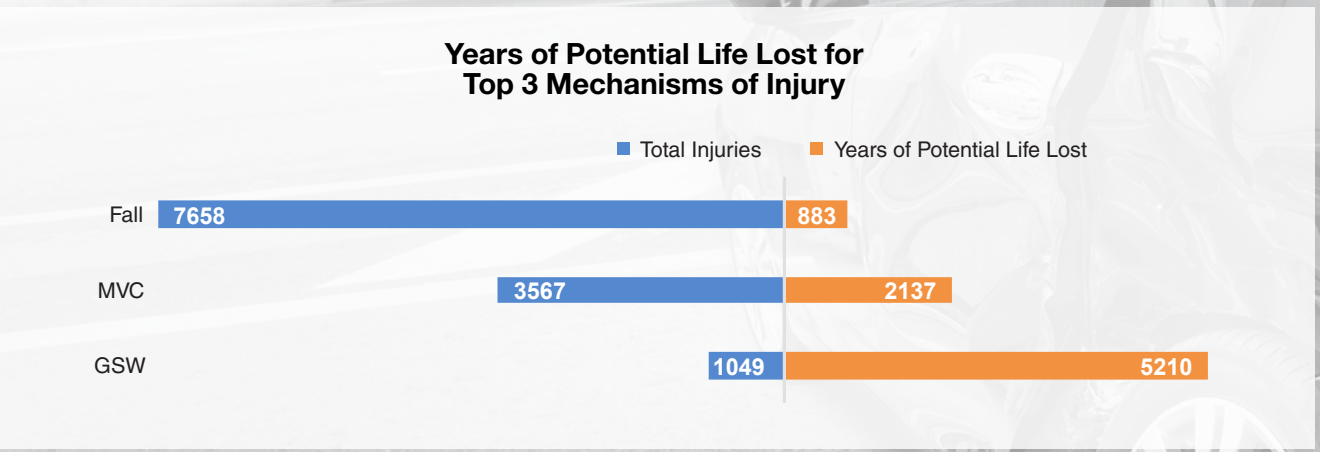
YEARS OF POTENTIAL LIFE LOST (YPLL)

Years of potential life lost (YPLL) is a measure of the years a person would have lived had they not died prematurely. This is used to give a measure of population burden of disease. For example, a high amount of YPLLs can point to lost contributions a person could have made to society. In these calculations, 75 years was used as the reference for life expectancy.

We looked at YPLLs for the top 3 mechanisms of injury in 2017: falls, motor vehicle collisions (MVC), and gunshot wounds (GSW). YPLLs are inversely proportional to the total injuries of that mechanism, with falls having the most injuries but fewest YPLLs, and GSWs having the least injuries but highest YPLLs. This is because falls tend to be more fatal in older individuals and GSWs in general occur more often in younger individuals.

	Total Injuries	Deaths	Mortality	YPLL*	Mean YPLL per Death
Fall	7658	165	2.2%	883	5.4
MVC	3567	69	2.1%	2137	31.0
GSW	1049	129	14.8%	5210	40.4

*This YPLL calculation assumes a 75-year life expectancy



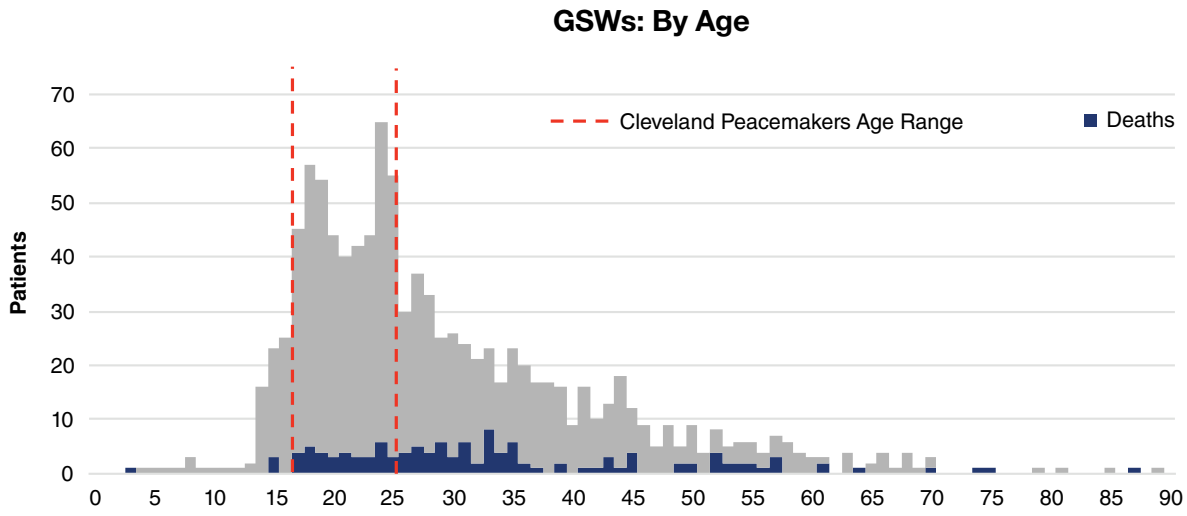
NOTS REGIONAL VIOLENCE INTERRUPTER PROGRAM

NOTS is very proud of the launch of the violence prevention program at MetroHealth and University Hospitals. In the fall of 2016, MetroHealth embedded violence interrupters in the emergency department to provide immediate support to patients being treated for gunshot wounds and stabbings. The focus is on ages 15-25. The bedside is viewed as the time that most patients are ready to make a change in their lives. We are excited to announce the launch of the program at University Hospitals in the spring of 2018. The collaboration with the Cleveland Peacemakers Alliance has been a benefit to the patient, family and hospital staff. Violence interrupters are typically known in their communities and are trusted individuals who work to decrease retaliatory acts. In addition, the violence interrupters are able to work with family and friends of the patient to encourage peace during a very traumatic time.

During the first year at MetroHealth, 93 patients received visits from the violence interrupters in the emergency department and during their inpatient recovery. We look forward to the continued success of the program at University Hospitals. Upon discharge, patients are connected to case managers who develop a case plan, which includes safety, education needs and various social service needs.

Hospital staff and the violence interrupters attend the annual Healing Justice Alliance conference to learn about other programs through workshops and networking events. NOTS is working to follow other evidence-based models to improve the health of patients.

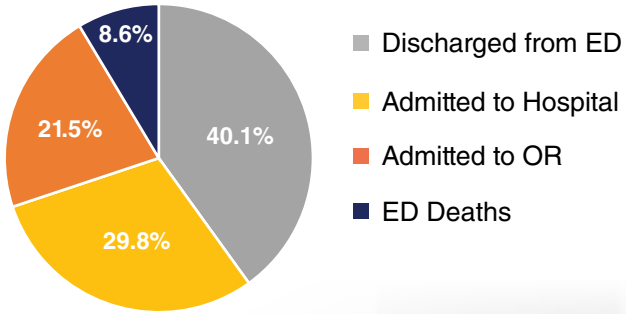
Mar'Yum Patterson (NOTS Violence Interrupter)



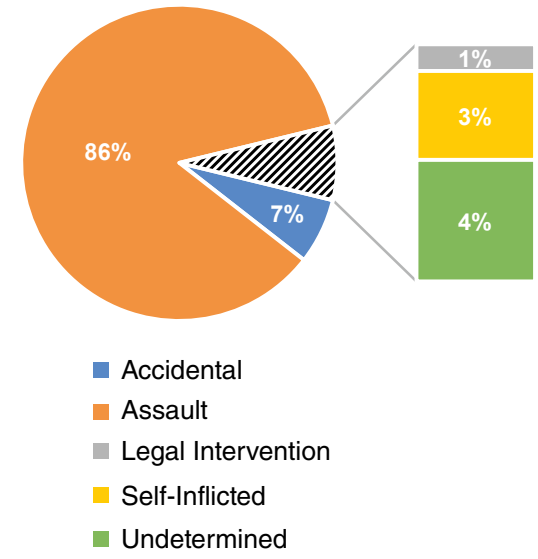
GUNSHOT WOUND SPOTLIGHT
2017 DATA

- There were 1,049 GSWs seen in 2017 (compared to 1,060 in 2016)
- 88% of GSW patients were male
- 40% were discharged from the ED
- 21% were taken directly to the OR from the ED
- Of those who were admitted, 36% went directly to the OR
- Of those who were admitted, 37% had a stay in the ICU, with an average ICU stay of 5.1 days
- The mortality rate of those who were admitted was 6.2%

