

*2021 ESO TRAUMA INDEX:*

# INSIGHTS AND BEST PRACTICES FOR TRAUMA SYSTEMS

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# CONTEXT AND OVERVIEW FOR THE INDEX

The world changes rapidly. Two years ago, the idea of a pandemic was most readily associated with video games, movies, and history books. Fast forward two years and we continue to adapt, adjust, and learn how to navigate life in a pandemic.

At the beginning of 2021, in light of COVID-19 overwhelming healthcare systems and impacting the ability to care for critically injured patients, we predicted that accurate data collection, with measures that matter, will provide key insights and trends. We also believed that hospitals would use analytics to be more efficient and better manage resources to mitigate staff burn-out; improve patient care; understand challenges at a facility, system, and state level; and unearth evidence-based approaches to solutions. In other words, data (and our understanding of that data), are critically important to preserving trauma systems' capacities to respond to time-sensitive traumatic injuries during the current pandemic.

This year, we are launching our inaugural ESO Trauma Index (to accompany our [EMS Index](#) and [Fire Service Index](#)) to help trauma system leaders answer the following questions, among others:



**Is my organization aligned with other organizations around the country for utilization of whole blood and packed red blood cells (PRBCs)?**



**Is my organization aligned with other organizations around the country when it comes to patient care, including response to fractures?**



**Are we above or below the national average when it comes to hospital events?**



**What are the best practices for each measure in the Index?**



## LIMITATIONS

This Index is retrospective and looks at aggregate data from 2020. There are no universal rules designed around these measures. The Index follows data definitions as published by the American College of Surgeons National Trauma Data Standard. The purpose of the Index is to be informative and directional, but it is not intended to be a scientific study. Nor is it intended to be comprehensive in nature. We hope it serves as a body of literature that adds to the discussion and conversation around best practices for each of the measures identified in this Index to improve positive patient outcomes.



**802,940**  
**PATIENT**  
**RECORDS**

This Index uses ESO data compiled from nearly 600 participating hospitals and represents 802,940 patient records from January 1, 2020 through December 31, 2020. The ESO Trauma Index is created from the ESO Data Collaborative, the world's largest de-identified trauma registry data program that is available at no cost.

We hope you find this Index helpful, enlightening, and empowering. We're always here to answer any questions, clarify any of the data, and share our expertise. Enjoy.

The appropriate metric for evaluating the success of your trauma system will vary depending upon a number of factors, including the size of the population served and geographic location. However, we believe an objective look at aggregate data across the United States can give you a good idea of how your trauma system is performing compared to your peers.

The purpose of this Index is to serve as a point of reference for trauma system stakeholders to identify which areas are in alignment and which areas represent opportunity for improvement – or at least further assessment and evaluation. This quantitative approach to measuring performance gives systems a framework to continually refine tactics, improve efficiency and outcomes, and allocate resources appropriately. Here are some of the questions we hope the 2021 Trauma Index will help you ask and investigate using your own data:



What percentage of trauma patients receive whole blood? How soon do they receive it?



What percentage of trauma patients receive PRBCs within the first four hours of arrival?



What is the time to head CT for patients with traumatic brain injuries?



What is the time to antibiotics for patients with open long bone fractures?



What is the time to surgical repair for geriatric patients with hip fractures?



What is the frequency of hospital events (such as deep vein thrombosis or severe sepsis)?



What is the injury severity score (ISS) breakdown?

