Extracorporeal Life Support Organization (ELSO)

ELSO Registry Trauma Addendum Data Definitions
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For all comments, questions and concerns please email

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Preface

This document is intended to assist data entry and identify definitions for each field. This document is organized into the sections and subsections that exist on the addendum. We also attempt to identify if fields will be incorporated in mandatory fields by highlighting those data elements.

Descriptions of fields in this document

Field Name is the name of the variable as it appears in the addendum.

Definition/ Explanation/ Example provides the definition of the variable with an explanation of how to collect the variable and, when appropriate, an example of choosing the correct data collection.

Data Entry Rules refers to formatting rules for data entry and any warnings or restrictions on data entry. For example, the user will receive a **Soft Notification** or warning when entering data that falls outside common values or if that value could represent a more common entry in a different unit. The warning does not necessarily mean data has been entered incorrectly; it is just an opportunity for the user to double check data entry. The data enterer will receive a **Hard Limit** when data is restricted from entry. This means ELSO assesses the value to be incorrect. For example, the entry of "Intracranial Pressure Monitor" after the Date of Death is not allowed. (The possibility of error exists; please email Justyna Swol at jswol@icloud.com if an unwarranted Hard Limit is received).

Collection / Modification describes the dates during which the data has been collected. If there was a modification of the method by which a variable is collected, the date when that modification occurred is noted here.

Table Name is a descriptor that provides the name of the table in which a given variable is stored. ELSO data is a relational database, meaning that different data elements are stored in different tables with common rows that allow merging of tables.

Column Name / Stored Values describes the column or variable name and stored values for a given variable. For example, the data field "**Damage Control Surgery**" is stored under Column Name (or variable name) "**DamageControlSurgery"** and is stored with values "**Yes = 1**", "**No = 2**", and "**Unknown = 3.**"

Mandatory Fields

We indicate mandatory fields in two ways. First, the box for the **Field Name** has a red background (see below). Second, the **Definition/ Explanation/ Example** includes the sentence "**This is a required field.**" See example below:

Mandatory Data Field

Extracorporeal Life Support Organization (ELSO) Registry Trauma Addendum Data Definitions

When should I complete a Trauma Addendum? When trauma is the underlying reason for ECMO indication.

- Examples:
  - A patient involved in a motor vehicle collision, is diagnosed with multiple long bone fractures and blunt abdominal trauma, and now has developed respiratory failure due to abdominal compartment syndrome.
  - A brain injured patient develops ventilator induced lung injury due to high tidal volume mechanical ventilation as a consequence of targeted pCO_2 for increasing intracranial pressure.
  - A patient with blunt injury of the chest and abdomen who requires cardiac support to restore circulation prior to bleeding coagulopathy.

When should not I complete a Trauma Addendum? When the underlying reason for ECMO indication is not trauma.

- Examples:
  - A patient with a fracture of the radius and fibula requiring fixation due to motor vehicle collision who has concomitant viral illness who progresses to ARDS from viral pneumonia requiring ECMO.
  - A patient with hypothermia and coagulopathy with no further injuries (no fractures, no blunt trauma, no crush injury) who requires rewarming via ECMO.

Addendum

Arrive here by clicking the "Addendum" tab in a given patient Run. Then click "+Add Trauma"