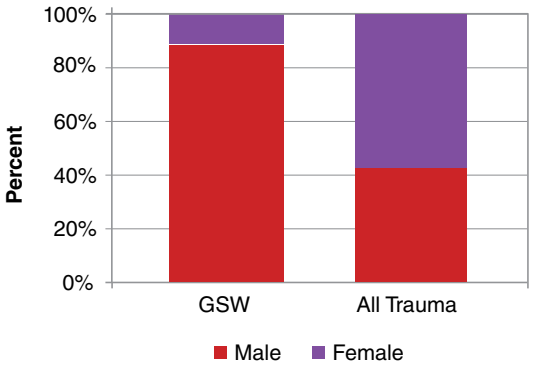
GSWs: By ED Disposition



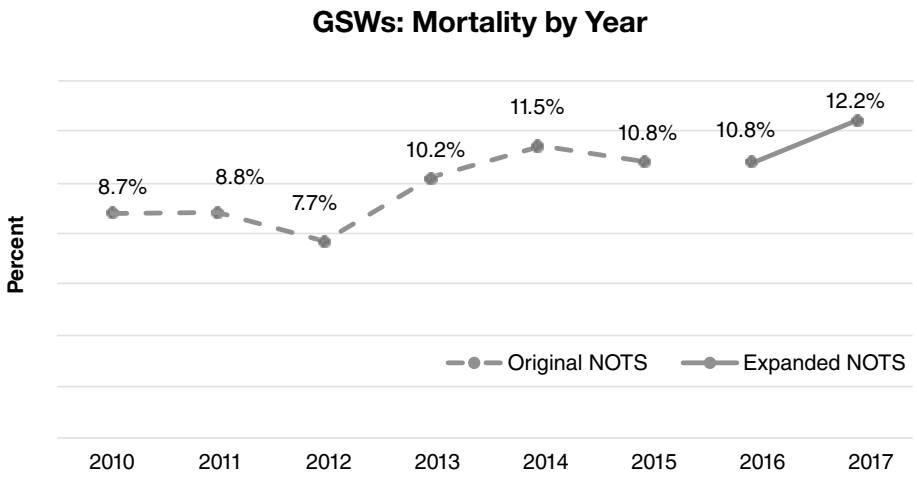
GSWs: By Intent

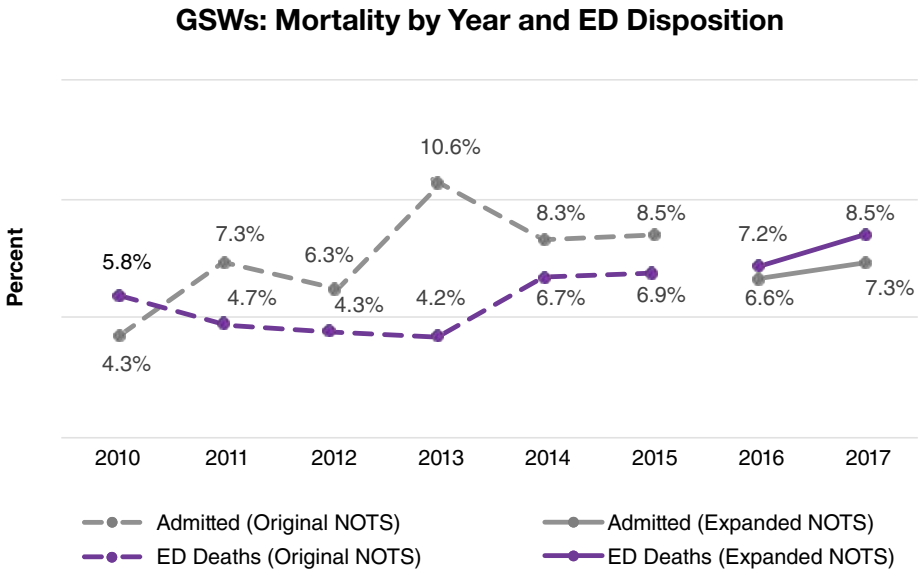


GSWs vs All Trauma: By Gender

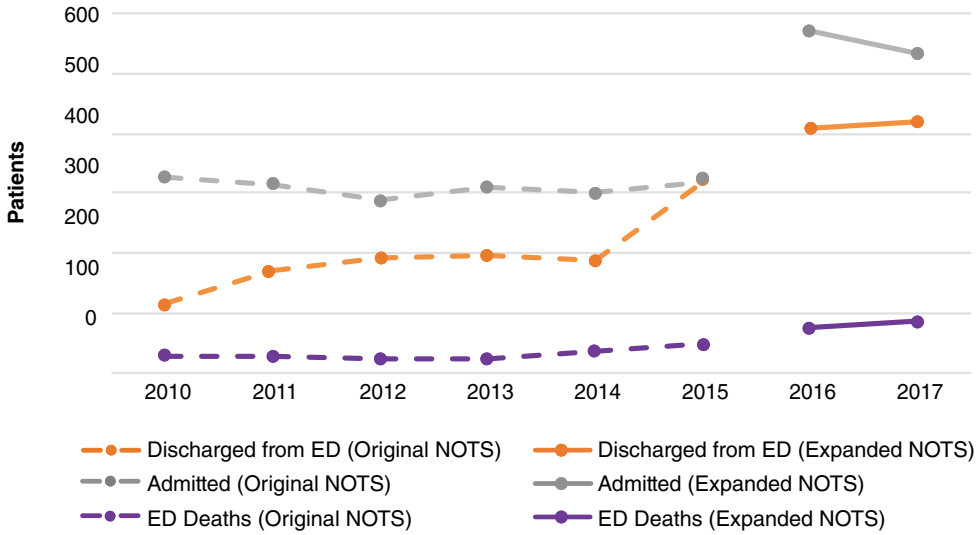


GUNSHOT WOUND SPOTLIGHT (CONTINUED)
2017 DATA



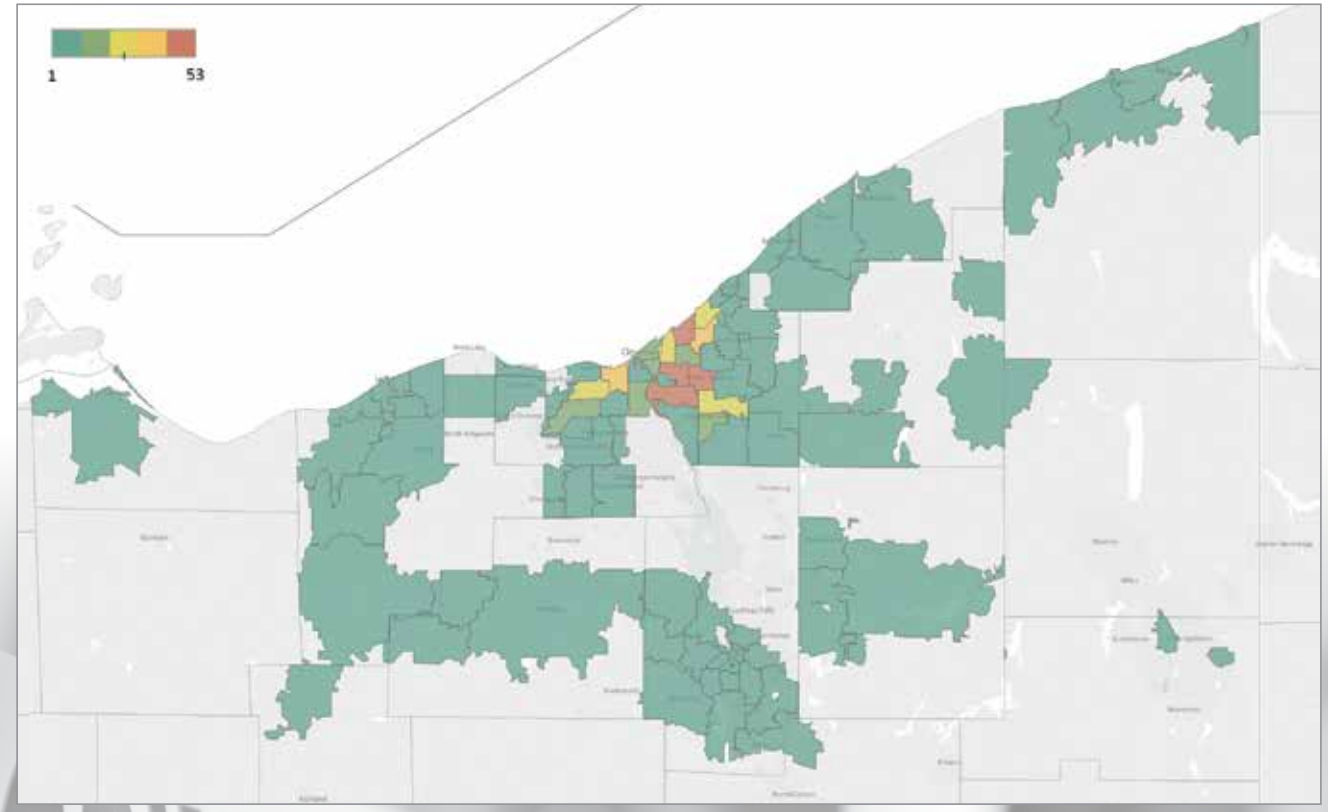


GSWs: By Year and ED Disposition

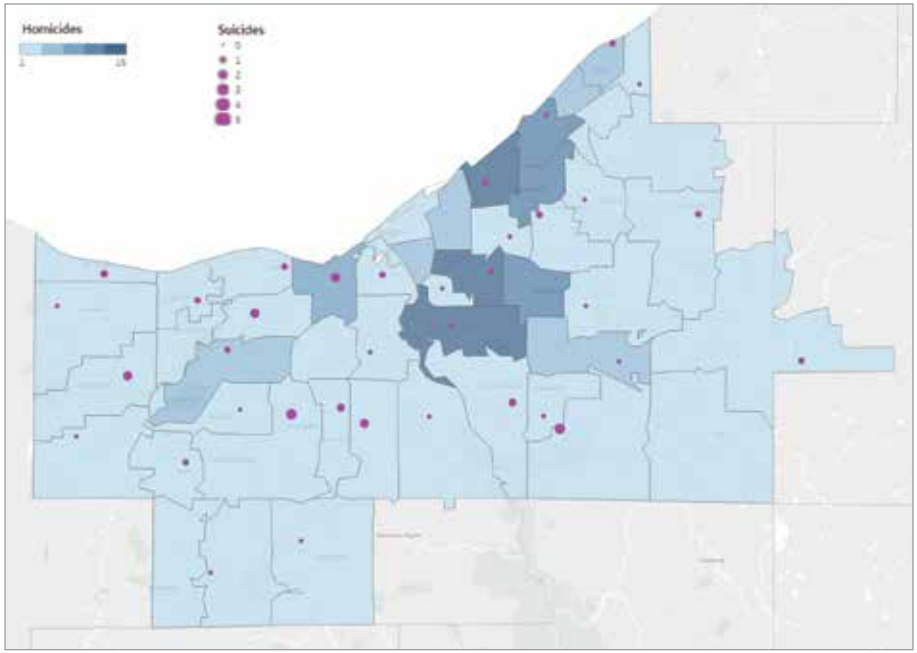


GEOGRAPHY: GSWs
2017 DATA

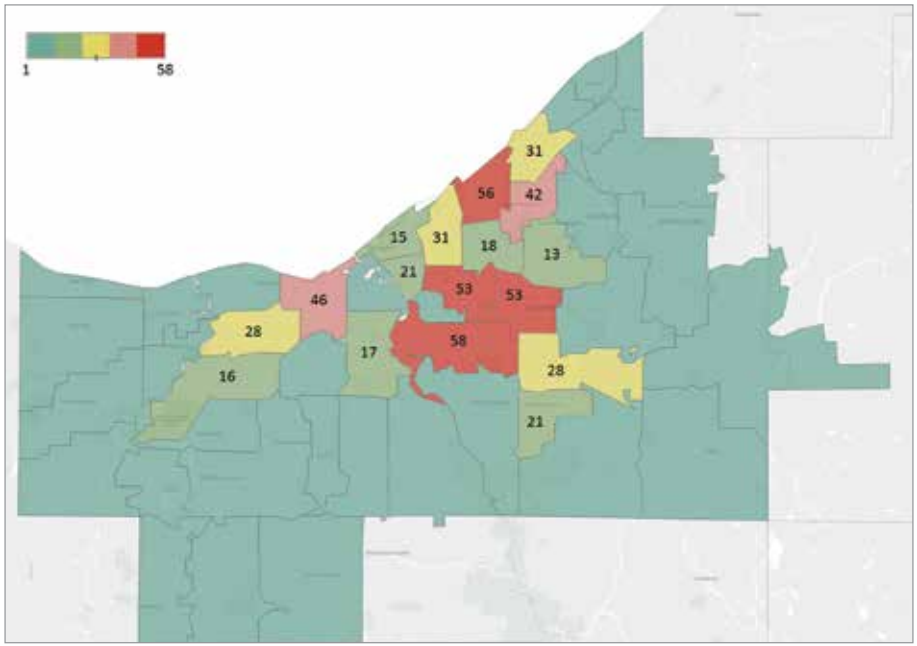
Geography: GSWs



Geography: GSWs and Intent in Cuyahoga County



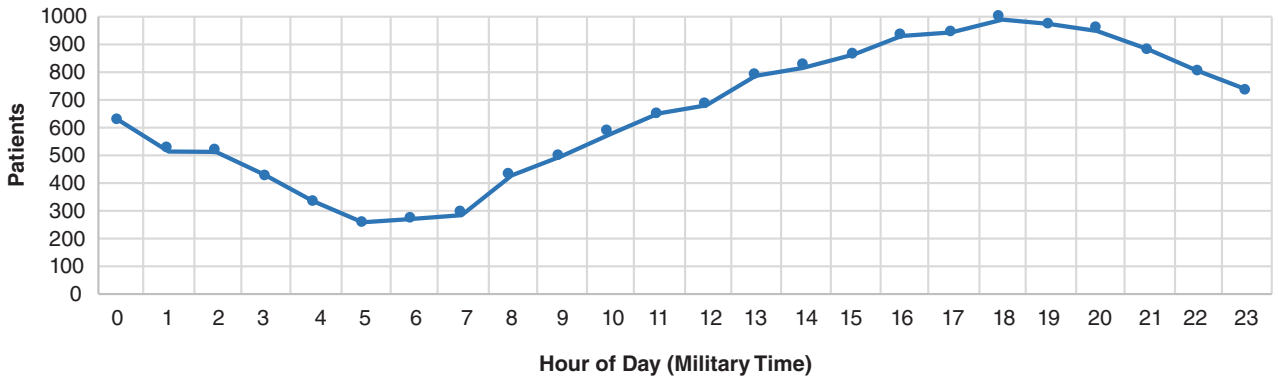
Geography: GSWs in Cuyahoga County



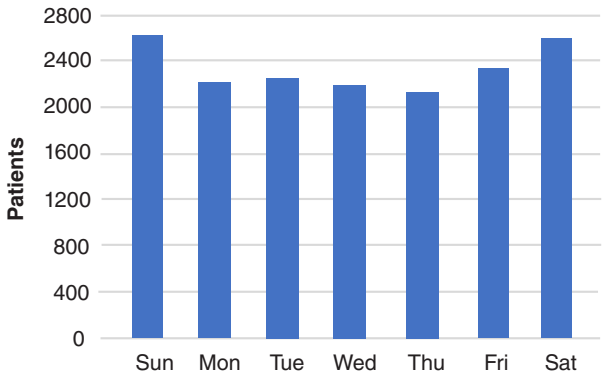
These maps look only at Cuyahoga County and include data from both NOTS and the Cuyahoga County Medical Examiner's Office. Incorporating Medical Examiner's Office data allows us to capture gunshot wound injuries that resulted in death on scene or somewhere in the County other than a NOTS trauma center, thus giving a more comprehensive picture of traumatic gunshot wound injuries.