# KEY METRICS



**HEMORRHAGES - WHOLE BLOOD  
USAGE FOR TRAUMA PATIENTS**



**HEMORRHAGES - PACKED RED  
BLOOD CELL (PRBC) USAGE  
FOR TRAUMA PATIENTS**



**TIME TO HEAD CT FOR PATIENTS  
WITH TRAUMATIC BRAIN INJURY (TBI)**



**FRACTURES - TIME TO ANTIBIOTICS  
FOR PATIENTS WITH OPEN LONG  
BONE FRACTURES**



**FRACTURES - TIME TO SURGICAL  
REPAIR FOR GERIATRIC PATIENTS  
WITH HIP FRACTURES**



**FREQUENCY OF HOSPITAL EVENTS**



**ISS SCORE SUMMARY**

# KEY FINDINGS

The 2021 ESO Trauma Index looks at 802,940 deidentified patient records from January 1, 2020–December 31, 2020. At a macro level, the data revealed the following:



## Hemorrhages - Whole Blood Usage:

Overall use of whole blood was rare, as less than 1% of trauma patients received whole blood.



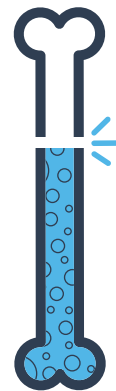
44%

**Hemorrhages - PRBCs:** For patients receiving PRBC transfusions, 44% received PRBCs within the first four hours of arrival.

99%  
WITHIN 24 HOURS

**Head CT for TBI:** About 77% of patients with TBI had a documented head CT. Of those patients with documented CT scans, the procedure was done within 24 hours 99% of the time and nearly 100% of the time within 72 hours of arrival at the emergency department.

63  
PERCENT



## Open Long Bone Fracture and Antibiotics:

Of the patients presenting with open long bone fractures, 63% received antibiotics within 60 minutes of arrival at the emergency department – meaning that more than 1/3 did not receive antibiotics in the 60-minute window.

## Surgical Repair for Hip Fracture:

Geriatric patients requiring surgery for a hip fracture were moved from the ED to the operating room (OR) in 24 hours or less more than 95% of the time. The majority of the remaining (5%) were in the OR in less than 48 hours.



## Hospital Events:

Nearly 8% of the time, there was a hospital event or complication. The most common include unplanned admission to ICU, unplanned intubation, cardiac arrest with CPR, and alcohol withdrawal syndrome.

# INDEX METRICS



## HEMORRHAGES

The purpose of the “Hemorrhages” measure is to evaluate the use of whole blood and PRBCs in trauma patients. The whole blood measure looks at how many trauma patients received whole blood upon arrival at the ED, while the PRBC measure explores the transfusion of PRBCs within four hours of arrival at the ED.

Chart 1 shows that, overall, few trauma patients received **whole blood** after arrival at the ED - less than 1% (3,236) to be exact.

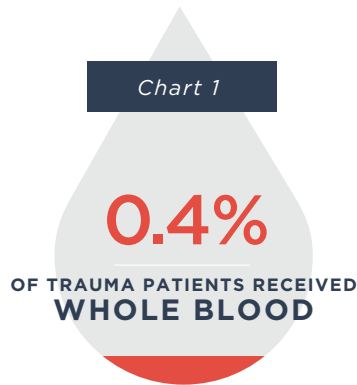


Chart 2 illustrates that when **PRBC** transfusions were initiated, 55% (30,204) of patients who received PRBCs received them more than 4 hours after arrival at the hospital.



### HEMORRHAGES INSIGHT

Uncontrolled hemorrhages are the most common cause of death within the first hour of a patient’s arrival to a trauma center. Blood transfusions are therefore a vital part of resuscitating injured trauma patients who are in hemorrhagic shock.

But, it is not just the treatment itself that matters - the quality of the treatment is also important. Recent research indicates that the use of whole blood over component blood products (plasma, platelets, and PRBCs) is linked to improved clinical outcomes. There is also a growing body of evidence that indicates the use of whole blood in the prehospital setting is superior to component therapy while being a life-saving treatment for hemorrhage. And whole blood is a more efficient means of resuscitation, with one bag of whole blood in a transfusion providing similar benefits as up to three bags of a balanced blood component transfusion.

The use of component blood products for hemorrhagic shock became a common practice without sufficient clinical evidence to back up whether it is comparable to using whole blood or whether it improves patient safety and effectiveness.