ECLS Indication					
Data Field	Definition/ Explanation/ Example	Data Entry Rules	Collection / Modification	Table Name	Column Name / Stored Values
ECLS Indication due to Trauma This is a required field.	**Pulmonary failure**: The use of extracorporeal membrane oxygenation for support of respiratory failure by providing gas exchange support after direct traumatic injury to the respiratory system. Injuries may include pulmonary contusion, blast injury, major airway injury (bronchi, trachea, etc.), acute traumatic airway obstruction, pleural injuries, fat or air embolism, and inhalational injury. Example: A 25yo male patient sufferes a motor vehicle collision. Chest x-ray, on primary survey, demonstrates extensive right-sided soft tissue emphysema extending to the neck. Flexible bronchoscopy of the shows a 1 cm subtotal transection of the right mainstem bronchus. The patient deteriorates (SaO2 84% despite of 100% FiO2) becomes severely hypoxemic (pH 7.18, pO2 45mmHg). He was cannulated by Veno-Venous ECMO for pulmonary support. **Cardiac failure (incl. cardiogenic shock)**: The use of extracorporeal membrane oxygenation for support of left and/or right ventricular failure by providing cardiac and gas exchange support after direct traumatic injury to the heart and/or great vessels.	Indicate "yes" by checking the box next to the indication. Each indication has its own corresponding box. By checking the corresponding box, the user affirms that indication is present. If a box is not checked, it means that indication was not present. Multiple indications are possible. At least one of the items in this list must be checked.		TRAUMA.ECLSIndicationTrauma	CodeId Lookup table: TRAUMA.ECLSIndicationTraumaCodes 1 = Pulmonary failure 2 = Cardiac failure (incl. cardiogenic shock) 3 = Cardiac arrest 4 = Hemorrhagic Shock 5 = Septic shock 6 = Enable Lung protective ventilation 7 = Rewarming

	Injuries may include traumatic cardiac rupture, ventricular rupture, myocardial contusion and/or stunning, or coronary artery rupture. Example: A 52yo old male suffers a fall injury from a height of more 10 feet (3meters) and was intubated on the scene due to GCS of 3. Focused Assessment Sonography for Trauma (FAST) estimates a small pericardial effusion, not hemodynamically significant. CT scan indicates a large bilateral hemo-pneumothorax, several rib fractures, and sternal fracture. Chest tubes were inserted bilaterally. The patient developed cardiac arrest during transfer to the ICU. After 10 minutes of CPR the patient has sustained return of spontaneous circulation (ROSC). However, Left Ventricular Ejection Fraction is less than 15%. The patient is femorally cannulated for VA-ECMO.				
	Cardiac arrest: Choose only if the cardiac arrest and the need for CPR is a direct result of traumatic injury with or without sustained ROSC. Sustained ROSC occurs when chest compressions are not required for 20 consecutive minutes and signs of circulation persist (Jacobs et al, Cardiac arrest and CPR outcome reports: Utstein templates from ILCOR. *Circulation*. 2004;110(21):3385-972004). Injuries may include but not limited to myocardial contusion or rupture, bleeding, air or fat embolism, hypothermia, septic shock, etc. If achievement of sustained ROSC is unsuccessful, ECPR (Extracorporeal Cardio-Pulmonary Resuscitation) may be indicated. ECPR is the application of rapid-deployment veno-arterial extracorporeal membrane oxygenation, to provide circulatory support in patients in whom conventional cardiopulmonary				

	resuscitation (CPR) is unsuccessful (sustained ROSC). For trauma patients with cardiac arrest and ECPR, the ECPR Addendum should also be completed Example: A 45yo male suffered blunt chest trauma after a fall from a horse. Primary survey chest X-ray shows a left pneumothorax, evacuated immediately with the chest tube. Despite immediate chest tube insertion, respiratory failure worsened. During intubation bradycardia, ventricular fibrillation, and finally asystole occurred. The patient did not have ROSC and was cannulated by veno-arterial with CPR in progress.				
	Hemorrhagic shock: the application of veno-arterial extracorporeal membrane oxygenation for the sole purpose of supporting or restoring the circulation as a result of massive hemorrhage. This must be the result of traumatic injury although there is no specific injury which must occur (however, this is frequently associated with thoracic aortic injuries, pelvic fractures, and/or great vessels injury). Example: A 34yo male suffers a motorcycle collision. He is noted to be hemodynamically unstable at the scene. Upon arrival in the ED his blood pressure was 70/40 mmHg with heart rate 128 beats/min. The initial labs show hemoglobin level of 4.9 g/dL, pH of 6.99, PaCO2 of 65 mmHg, BE -10 and PaO2/FiO2 ratio of 70 mmHg. Focused Assessment Sonography for Trauma (FAST) shows bilateral hemothorax. The patient remained hemodynamically instable despite massive blood product replacement. He was femorally cannulated by veno-arterial ECMO.				