FREQUENCY OF TRAUMA
2017 DATA

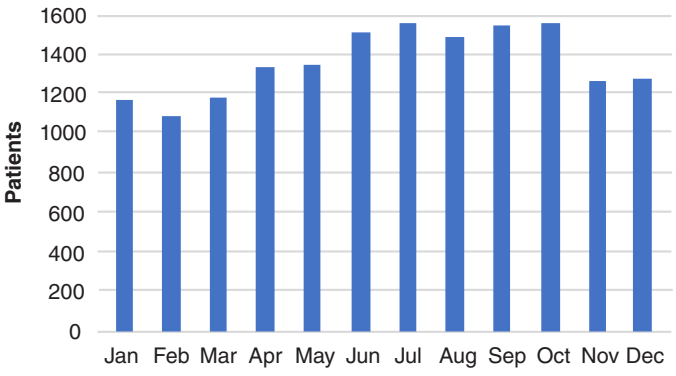
Frequency of Trauma: By Hour of Day



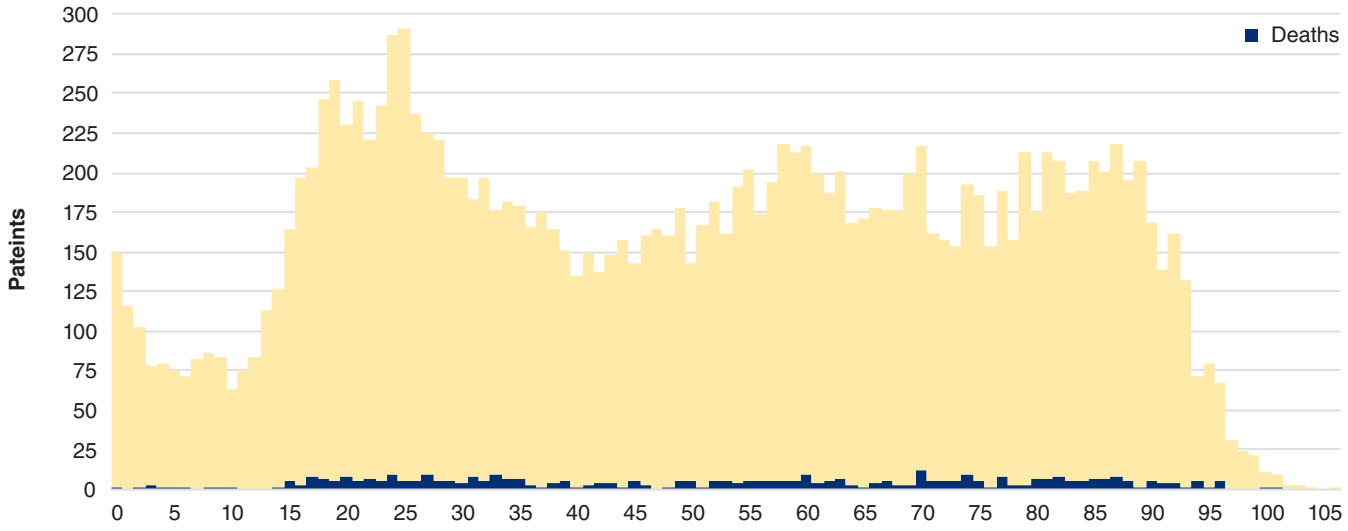
Frequency of Trauma: By Day of Week



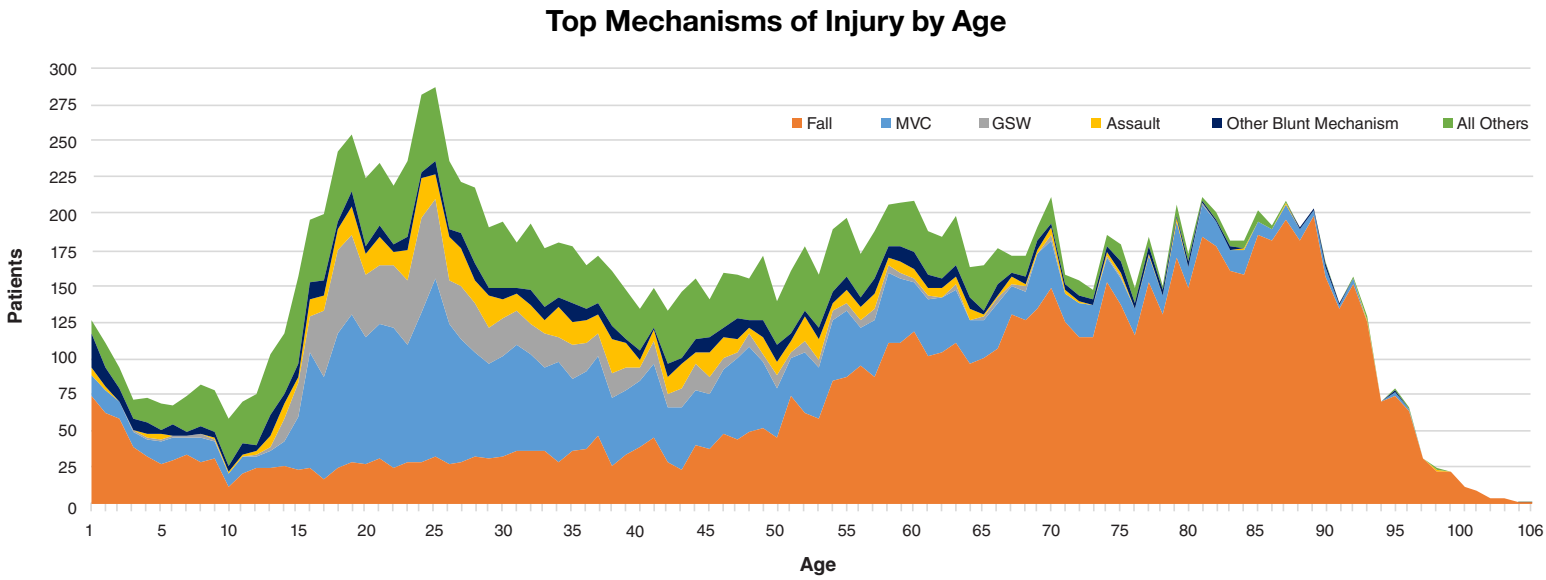
Frequency of Trauma: Month



Frequency of Trauma: All Patients by Age

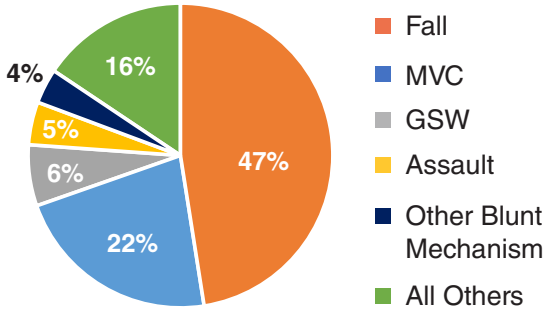


MECHANISM OF INJURY
2017 DATA



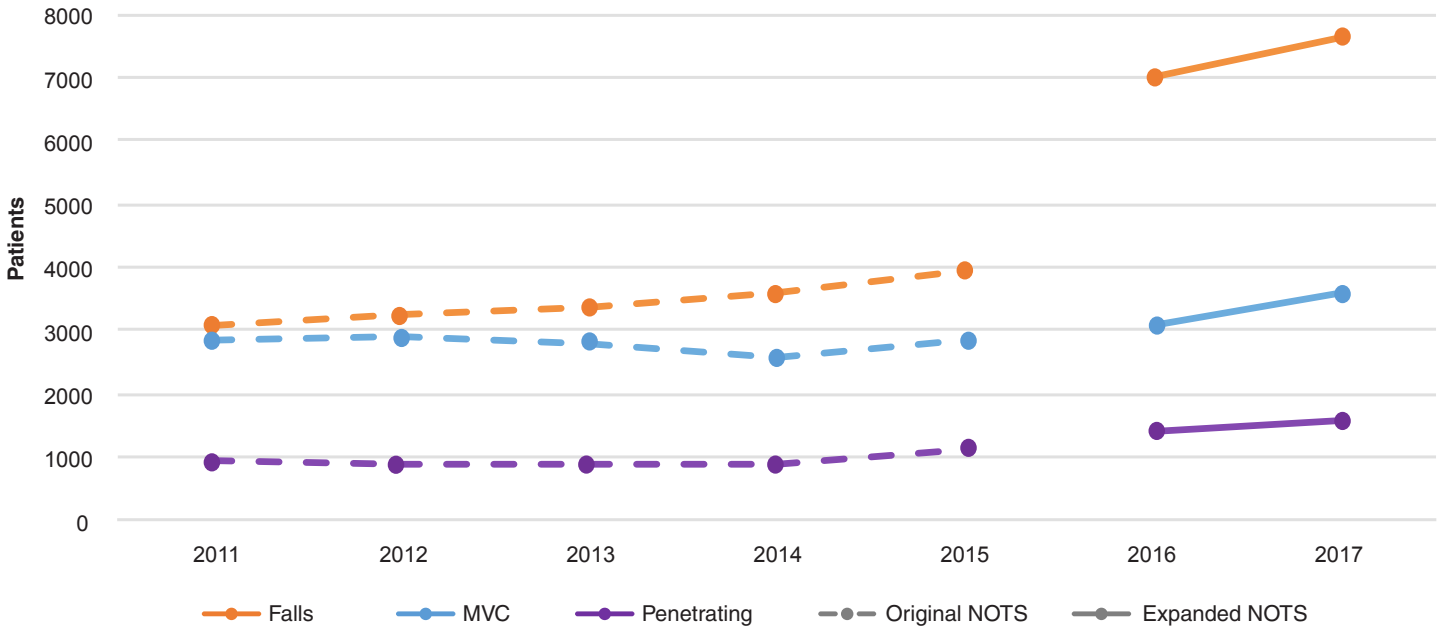
Note: "All Others" includes Asphyxiation, Hanging, MVC vs Pedestrian, Bicycle, ATV, Horse & Rider, Stab, Drown, Watercraft, Bite, Sport, Burn, and all otherwise unclassified.