*Patients generally continue to receive blood products after an OR visit and throughout their hospital stay. However, almost half of all blood products are administered within the first four hours of arrival at the hospital.*

## HEMORRHAGES BEST PRACTICES



A trauma system's ability to monitor treatment outcomes for patients in hemorrhagic shock and timely transfusion of whole blood or PRBCs is essential.



Whole blood has the potential to improve outcomes for patients experiencing severe hemorrhage and shock.



Assess your trauma system's use of whole blood against the outcomes of injured trauma patients who are in hemorrhagic shock.



Evaluate your trauma system's current policies and procedures around the prehospital EMS and hospital administration of whole blood. EMS whole blood programs require close coordination with trauma systems to ensure blood is available where it is needed and does not expire.



Consider implementing changes that enable clinicians to use whole blood for patients with life-threatening hemorrhages when appropriate.

*As of 2020, the American College of Surgeons Trauma Quality Improvement Program defines a trauma system's hemorrhagic shock cohort as a patient with an initial hospital systolic blood pressure (SBP) between 0 and 90 mmHg and transfusion PRBCs  $\geq 6$  unit and/or whole blood  $\geq 6$  units within the first four hours of arrival.*

# INDEX METRICS



## TRAUMATIC BRAIN INJURY

The “Traumatic Brain Injury (TBI)” measure looks at the amount of time it takes for a patient to receive a CT scan after arriving at the ED. Reports indicate that 22% (10,156) of patients with a confirmed TBI diagnosis did not have a CT scan reported in the trauma registry.

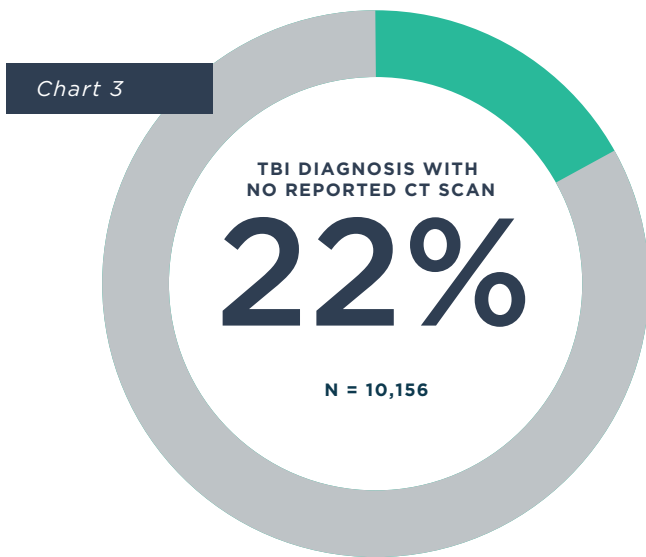
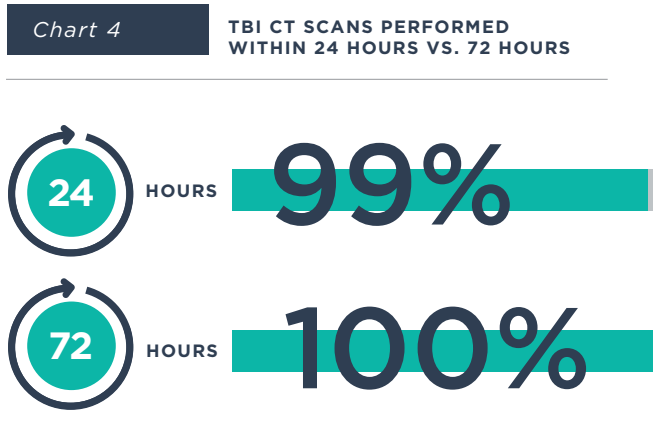


Chart 4 shows that of those patients with documented CT scans, the procedure was done within 24 hours 99% of the time and nearly 100% of the time within 72 hours of arrival at the emergency department.