	Septic shock: Shock due to the presence of an infective organism directly related to the traumatic event. This most often occurs in the presence of posttraumatic abdominal sepsis or wound infections. Example: A 38yo male suffered a 3rd degree open fracture of the lower extremity. He is stabilized and transferred to a Level 1, Trauma center for surgery 3 days after the event. He develops shock unresponsive to intervention and grows gram negative rods from both his blood and wound. He was cannulated for VA-ECMO.				
	Enable Lung Protective Ventilation: the application of extracorporeal membrane oxygenation for the sole purpose of enabling lung protective ventilation in the absence of direct lung trauma (i.e., posttraumatic systemic inflammatory response (SIRS) with multiorgan failure). Example: 28yo female suffers severe blunt abdominal trauma (spleen and liver rupture) and multiple lumbar spine fractures after motor vehicle collision. Successful surgery was performed immediately to control the intra-abdominal bleeding. On post-op day 3, she develops multiorgan failure (renal, pulmonary and liver disfunction) due to posttraumatic systemic inflammatory response with PaO_2/FiO_2 ratio of 80 mmHg. She is placed on Veno-venous ECMO				
	Rewarming: Hypothermia requiring extracorporeal rewarming after trauma (isolated, accidental hypothermia excluded); Injuries may include crush injury, fractures, blunt trauma. Example: A 32 yo avalanche victim is found after more than 35 min. of burial with core temperature less than 32 degrees Celsius. The patient is non-responsive with vital signs				

	(bradycardia, 30 bpm and thread pulse). He has obvious blunt chest trauma likely from being struck by a tree as well as multiple long bone fractures. He suffers ventricular fibrillation and CPR is initiated. He is transferred to a Level 1 Trauma center, cannulated for VA ECMO.				

Injury Specific Data					
Data Field	Definition / Explanation / Example	Data Entry Rules	Collection/ Modification	Table Name	Column Name / Stored Values
Date / Time of trauma **This is a required field.**	Date and time when the accident or injury occurred. If this time is not known please provide an estimated time and check the box "Time estimated".	jjjj/mm/dd hh:mm **Hard Limit:** Date of Trauma must be before hospital admit date. Check box if time is estimated Days to hospital admission and days to ECLS cannulation will be calculated from this value		TRAUMA.TraumaAddendum	DateOfTrauma
Mechanism of injury **This is a required field.**	**Blunt:** Blunt trauma stems from forces like compression (crushing), shearing (tearing), acceleration, and deceleration or is caused by a dull object or surface. In blunt, non-penetrating trauma, there may be an impact, but the skin is not necessarily broken. Blunt trauma is the initial trauma, from which develops more specific types such as contusions, abrasions, lacerations, and/or bone fractures. Some examples of blunt trauma include, fall from a height more than 10FT (3 m), a bomb blast, being hit with a blunt object like a baseball bat or even a fist In the case of **crush injury,** choose "blunt" Example: An 18yo female suffered severe blunt thoracic trauma after he was hit by a truck. Initial arterial blood gas analysis revealed: pH 7.12, $PaCO_2$ 65.9 mmHg, PaO_2 55 mmHg. Endotracheal bleeding was observed during intubation. Extensive lung contusion of both lungs with a hemopneumo-thorax, pneumomediastinum, and fracture of the right first rib are shown on chest computed	Indicate "yes" by checking the box next to the mechanism. Each mechanism has its own corresponding box. By checking the corresponding box, the user affirms that mechanism is present. If a box is not checked, it means that mechanism was not present. Multiple indications are possible. At least one of the items in this list must be checked.		TRAUMA.TraumaAddendum	MechanismBlunt, MechanismBurns MechanismPenetrating BurnsPercentage