All Patients

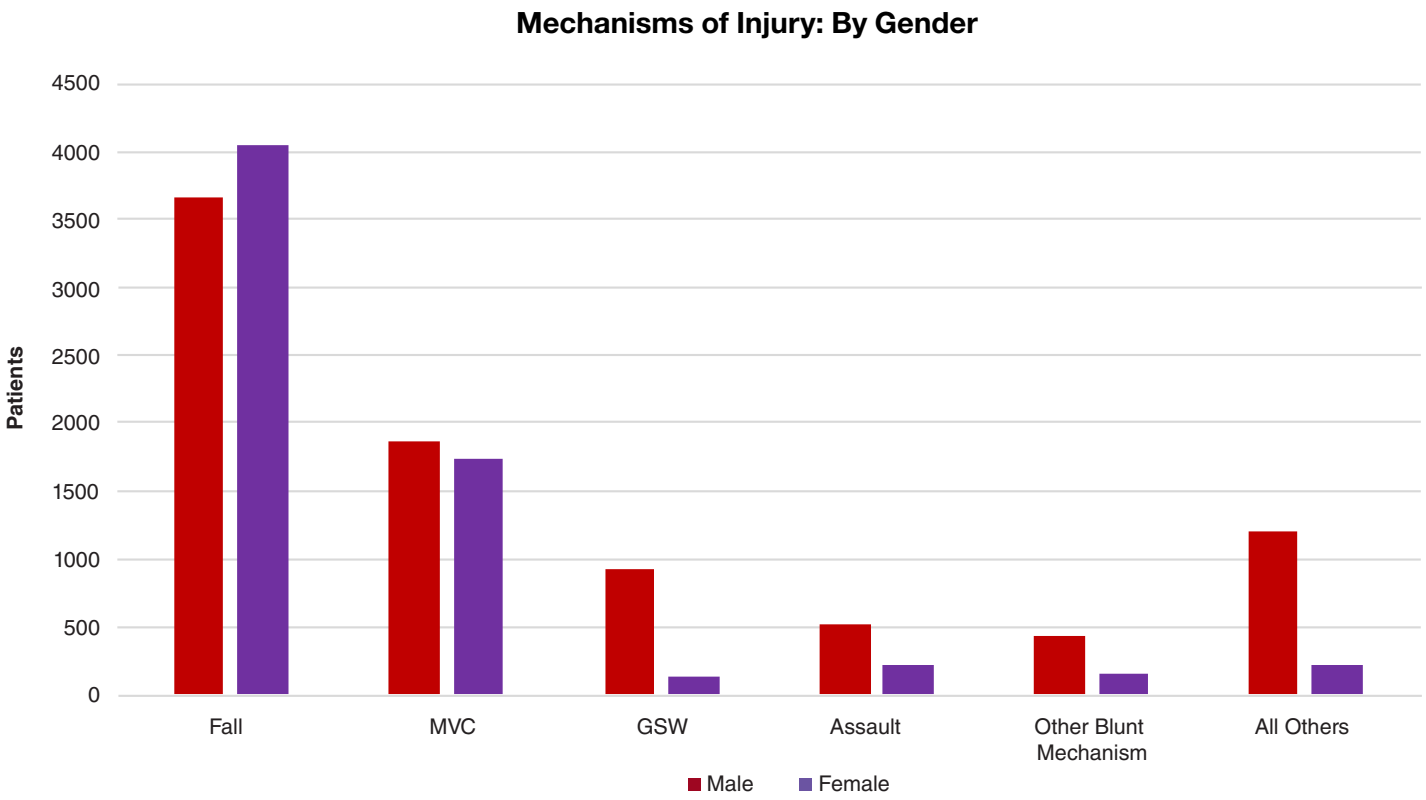


Note: "All Others" includes Asphyxiation, Hanging, MVC vs Pedestrian, Bicycle, ATV, Horse & Rider, Stab, Drown, Watercraft, Bite, Sport, Burn, and all otherwise unclassified.

Top Mechanisms of Injury: By Year



MECHANISM OF INJURY (CONTINUED)
2017 DATA



Note: "All Others" includes Asphyxiation, Hanging, MVC vs Pedestrian, Bicycle, ATV, Horse & Rider, Stab, Drown, Watercraft, Bite, Sport, Burn, and all otherwise unclassified.

Mechanism of Injury by Age Group

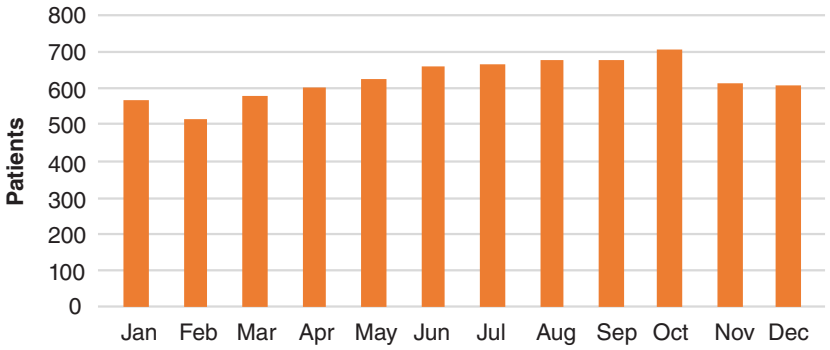
Mechanism	<15	15-20	21-40	41-65	66-80	>80	Total
MVC	193	471	1451	998	330	124	3567
Fall	526	145	653	1821	2010	2503	7658
Assault	40	76	349	232	32	5	734
Asphyxiation	0	1	1	0	0	0	2
Hanging	2	5	18	8	0	1	34
Motorcycle	3	27	167	242	30	3	472
MVC vs Pedestrian	77	56	133	158	49	16	489
Bicycle	70	29	74	113	28	2	316
ATV	37	38	88	55	8	1	227
Horse & Rider	13	14	13	22	4	0	66
Other Blunt	116	54	154	194	62	16	596
Other Penetrating	29	14	68	54	9	0	174
Stab	3	28	175	105	10	3	324
Drown	2	1	3	0	1	0	7
GSW	30	247	582	168	16	4	1047
Watercraft	2	1	1	8	3	0	15
Bite	42	3	11	25	7	0	88
Sport Injury	70	62	36	19	0	2	189
Burn	18	3	24	45	6	4	100
Unknown	0	0	3	5	1	2	11
Totals	**1273**	**1275**	**4004**	**4272**	**2606**	**2686**	**16116**

Mechanism of Injury by ISS Group

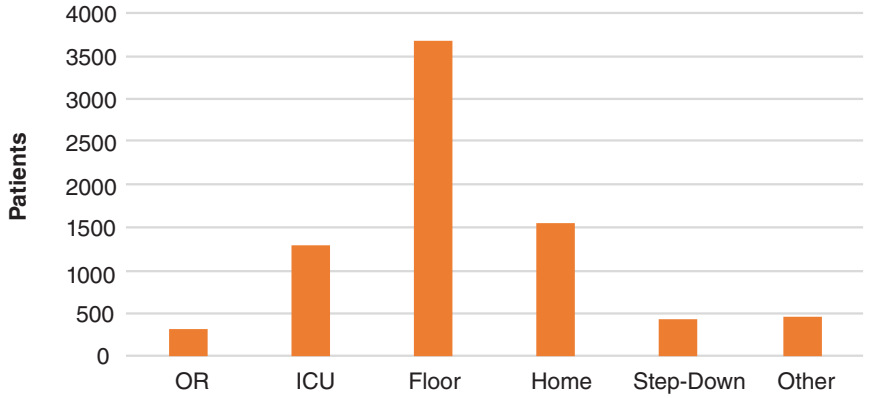
Mechanism	<9	9-14	15-24	25+
MVC	1816	497	209	128
Fall	3739	2426	453	230
Assault	351	125	37	9
Asphyxiation	1	0	1	0
Hanging	7	12	0	4
Motorcycle	186	126	63	45
MVC vs Pedestrian	212	88	44	36
Bicycle	155	76	22	12
ATV	116	59	29	8
Horse & Rider	40	20	1	1
Other Blunt	372	115	28	18
Other Penetrating	125	11	0	1
Stab	207	46	10	11
Drown	2	0	1	4
GSW	421	264	97	136
Watercraft	7	4	2	0
Bite	74	5	0	1
Sport Injury	128	33	6	5
Burn	34	7	2	3
Unknown	5	5	1	0
Totals	**7998**	**3919**	**1006**	**652**

FALLS
2017 DATA

Falls: By Month

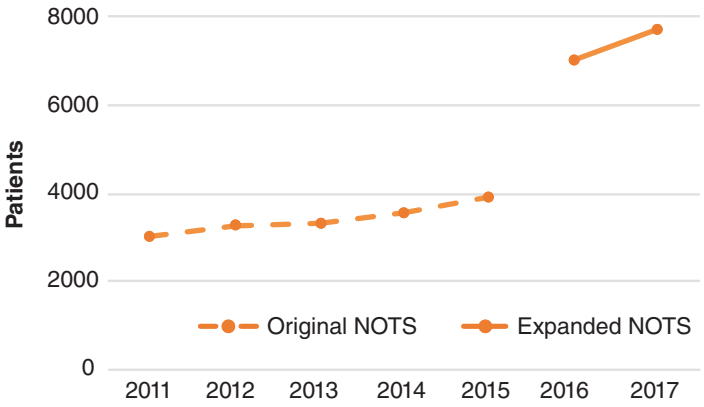


Falls: By ED Disposition

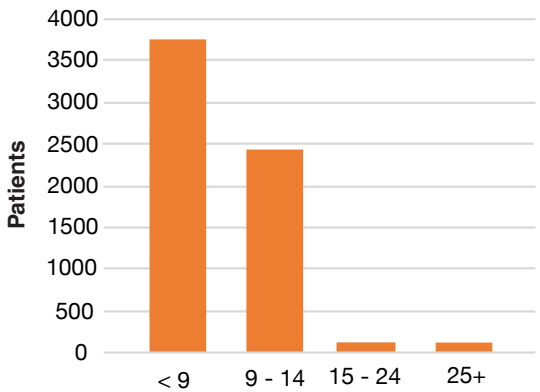


Note: "Step-Down" includes Step-Down Unit, and Telemetry. "Other" includes Observation, Special Procedures, AMA, Correctional Facility, Morgue, Acute Care Facility, or other inpatient facility.

Falls: By Year

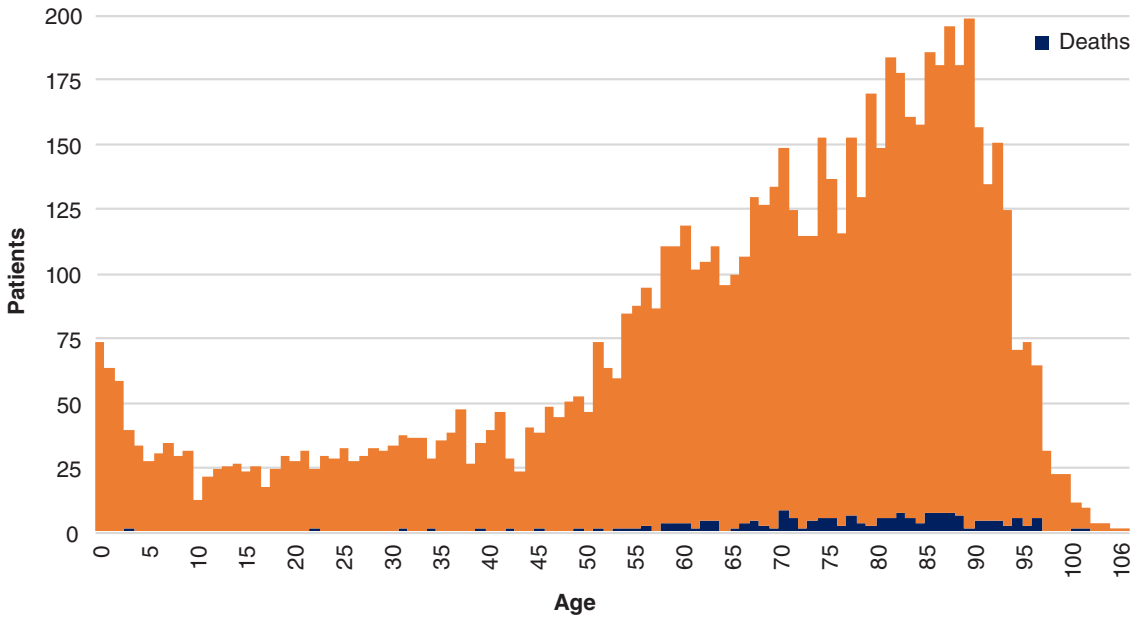


Falls: By Injury Severity Score (ISS)



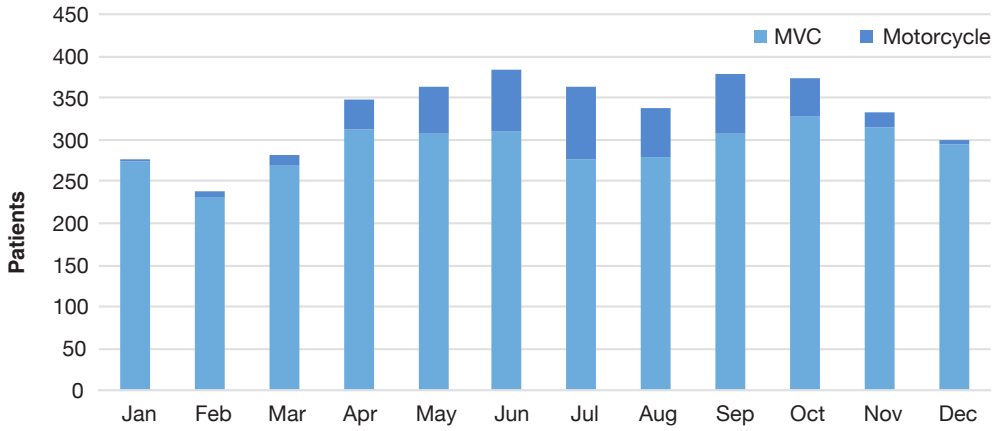
Note: Those without a scored ISS are excluded from this chart.