### TRAUMATIC BRAIN INJURY INSIGHT

According to the Centers for Disease Control and Prevention (CDC), there were approximately 61,000 TBI-related deaths in the United States in 2019. That averages out to 166 deaths a day. These types of injuries can also lead to significant disabilities over the course of an individual's lifetime. As a matter of fact, TBI is one of the leading causes of disability in the United States.

Not surprisingly, adults over the age of 65 are particularly susceptible to TBI related to falls. The use of anticoagulants can exacerbate internal hemorrhaging, while a TBI in an older adult could be misdiagnosed as dementia.

*How quickly are hospitals and trauma centers responding to patients where an anticoagulant is identified as a risk factor? The two charts below show time to CT scan and time to OR when anticoagulant therapy is documented.*

#### TIME TO CT WHEN ANTICOAGULANT THERAPY DOCUMENTED AS RISK FACTOR

	2020 (N=1,745)
<b>RANGE</b>	<b>0 TO 7,346 MINUTES</b>
<b>MEDIAN (IQR)</b>	<b>37 (21 TO 77) MINUTES</b>
<b>MEAN (SD)</b>	<b>116.2 (352.9) MINUTES</b>

#### TIME TO OR WHEN ANTICOAGULANT THERAPY DOCUMENTED AS RISK FACTOR

	2020 (N=123)
<b>RANGE</b>	<b>11 TO 2,466 MINUTES</b>
<b>MEDIAN (IQR)</b>	<b>125 (73 TO 200) MINUTES</b>
<b>MEAN (SD)</b>	<b>216.2 (303.6) MINUTES</b>



## TRAUMATIC BRAIN INJURY BEST PRACTICES



CT scans are vital in the acute setting of head trauma, allowing for accurate detection of intracranial hemorrhages that require immediate neurosurgical action.



Patients who sustain a traumatic brain injury have an increased risk for a venous thromboembolism (VTE). The American College of Surgeons Trauma Quality Improvement Program (TQIP) recommends pharmacologic prophylaxis for VTEs should be considered within the first 72 hours for patients who have a stable repeat head CT scan and are at low risk for progression of intracranial bleeding.



CT scans for patients with minor head injury trauma remains controversial.

# INDEX METRICS



## FRACTURES

The two metrics associated with fractures look at amount of time it takes to get a patient on antibiotics from arrival at the ED in the event of an open long bone fracture, and the amount of time it takes to begin surgical repair of a hip fracture for patients 65 years and older.

For patients with open bone fractures, it's critical to begin antibiotic treatment quickly to minimize the risk of infection. Chart 5 shows the percentage of patients with open long bone fractures who received antibiotics within 60 minutes (63% - 22,569).

Chart 5

PERCENTAGE OF PATIENTS WITH OPEN LONG BONE FRACTURE RECEIVING ANTIBIOTICS WITHIN 60 MINUTES

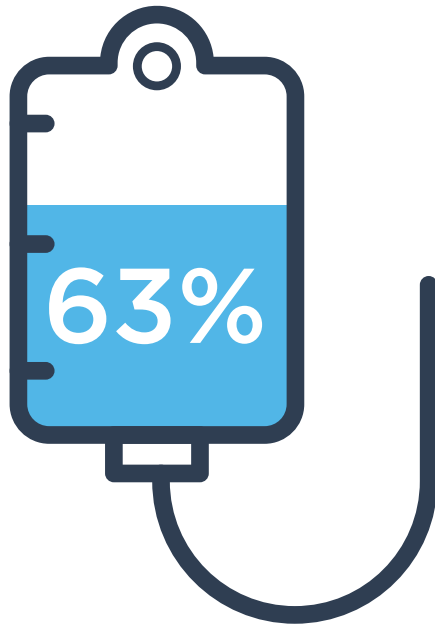


Chart 6 highlights the percentage of geriatric patients moved from ED to OR in 24 hours or fewer (95% - 3,507) and 48 hours or fewer (99%+ - 3,671).