	tomography. There was no injury to the head and neck, cardiovascular system or abdominal organs. Her injury severity score (ISS) was 25. Her oxygenation did not improve after proning for 12 hours. She was cannulated for veno-venous ECMO. For **mixed blunt/penetrating** click both.				
	Penetrating trauma occurs when an object pierces the skin and enters a tissue of the body, creating an open wound. The penetrating object may remain in the tissues, come out the way it entered, or pass through the tissues and exit from another area (perforating injury). Examples include stab wounds and ballistic trauma. In addition to injury caused directly by the object that enters the body, penetrating injuries may be associated with secondary blunt injuries, such as those that may occur from a blast injury. Example: A 32yo male was referred to a level one trauma center after being stabbed in the chest. He suffered penetrating chest trauma with traumatic arrest from cardiac tamponade, left ventriculotomy and mitral valve injury. The patient underwent resuscitative thoracotomy converted to clamshell thoracotomy for hemorrhage control. Ventriculotomy was repaired on initial damage control operation. He was continued on VA-ECMO and bridged to definitive cardiac repair 3 days later. For **mixed blunt/penetrating** click both.	If "Burns with or without inhalational injury" is selected, there is an additional field required: "PERCENTAGE OF BODY SURFACE AREA BURNED" **Hard Limit:** if checked then must also fill in Percentage of Body Surface Area Burned. This should only be filled in if Burns and/or Inhalational Injury is Checked This box is represented as a number between 0% and 100 %			
	Burns with or without inhalation injury. Burn is an injury that can involve the skin all the way to deeper tissues, such as muscle, tendons, or bone (first to fourth degree). This can include inhalation burns by chemical, heat and external chemical (e.g. acid). Burns are classified as thermal (heat-related), chemical, electrical, and radiation.				

	Example: A 40yo male is transferred to a burn center after an explosion sustaining > 50% TBSA burns. After initial fluid resuscitation, escharotomies to his lower extremities and torso were performed. He developed acute respiratory distress syndrome within 36 hours of injury with increasing ventilator support on FiO2 100% and PaO2 ≤ 50 mm Hg. The Patient was cannulated for veno-venous ECMO. **Percentage of Body Surface Area Burned:** This is the percentage of total body surface area (TBSA) affected by partial thickness or full thickness burns. For patients over the age of 16 years the "rule of nines" is commonly used for the measurement of burn surface area. The "rule of nines" indicates the percentage of TBSA accounted for by various parts of the body. Nine per cent for the head and each arm, 18 per cent each for lower limbs and front and back of the trunk, and 1 per cent for the perineal region. Ref: Wallace AB (1951) *The exposure treatment of burns*. Lancet. 1, 501	If this box is not checked, "PERCENTAGE OF BOSY SURFACE AREA BURNED" should not be allowed to be filled in.			
Trauma related injuries **This is a required field.**	**Trauma related injuries** refer to traumatic injuries which are present but are **not the leading indication for ECLS.** Multiple injuries are often associated with car or motorbikes crashes occurring at high velocities and acceleration forces. Some injuries may be missed during the primary survey and detected during the course. Example: multiple traumatic injuries, such as a serious head injury in addition to a blunt chest trauma. Related injuries are multiple fractures of lower extremities and pelvis in addition to coronary artery rupture and cardiac arrest.	Indicate "yes" by checking the box next to the related injury. Each injury has its own corresponding box and by checking the corresponding box, the user affirms that injury is present. If a box is not checked, it means that injury was not present. Multiple indications are possible.		TRAUMA.TraumaRelatedInjuries	CodeId Lookup table: TRAUMA.ECLSIndicationTraumaCodes 1 = Traumatic brain injury with bleeding 2 = Traumatic brain injury, with no bleeding (increased ICP <20mmHg) 3 = Unstable spine fracture 4 = Long bone fractures (at least 2 extremities) 5 = Pelvic fracture 6 = Chest trauma 7 = Tracheal/bronchial injury 8 = Cardiac injury 9 = Abdominal trauma 10 = Great vessel injury