Falls: By Age

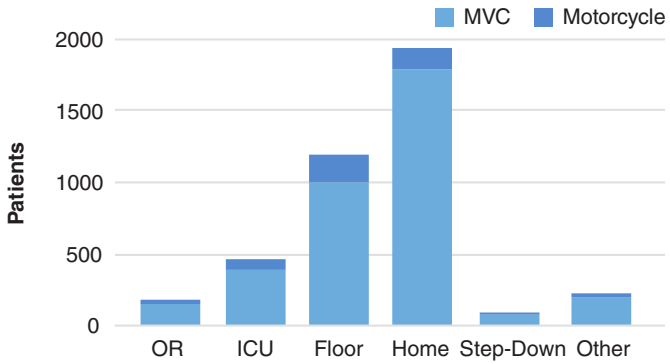


MOTOR VEHICLE AND MOTORCYCLE CRASH **2017 DATA**

MVC and MCC: By Month

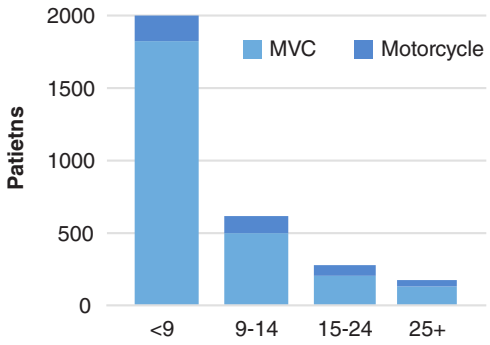


MVC and MCC: By ED Disposition



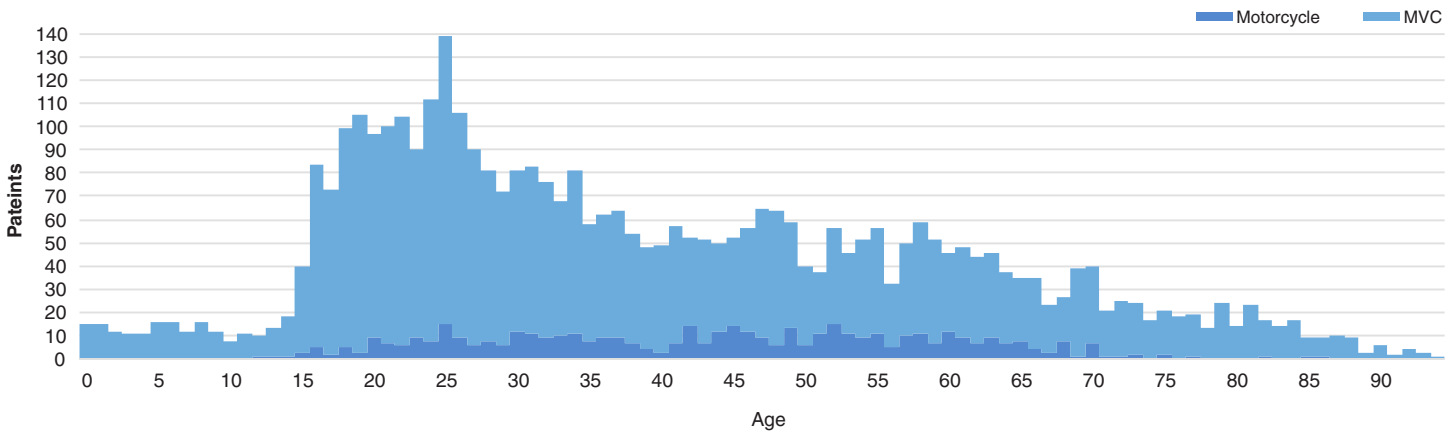
Note: "Step-Down" includes Step-Down Unit, and Telemetry. "Other" includes Observation, Special Procedures, AMA, Correctional Facility, Morgue, Acute Care Facility, or other inpatient facility.

MVC and MCC: By Injury Severity Score (ISS)

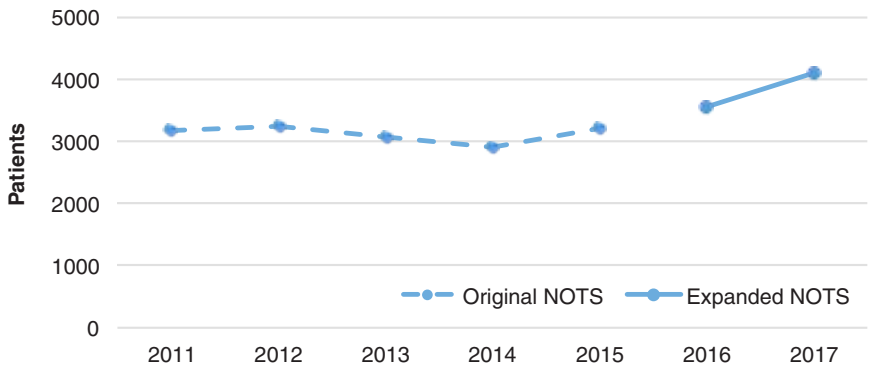


Note: Those without a scored ISS are excluded from this chart.

MVC and MCC: By Age



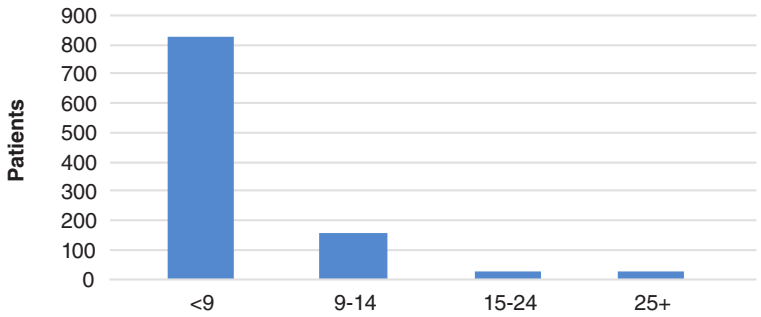
MVC and MCC: By Year



PEDIATRIC AND ADOLESCENT **2017 DATA**

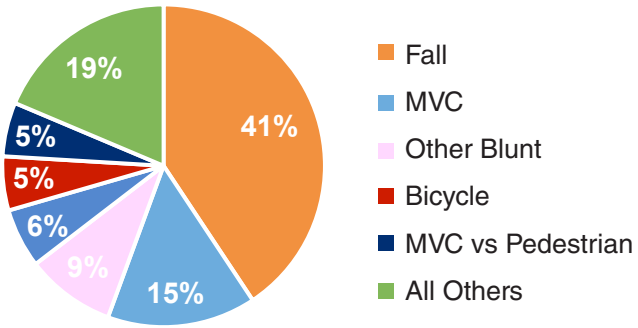
14 YEARS OF AGE AND YOUNGER

Pediatric Trauma: By Injury Severity Score (ISS)



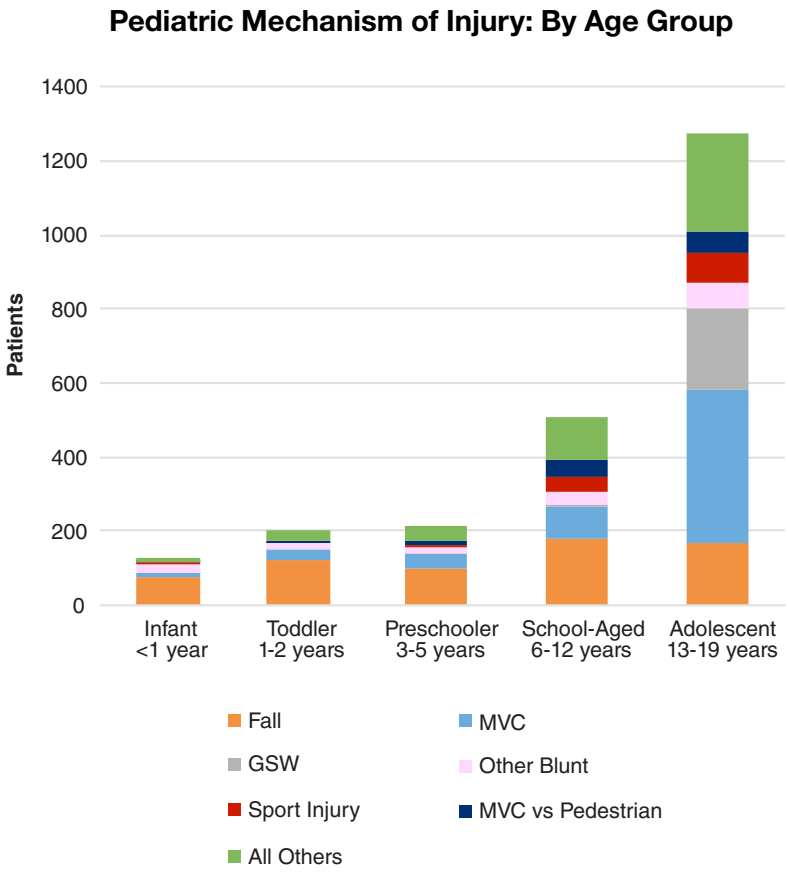
Mechanism of Injury	Patients
MVC	193
Fall	526
Assault	40
Asphyxiation	0
Hanging	2
Motorcycle	3
MVC vs Pedestrian	193
Bicycle	70
ATV	37
Horse & Rider	13
Other Blunt	116
Other Penetrating	29
Stab	3
Drown	2
GSW	30
Bite	42
Sport Injury	70
Burn	18
Watercraft	2
Total	**1223**

Pediatric Mechanism of Injury



Note: "All Others" includes Assault, ATV, Bite, Burn, Drown, GSW, Hanging, Motorcycle, Other Penetrating, Horse & Rider, Sport, Stab, and Watercraft.