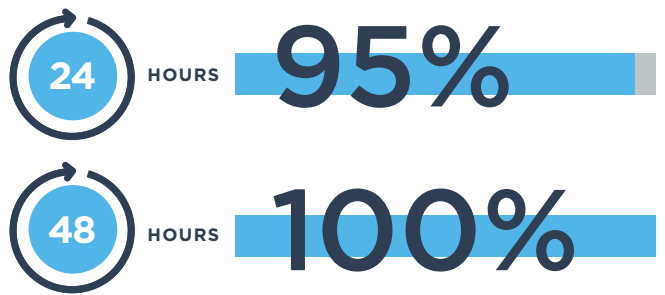
### FRACTURES INSIGHT

Bone fractures happen to millions of people throughout the United States every year. The majority of open long bone fractures are of the tibia, which tends to be more severe than upper-body long bone fractures. According to research from the Global Burden of Disease, lower leg fractures are the most common and burdensome to patients, with older adults having a higher risk of experiencing a fracture.

Hip fractures are one of the most serious fall injuries. According to the CDC, more than 300,000 people aged 65 and older are hospitalized each year with a hip fracture. Ninety-five percent (95%) of all hip fractures are caused by falling, usually by falling sideways. Women experience 75% of all hip fractures.

Chart 6

GERIATRIC (65 AND OLDER) PATIENTS WITH HIP FRACTURE FROM ED TO OR



■ YES ■ NO

## FRACTURES BEST PRACTICES



Early administration of antibiotics for open fractures is linked to a significant decrease in infection.



To reduce risk of infection and complications for trauma patients with open fractures, antibiotics should be given within 60 minutes or less from arrival at the ED.



Prehospital personnel are able to safely provide antibiotics for patients with open fractures prior to arrival at trauma centers, thus reducing time to antibiotics and decreasing infection rates.



Surgical intervention within 48 hours of hip fracture substantially reduces morbidity and mortality in geriatric patients.

# INDEX METRICS



## HOSPITAL EVENTS

Patients expect that the care they receive in the hospital will improve their health, not worsen it. Closely monitoring the occurrence of hospital events, especially those deemed preventable, is key to ensuring that patients are not harmed as a result of their medical care. Our ability to mitigate and reduce these types of events is crucial to improving patient outcomes.

In chart 7 below, we look at the most common hospital events that are classified by the National Trauma Data Standard (NTDS). Overall, nearly 8% (62,969) of patients experienced some form of hospital event.

Chart 7

TOP 5 MOST COMMON HOSPITAL EVENTS - NTDS	% OF ALL HOSPITAL ENCOUNTERS WITH EVENT
UNPLANNED ADMISSION TO ICU	1.4%
UNPLANNED INTUBATION	0.8%
CARDIAC ARREST WITH CPR	0.7%
ALCOHOL WITHDRAWAL SYNDROME	0.6%
DELIRIUM	1.0%

UNCATEGORIZED HOSPITAL EVENTS	% OF ALL HOSPITAL ENCOUNTERS WITH EVENT
ANY HOSPITAL EVENT	7.8%
OTHER (NOT CLASSIFIED BY ACS)	2.8%

### HOSPITAL EVENTS INSIGHT

Hospital events impact anywhere from 8-10% of hospital patients in the United States, with many of these events leading to preventable death. The financial impact of such events reaches into the millions. Not surprisingly, the most vulnerable and marginalized of our society experience lion's share of these types of events, including older adults and those of lower socioeconomic status.



## HOSPITAL EVENTS BEST PRACTICES



Create a process for identifying hospital events concurrently.



Prospective data validation and accurate benchmarking of hospital events should be priority for trauma centers.



Establish a non-punitive process to review select hospital events and identify potential factors that could be incorporated into a hospital performance improvement project.



Engage the trauma team to take action by implementing performance improvement projects to address systematic issues.

# INDEX METRICS



## INJURY SEVERITY SCORE SUMMARY

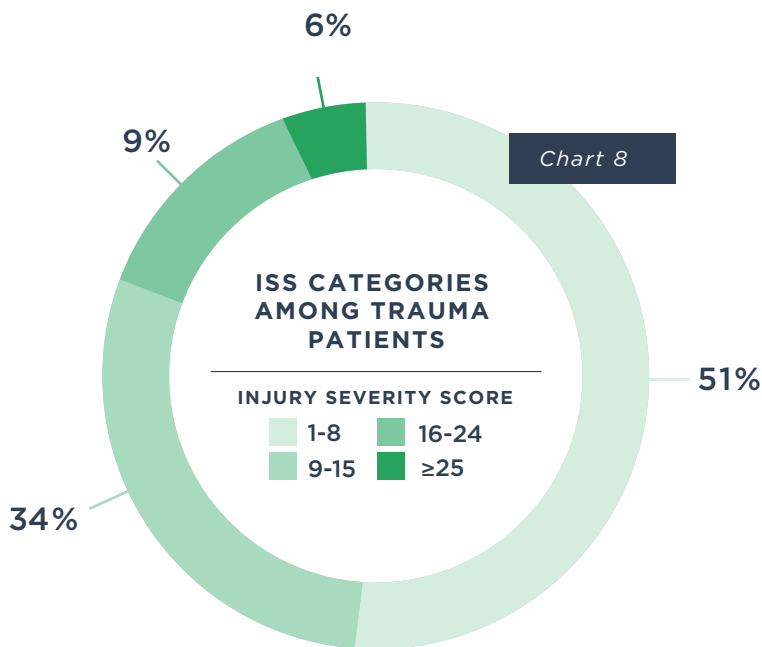
Susan Baker, MPH, is widely known for developing the Injury Severity Score (ISS) to help determine the severity of a traumatic injury.

This report presents ISS in standard grouped categories:

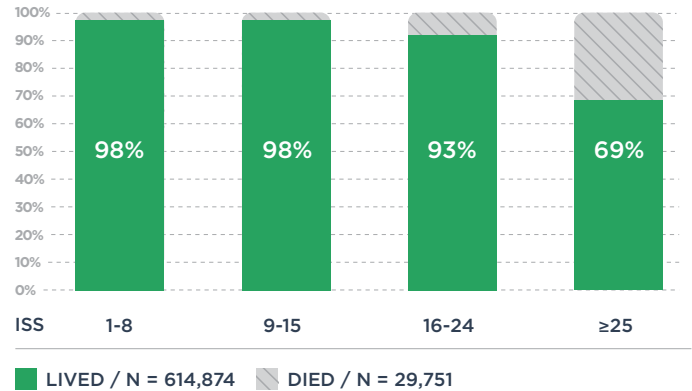
- 1 to 8:** Minor injury
- 9 to 15:** Moderate injury
- 16 to 24:** Severe injury
- ≥25:** Very severe injury

A little more than half - 51% (400,814) - of all trauma patients suffered a minor injury. A little more than one third - 34% (266,820) - of all trauma patients suffered a moderate injury.

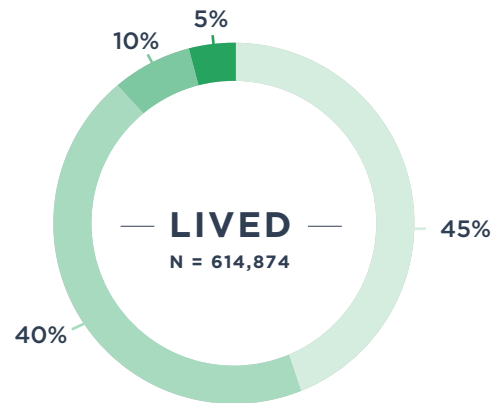
The metric in this study explores the frequency of scores across different ranges (see chart 8), as well as looks at the survival and mortality rate based on the severity (see chart 9).