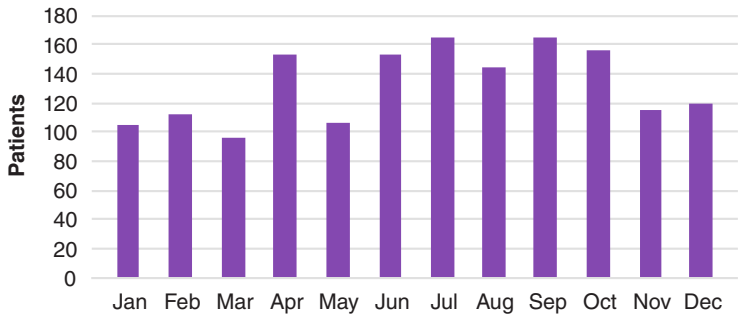
19 YEARS OF AGE AND YOUNGER



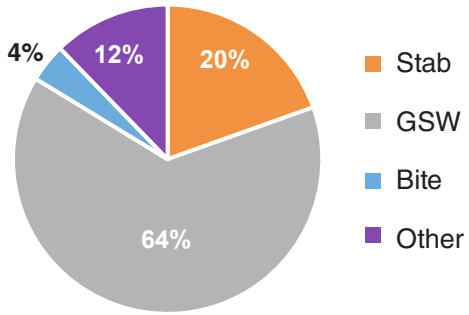
Pediatric Mechanism	Infant <1 year	Toddler 1-2 years	Preschooler 3-5 years	School-Aged 6-12 years	Adolescent 13 -19 years
Fall	75	121	99	181	169
MVC	15	27	38	84	412
GSW	0	0	3	9	222
Other Blunt	23	21	18	33	69
Sport Injury	3	0	3	42	81
MVC vs Pedestrian	2	6	14	41	58
All Others	10	30	39	117	260

PENETRATING TRAUMA
2017 DATA

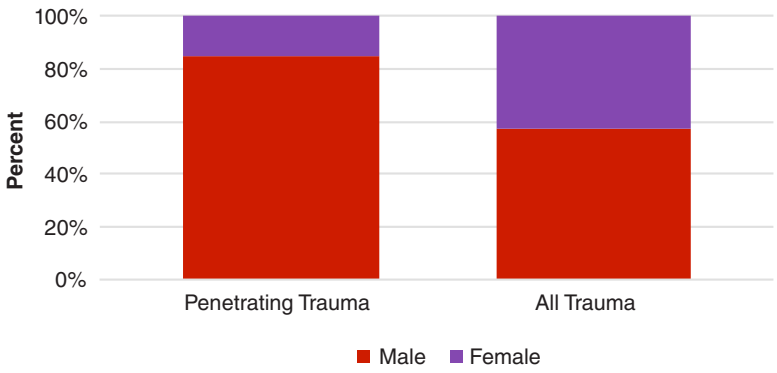
Penetrating Trauma: By Month



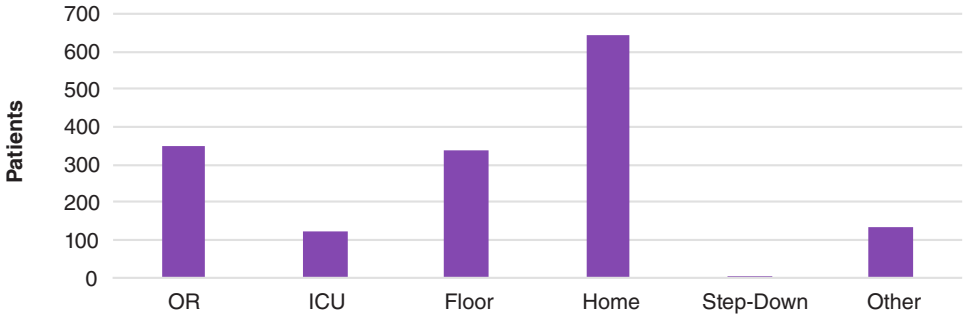
Penetrating Trauma: By Type



Penetrating Trauma vs All Trauma: By Gender

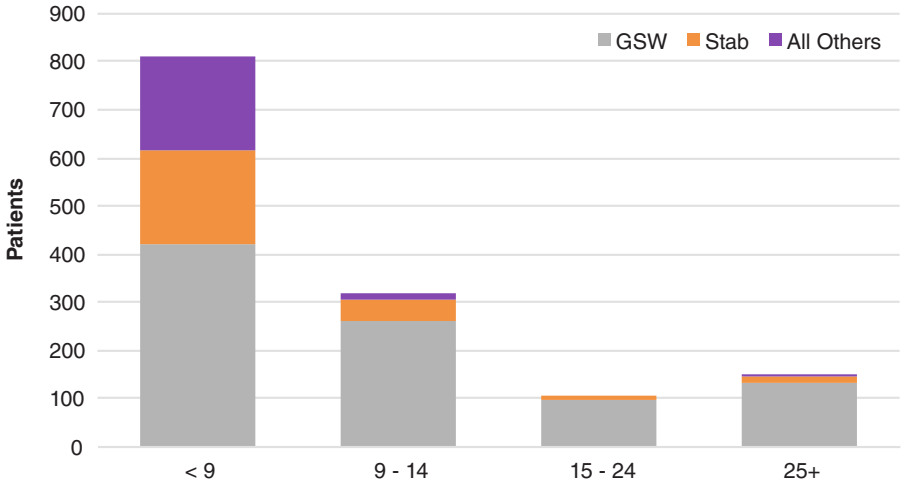


Penetrating Trauma: ED Disposition

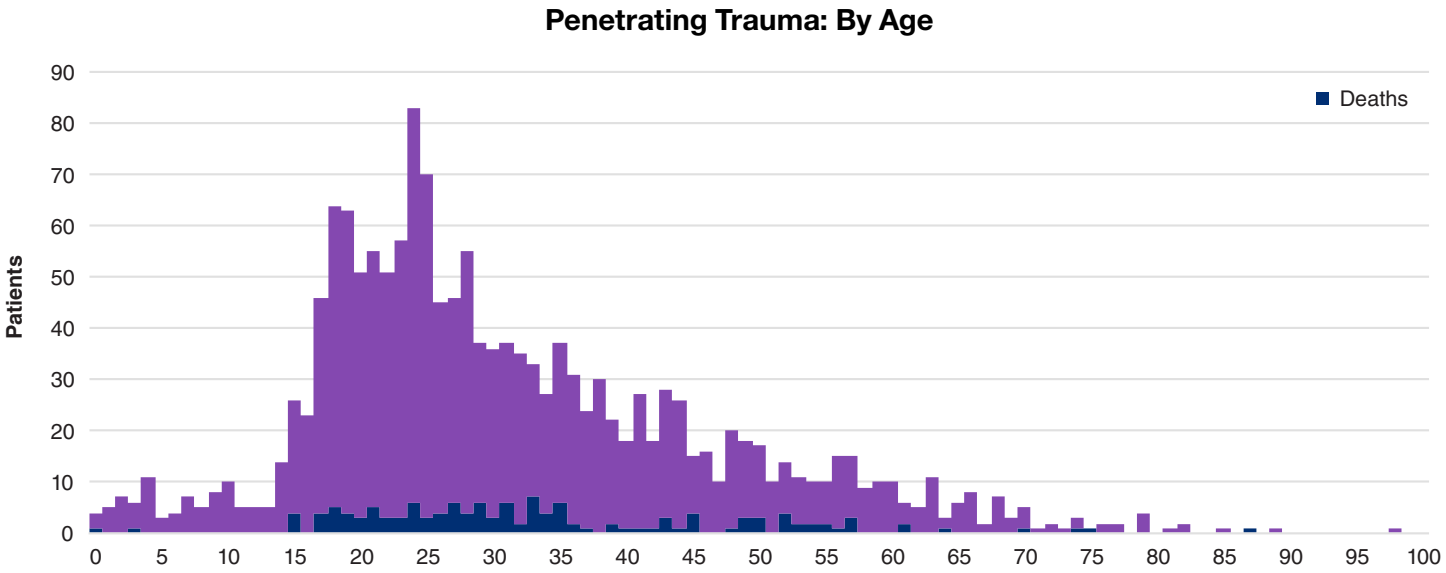


Note: "Step-Down" includes Step-Down Unit, and Telemetry. "Other" includes Observation, Special Procedures, AMA, Correctional Facility, Morgue, Acute Care Facility, or other inpatient facility.

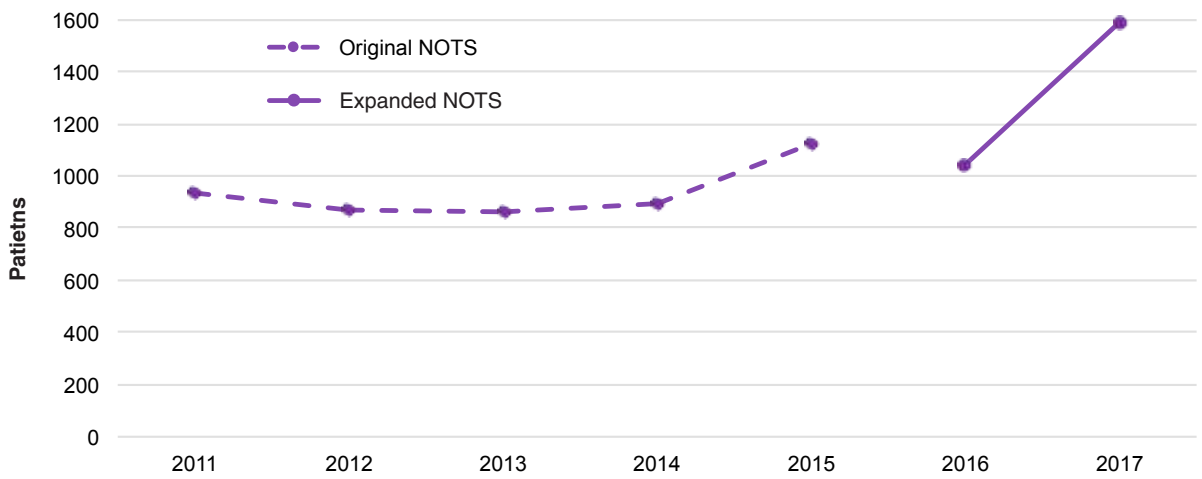
Penetrating Trauma: By Injury Severity Score (ISS) and Type



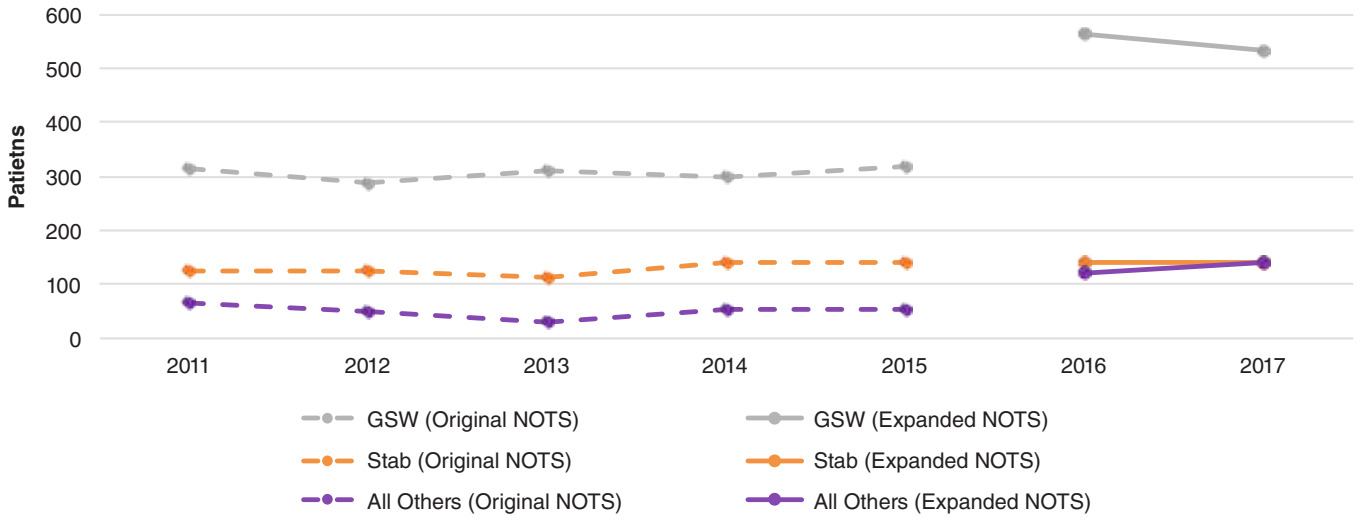
PENETRATING TRAUMA (CONTINUED)
2017 DATA



Penetrating Trauma: Total by Year



Admitted Penetrating Trauma: By Type and Year

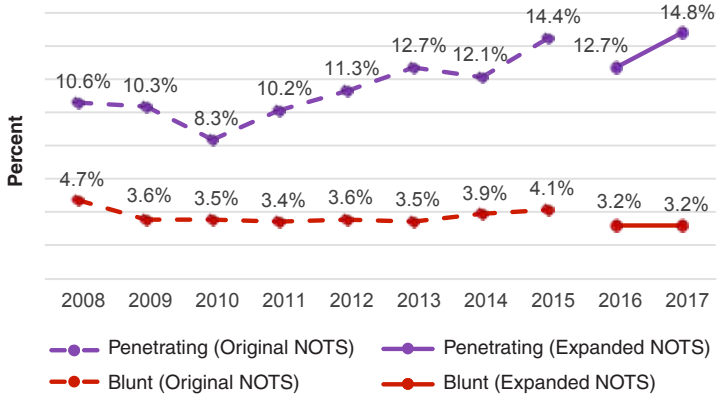


OUTCOMES - ADMITTED PATIENTS

The figures on these pages show the trends of mortality in the NOTS region over time. Data includes all trauma admissions and ED deaths secondary to trauma, and is separated based on blunt and penetrating injuries. Blunt injuries are mechanisms of injury such as falls or motor vehicle crashes. Penetrating injuries mainly include gunshot wounds or stabbings. Included are the number of patients (n) by each category for each year (*expanded NOTS counts are provided for 2016 and 2017). It is important to keep in mind the change in overall NOTS patient population and injury trends that occurred with the expansion of the System. Therefore, caution must be taken when comparing trends before and after the NOTS expansion in 2016.