**Chart 9** SURVIVAL AND MORTALITY RATE BASED ON INJURY SEVERITY

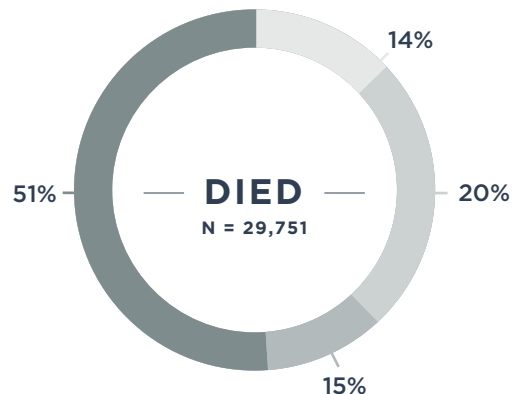


**SURVIVAL AND MORTALITY RATE BASED ON INJURY SEVERITY**



**INJURY SEVERITY SCORE**

- 1-8
- 9-15
- 16-24
- ≥25



## METHODOLOGY

The dataset for the ESO Trauma Index is real-world, deidentified data, compiled and aggregated from nearly 600 participating hospitals across the United States that use ESO's products and services and agreed to have their data used for research purposes. These data are based on 802,940 anonymized patient records between January 1, 2020 and December 31, 2020, representing a full calendar year.

### OK, NOW WHAT?

Trauma systems should use this information to understand why metrics are important and which metrics and drivers can have the biggest effect on your organization and the patients you serve. With this Index as a foundation, you can do your own analysis to serve as the basis for other modeling and outcomes.

The metrics shown in this Index are by no means exhaustive. Every organization is unique and has its own strengths, structure, and goals. Because of these attributes, results achieved by one organization may not be attainable by another for a variety of reasons. However, these metrics should provide a foundation to compare your measurements and outcomes to what we are seeing nationally.

## CONCLUSION

### SO, WHAT DOES THIS MEAN?

We are seeing solid performance across a couple of metrics, including time to head CT scan for those patients experiencing TBI and time to surgery for geriatric patients with a fractured hip. However, there is room for improvement across some of the other metrics, including the administration of whole blood, the use of CT scans for TBI patients, and administration of antibiotics for patients with an open long bone fracture.

PREVIEW COMING IN 2022

# ESO PATIENT REGISTRY



**ESO Patient Registry is a next-generation software as a service (SaaS) clinical disease registry that simplifies the collection and processing of patient data, empowering service line leaders to focus on driving insights to help improve quality of care.**

**Features like** built-in data validation, patient-centric workflows, and advanced data interoperability will ensure that trauma programs are compliant and up-to-date with the latest national and local performance improvement and quality improvement measures.

**ESO Patient Registry** and an integrated ESO Insights application will enable trauma centers to create and monitor specific index measures in real time and receive automated alerts when the trauma program deviates from national and local standards.

**Made for:**

**HOSPITALS**

Check [eso.com](https://eso.com) for product news and updates.

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# ABOUT ESO

ESO (ESO Solutions, Inc.) is dedicated to improving community health and safety through the power of data. Since its founding in 2004, the company continues to pioneer innovative, user-friendly software to meet the changing needs of today's EMS agencies, fire departments, hospitals, and state EMS offices. ESO currently serves thousands of customers throughout North America with a broad software portfolio, including the industry-leading [ESO Electronic Health Record \(EHR\)](#), the next generation ePCR; [ESO Health Data Exchange \(HDE\)](#), the first-of-its-kind healthcare interoperability platform; [ESO Fire RMS](#), the gold standard for Record Management Systems; trauma, burn and stroke registry software; and ESO State Repository. ESO is headquartered in Austin, Texas. For more information, visit [www.eso.com](http://www.eso.com).