MORTALITY: ALL ADMITTED PATIENTS AND ED DEATHS

This first figure shows mortality over time for patients of all Injury Severity Score (ISS) scores. In 2017, the region saw 9,282 patients with blunt injuries and 918 patients with penetrating injuries. The mortality percentages are not adjusted for injury severity or any other factors. Overall counts of injuries continued to increase in 2017. Mortality percentage from penetrating injuries went up between 2016 and 2017, while mortality from blunt injuries remained the same.

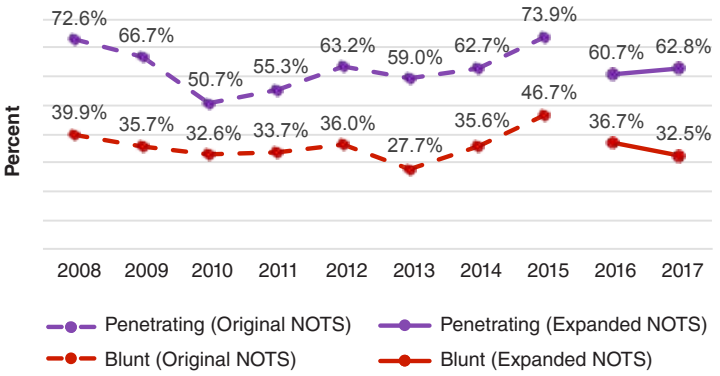


	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blunt (n)	4515	4583	4951	4443	4440	4266	4647	4821	8739	9282
Penetrating (n)	663	697	637	581	495	479	530	561	896	918

MORTALITY: ADMITTED PATIENTS AND ED DEATHS WITH ISS OF 25+

This figure represents the patients with the highest severity of injury: an ISS of 25 or higher. A large percentage of these patients have fatal injuries and are not expected to survive. A historical rule of thumb is that roughly 50% of patients with an ISS > 25 don't survive. ISS can go as high as 75; thus the range for these patients is 25-75. This figure does not go into detail beyond ISS > 25. In 2017, penetrating mortality in this group of patients increased, while blunt mortality decreased.

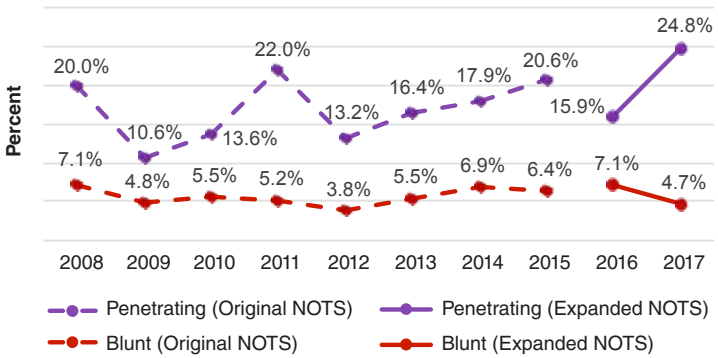
Likewise, part of the trauma surgeon's job is to respect family and patient wishes and recognize that it is our responsibility to allow people to die comfortably. At this time, we do not monitor how often we honor patient and family wishes to provide just comfort care and withhold life sustaining therapy.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blunt (n)	308	283	288	249	239	238	236	244	370	480
Penetrating (n)	73	96	73	76	76	83	83	88	141	148

MORTALITY: ADMITTED PATIENTS AND ED DEATHS WITH ISS OF 15-24

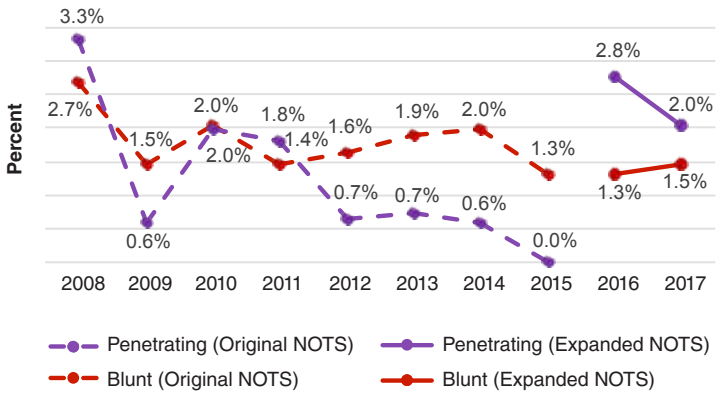
This group represents patients with a moderate severity of injury. When NOTS started, our goal was specifically to improve the outcomes of this patient group. While we will never get this number to zero, doing so is still the goal that we strive for. Mortality for blunt injuries has remained about the same the past several years, with a decline in mortality in 2017. Mortality in patients with penetrating injuries in this ISS group increased in 2017. Further analysis will be explored by the NOTS Quality Committee to evaluate for opportunities for improvement, and how to potentially bring this rate back down in the future.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blunt (n)	392	394	434	501	476	457	467	486	745	867
Penetrating (n)	60	66	44	50	53	67	56	68	90	105

MORTALITY: ADMITTED PATIENTS AND ED DEATHS WITH ISS OF 9-14

Patients with a minor ISS of 9-14 are numerous. In 2017, penetrating mortality decreased. However, this followed a sharp increase in 2016, so there is still room for improvement in this measure. Blunt mortality continues to remain roughly the same as it has been since 2015, which shows a sustained improvement from a brief spike in 2013 and 2014.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blunt (n)	1156	1226	1373	1173	1282	1164	1316	1454	3021	3347
Penetrating (n)	151	167	153	165	153	137	171	163	263	296

We would like to stress that we are sharing data in order to be transparent and highlight our successes as well as identify further opportunities for improvement. The most important thing to recognize is that while we talk about this as data, one must remember that we are talking about patients' lives. Every life matters and we would like to take a moment to humbly express our sympathy to all the families who have been affected by the loss of a loved one as a result of a traumatic injury.

NOTS ADVISORY BOARD

Collaboration has been key in maintaining the NOTS vision of "right patient, right place, right time". The NOTS Advisory Board has helped instill that vision within their hospital systems and throughout the region. With that vision, NOTS continues to strive to expand our educational activities across all three systems and throughout the region. We plan to continue the collaboration, transparency and the commitment to place the community above self.

Robert Wyllie, MD

Chief Medical Operating Officer
Systemwide Medical Operations
Associate Chief of Staff
Professor, Lerner College of Medicine
Cleveland Clinic

Bradford L. Borden, MD, FACEAP

Chairman
Emergency Services Institute
Associate Chief of Staff
Staff Affairs
Cleveland Clinic

Christopher Brandt, MD

Chair, Department of Surgery
MetroHealth Medical Center
Richard B. Fratianne MD
Professor of Surgery
Case Western Reserve University

Christopher Miller, MD, MS

Chair of the University Hospitals' Cleveland Medical Center Department of Emergency Medicine
Clinical Professor of Emergency Medicine
Case Western Reserve University School of Medicine

Terry Allan, MPH

Health Commissioner
Cuyahoga County
Board of Health

Bernard Boulanger, MD, MBA

Executive Vice President, Chief Clinical Officer of The MetroHealth System
Professor of Surgery, Senior Associate Dean
Case Western Reserve University
School of Medicine

E.J. Eckart, Jr.

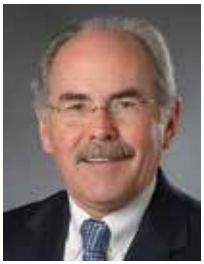
Assistant Director
Cleveland Department of Public Safety

Glen Tinkoff, MD, FACS, FCCM

System Chief for Trauma and
Acute Care Surgery
University Hospitals Cleveland

R. Matthew Walsh, MD, FACS

Professor of Surgery
Rich Family Distinguished Chair
of Digestive Diseases
Chairman, Department of General
Surgery, Digestive Disease Institute
Chairman, Academic Department
of Surgery, Education Institute
Cleveland Clinic



John H. Wilber, MD

Chairman, Department of Orthopaedic Surgery
MetroHealth Medical Center
Professor of Orthopaedics
Case Western Reserve University
School of Medicine

Dan Ellenberger

Director, EMS Institute University
Hospitals EMS Training & Disaster
Preparedness Institute

Brandy Carney

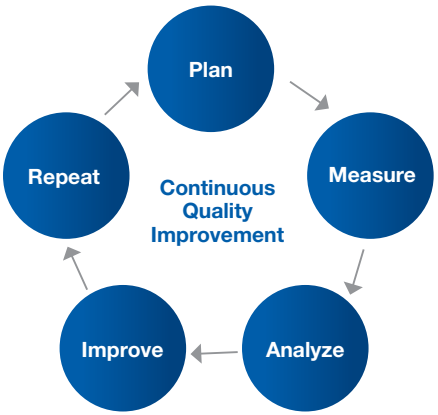
Chief
Cuyahoga County Public Safety & Justice

QUALITY COMMITTEE

The NOTS Quality Committee's mission is to emphasize a continuous, multidisciplinary effort to measure, evaluate, and improve the process of care and its outcome. The patient safety program evaluates the overall care process to minimize risk of harm related to the care process itself. Our mission is to reduce inappropriate variation in care and to improve patient safety.

The basic components of the Quality meeting:

- Identification of the overall monitoring plan based on high volume, high risk and problem-prone areas;
- Development of standards of care and appropriate monitoring of criteria;
- Review of data from monitoring activities;
- Analysis of data in order to draw logical conclusions and identify problems or trends in patient care/service or in individual physician practice;
- Development of plans to pursue opportunities to improve patient care and services, resolve identified problems, and/or identify opportunities to reduce the risk of adverse events;
- Evaluate the effectiveness of problem solutions or changes in the delivery of care to determine if the defined goals have been achieved;
- Communicate information to the appropriate groups or individuals.



Committees under the Quality Committee:

Adult Protocol Committee
- To develop and initiate guidelines for the adult trauma patient.

Pediatric Protocol Committee
- To develop and initiate guidelines for the pediatric trauma patient.

Injury Prevention
- Educating on how to reduce trauma (falls, MVC, GSW, etc.).

Trauma Program Manager Committee
- Review statewide trauma goals, discuss institution differences and learn from one another.

Left to right:

Back row: Dr. Craig Bates, Olivia Houck, Tod Baker, Dr. Michael Dingeldein, Dr. Glen Tinkoff, Dr. Jeffrey Claridge, Dr. Steven Meldon, Dr. Tony Capizzani, Bernadette Szmigielski

Front row: Mary Anne Edwards, Lynn Horton, Sandy Daly-Crossley, Noreen Molek, Dr. Jeffrey Luk, Danielle Rossler, Sharon Wiita, Cristina Ragone, Bridget Gill, Dr. Nimitt Patel

Not pictured: Dr. Cathleen Khandelwal, Dr. Bradford Borden, Dr. John Tafuri, Dr. Farid Muakkassa, Dr. Zac Robinson, Dr. Damon Kralovic, Shannon Swader, Dr. John Como, Dr. Craig Eyman.

EMS COMMITTEE

The purpose of the NOTS EMS Committee is to establish education, guidelines and standards for the transfer of the trauma patient to an acute care facility. The information is available to any physician, EMS organization or EMS provider throughout the region. The goal of the committee is to improve outcomes in our trauma patients.

Guidelines:

- Non-Trauma Triage Adult
- Non-Trauma Triage Pediatrics
- Field Triage Adult
- Field Triage Pediatrics
- Spine Immobilization

Left to right: Tod Baker, Danielle Rossler, David Yarmesch, Shaun Buehner, Dr. Tom Collins, Dr. Jim Sauto, Dr. Susan Tout, Dr. Don Spaner, Joe Gavlak, Dr. Craig Bates, Jim Sekerak, Chief Bruce Elliott, Andrea Rinker, Dave Sirl

Not pictured: Alonzo Cady, Beth Sundman, Cheryl Behm, Kathy Cern, Dan Ellenberger, Dennis Anderson, Deb Juba, Dominic Silvestro, John Dunn, Dr. Jeff Claridge, Jeff Gembus, Jackie Haumschild, Jamie Meklemburg, John Thomas, Chief Ken Papesh, Asst. Chief Neil Rozman, Dr. Amy Raubenolt, Rick Moskalski, Chief Scott Gilman, Bruce Shade, Tyler Hallquist, Chief Tony Raffin, Bill Sillasen

REGISTRY COMMITTEE

The NOTS Trauma Registry Committee's mission is to increase the accuracy and consistency of data abstracted into the trauma database through education, validation and software updates.

Objective:

- To help maintain hospital-specific trauma registries.
- To help manage the NOTS regional trauma registry.
- To help hospitals meet submission deadlines for state and national requirements.
- To help ensure a high level of data quality.

Importance of Trauma Research:

Research is being conducted every day to stop the disease process that we call "trauma." NOTS was founded on the missions to carry out research using regional data in order to establish evidence-based best practices for EMS, hospitals, injury prevention programs, and much more. This ultimately supports the NOTS goal to get the right patient, to the right place, at the right time.

Left to right: Wendi Dean, Alison Ziemak, Dawn Ulle, Jessica Mazzocco, Patricia Baskin, Joyce Hudak, Pamela Owen, Karen Silberhorn, Olivia Houck

Not pictured: Ellen Fitzenrider, Noreen Molek, Terrie Weir-Edwards, Kate Amsden-Strah, Jessica DeVaughn, Kim Dalessandro

GLOSSARY OF TERMS

Age-Specific Rate: A rate for a specified age group. The numerator and denominator refer to the same age group.

Cause of Death: For the purpose of national mortality statistics, every death is attributed to one underlying condition, based on information reported on the death certificate. For injury deaths, the underlying cause is defined as the circumstance of the accident or violence that produced the fatal injury.

Cut/Pierce: This category includes injuries cause by cutting and piercing instruments: knives, swords, daggers, power lawn mowers, power hand tools, household appliances.

Drown: This category includes injuries from drowning/near drowning and submersion with and without involvement of watercraft.

E-Code: Code indicating an external cause of an injury. E codes specify the type of circumstance involved, for example: fall from steps/stairs, ladder, building, cliff, furniture.

External Cause of Injury: The external cause of injury is used for classifying the circumstance in which injuries occur. The external cause is comprised of two axes, the mechanism or cause (i.e., firearm or motor vehicle) and manner or intent (i.e., homicide or suicide).

Firearms: This category includes injuries from firearms, including unintentional, suicide, homicide, legal intervention and undetermined intent.

Frequency: The number of times an event happens.

Geriatric: Patient ages 65 and older.

Homicide: The killing or intent to kill of one person by another.

Incidence: The number of instances of illness or injury during a given period of time in a specified population.

Injury: Any unintentional or intentional damage to the body resulting from acute exposure to thermal, mechanical, electrical or chemical energy or from the absence of such essentials as heat or oxygen. According to the Injury Surveillance Guidelines, an injury is the physical damage that results when a human body is suddenly or briefly subjected to intolerable levels of energy. Injury can be a bodily lesion resulting from acute exposure to energy in an amount that exceeds the threshold of physiological tolerance, or it can be an impairment of function resulting from a lack of one or more vital elements (air, water, or warmth), as in strangulation, drowning, or freezing. The time between exposure to the energy and the appearance of an injury is short. The energy causing an injury may be one of the following:

- Mechanical
- Thermal
- Chemical
- Radiant
- Electrical

Intent of Manner of Injury: Intent refers to one of the two dimensions of the external cause of injury matrix. This dimension classifies manner of the injury (unintentional or accidental, suicide or self inflicted, homicide or assault, or undetermined) in three versions of the external cause of injury matrix.

International Classification for Diseases (ICD): The ICD provides the ground rules for coding and classifying cause of death data.

Major Trauma: This is defined as injuries that result in death, intensive care admission, a major operation of the head, chest or abdomen, a hospital stay of three or more days, or an Injury Severity Score (ISS) of greater than or equal to 15.

Minor Trauma: This is defined as a patient who is entered into the trauma system, has an ISS of less than or equal to15, and survives until hospital discharge.

Mechanism of Injury: The manner in which a physical injury occurred (e.g., fall from a height, ground-level fall, high- or low-speed motor vehicle accident, ejection from a vehicle, vehicle rollover). The MOI is used to estimate the forces involved in trauma and, thus, the potential severity for wounding, fractures, and internal organ damage that a patient may suffer as a result of the injury.

Mortality: Deaths caused by injury and disease. Usually expressed as a rate, meaning the number of deaths in a certain population in a given time period divided by the size of the population.

Morbidity: Number of persons, nonfatally injured or disabled. Usually expressed as a rate, meaning the number of nonfatal injuries in a certain population in a given time period divided by the size of the population.

Pedestrian, Other: This category includes injuries among pedestrians hit by a train, a motor vehicle while not in traffic or another means of transportation.

Pediatric: Patients are 15 years of age and younger.

Risk factors: Characteristics of people, behavioral or environmental, that increase the chance of disease or injury occurring. Examples: alcohol use, poverty, gender.

Struck by/Against: This category includes injuries resulting from being struck or by striking against objects or persons. This category includes being struck (unintentionally) by a falling object, being struck or striking objects or persons (sports) and injuries sustained in an unarmed fight or brawl.

Years of Potential Life Lost: The concept of years of potential life lost involves estimating the average time a person would have lived had he or she not died prematurely.

NOTS RESEARCH

Despite Trauma Center Closures, Trauma System Regionalization Reduces Mortality and Time to Definitive Care in Severely Injured Patients

He JC, Schechtman D, Allen DL, Cremona JJ, Claridge JA

Abstract:

The Northern Ohio Trauma System (NOTS), consisting of multiple hospital systems, was established in 2010 to improve trauma outcomes. This study assessed its impact on mortality and time to definitive care, focusing especially on the severely injured patients. NOTS trauma registry was queried for all trauma activations from 2008 to 2013. The years between 2008-2009 and 2011-2013 were designated as pre- and post-NOTS, respectively. Data from 2010 was excluded as a transitional year. Two trauma centers (TCs) closed in 2010. Predetermined patient subgroups were analyzed. A total of 27,843 patients were examined. Mean age was 46 and 64 percent were male. Median Injury Severity Score (ISS) was five, and 87 percent sustained blunt injuries. Of these, 10,641 patients were pre-NOTS and 17,202 were post-NOTS. Comparing the two groups, mortality decreased from 5 to 4 percent post-NOTS ($P < 0.001$); median time to definitive care increased by 12 minutes post-NOTS. Multivariate logistic regression showed that NOTS implementation was an independent predictor for survival ($P = 0.008$), whereas time to definitive care was not. Subgroup analyses demonstrated mortality reductions post-NOTS for all subgroups except patients with penetrating injuries, where mortality remained the same despite an increase in ISS. Patients with ISS ≥15 had a 23 percent relative reduction in mortality, and their median time to definitive care decreased by 12 minutes. Implementation of a collaborative, regional trauma system was associated with mortality reduction and shortened time to definitive care in the severely injured patients. These findings highlight the importance of collaboration in the future development of regional trauma systems.

Trauma System Regionalization Improves Mortality in Patients Requiring Trauma Laparotomy

Schechtman D, He JC, Zosa BM, Allen D, Claridge JA

Abstract:

INTRODUCTION:
This study evaluates the impact of a regional trauma network (RTN) on patient survival, intensive care unit (ICU) length of stay, and hospital length of stay in patients who required trauma laparotomy.

METHODS:
Patients who required trauma laparotomy from January 2008 to December 2013 were analyzed. Patients admitted during 2008-2009 and 2011-2013 were designated as pre-RTN and RTN groups, respectively. The primary outcome was mortality.

RESULTS:
A total of 569 patients were analyzed, 231 patients were pre-RTN, and 338 were in the RTN group. Overall, mean age was 35.7 ± 17.1 and median Injury Severity Score was 16 (25th-75th percentile: 9-26). The two groups were similar with regard to age, Injury Severity Score, Abbreviated Injury Scale abdomen, sex, and mechanism. Overall, there was a 35% relative reduction in mortality from the pre-RTN to RTN group ($p = 0.035$), and 30% more patients were triaged to a Level 1 trauma center in the RTN group ($p < 0.001$). Logistic regression showed that being in the RTN group was an independent predictor for survival ($p = 0.026$) with odds ratio of 0.53 (95% confidence interval, 0.30-0.93). Patients with penetrating trauma had a nonsignificant decrease in mortality and a reduction of 1 day of ICU stay ($p = 0.001$). Patients with blunt trauma had a significant reduction in mortality from 38% in the pre-RTN group to 23% in the RTN group ($p = 0.017$).

CONCLUSION:
This study focused on the unique patient population that required trauma laparotomies. It showed that trauma system regionalization led to a significant increase in the number of patients triaged to a Level 1 trauma center and reduction of ICU length of stay. More importantly, it demonstrated the benefit of regionalization by showing a significant reduction of hospital mortality in this critically injured patient population.

LEVEL OF EVIDENCE:
Therapeutic study, level IV.

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NOTS EDUCATION

Educational Offerings:

- Traumatic Brain Lecture
- Shock and Hemorrhage
- Frostbite and Hypothermia
- Burns
- Pediatric Trauma
- Stop the Bleed
- Annual Trauma Symposium

Stop the Bleed

- Nationwide initiative to educate the general public in bleeding control
- Over 100 classes held in northern Ohio

Annual NOTS Trauma Symposium

- Educating hundreds of attendees every year since 2011
- Attendees: physicians, nurses, fire & EMS, partner professions (social work, attorneys)
- Speakers: local and national surgeons, nurses, trauma survivors

"Great information! I am truly inspired to learn more about trauma. The passion in all of the speakers was evident and I hope to be back next year."

– 2017 Attendee

NOTS
NORTHERN OHIO TRAUMA SYSTEM

NOTS Transfer Center:
216-778-7850

NOTS 2018 Annual Report

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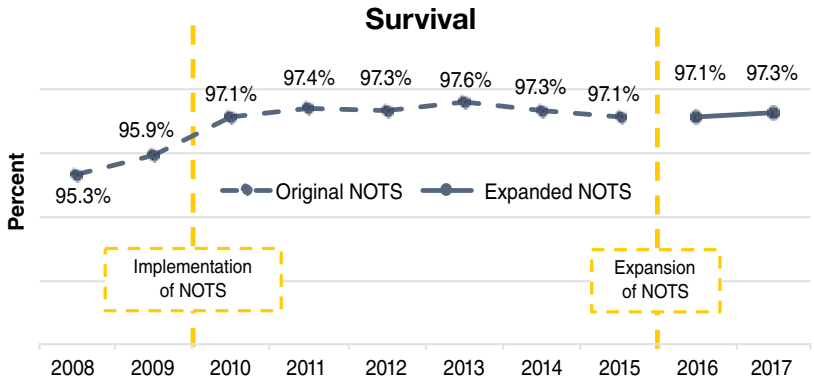

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