		At least one of the items in this list must be checked. Inhalation and/or Crush injury must be accompanied by at least one other injury.			11 = Crush injury (e.g. avalanche) 12 = Inhalation injury
	Traumatic brain injury (TBI) with bleeding: TBI bleeding multiple or > 1cm in CT scan. TBI means an insult to the brain from an external mechanical force which can cause intracerebral hemorrhage, with bleeding in the brain tissue itself. Intracranial hemorrhage involves bleeding that is not mixed with tissue. These lesions include epidural hematoma, subdural hematoma, subarachnoid hemorrhage, and intraventricular hemorrhage.	This information is to be obtained from the local Trauma Center Coordinator			Lookup table: TRAUMA.ECLSIndicationTraumaCodes 1 = Traumatic brain injury with bleeding
	Traumatic brain injury (TBI), with no bleeding (elevated ICP > 20 mmHg) TBI means an insult to the brain from an external mechanical force with cerebral contusion (bruising of brain tissue) which can cause elevated intracranial pressure (ICP). Clinical deterioration or death may follow increased ICP that shift intracranial contents, distorts vital brainstem centers, or compromise cerebral perfusion. The normal ICP range is 5 - 15 mmHg, levels above 20mmHg are defined as elevated ICP and require an intervention				Lookup table: TRAUMA.ECLSIndicationTraumaCodes 2 = Traumatic brain injury, with no bleeding (increased ICP <20mmHg)
	Unstable spine fracture or more vertebral bodies fractured with or without spinal cord injury. Spinal instability is caused by torn ligaments and broken bones. It can result in damage to the spinal nerves or spinal cord. Unstable fractures usually require surgery to prevent spinal cord or nerve injury. Patients with unstable spinal cord fracture are at substantial risk for pulmonary complications.				Lookup table: TRAUMA.ECLSIndicationTraumaCodes 3 = Unstable spine fracture
	Long bone fractures (at least 2 extremities): Long bones are defined as the humerus, radius,				Lookup table: TRAUMA.ECLSIndicationTraumaCodes

	ulna, femur, tibia, and fibula. They can cause severe hemorrhage or predispose to other life-threatening complications like fat embolism.				4 = Long bone fractures (at least 2 extremities)
	Pelvic fracture includes any breaks of the sacrum, hip bones (ischium, pubis, ilium), or tailbone. Pelvic fractures can damage arteries or veins causing life-threatening hemorrhage. There is also a high incidence of pulmonary complications including Acute Respiratory Distress Syndrome (ARDS) and pulmonary embolism.				Lookup table: TRAUMA.ECLSIndicationTraumaCodes 5 = Pelvic fracture
	Chest trauma is any form of physical injury to the chest including the ribs, heart and lungs. Chest trauma may include multiple rib fractures, fracture of the 1st rib, lung contusion, pneumothorax, parenchymal bleeding or hemothorax, tension pneumothorax. Patients with multiple rib fractures, esp. 1st rib, are at substantial risk for pulmonary contusion and related complications like ARDS. A pneumothorax is a collection of air in the pleural space between the lung and the chest wall and may result in atelectasis or cardiac arrest (tension pneumothorax). A traumatic pneumothorax may result from either blunt trauma or penetrating injury to the chest wall and also may also be observed in blasts injury even though there is no apparent injury to the chest. A hemothorax is an accumulation of blood within the pleural cavity. Parenchymal hemorrhage is bleeding within lung parenchyma.	***must be accompanied by another injury not including inhalation injury**			Lookup table: TRAUMA.ECLSIndicationTraumaCodes 6 = Chest trauma
	Tracheal/bronchial injury includes tracheal/bronchial contusions, lacerations, hematomas, avulsions, and fracture/dislocation of the tracheal/bronchial cartilages. In rare cases, a complete transaction of the trachea/bronchus may occur.	***must be accompanied by another injury not including crush injury**			Lookup table: TRAUMA.ECLSIndicationTraumaCodes 7 = Tracheal/bronchial injury
	Cardiac injury includes chest trauma that causes contusion of myocardial muscle, rupture of a				Lookup table: TRAUMA.ECLSIndicationTraumaCodes

	cardiac chamber, disruption of a heart valve acute resulting in cardiac tamponade, pericardial or myocardial lacerations, cardiac luxation, myocardial contusion or ischemia secondary to a vessel injury. Sometimes a blow force to the anterior chest wall causes cardiac arrest without any structural lesion.				8 = Cardiac injury
	Abdominal trauma is the injury to abdomen, including abdominal wall, solid organ (liver, spleen, pancreas, kidneys), hollow viscus (stomach, small intestine, colon, ureters, bladder) or vasculature.				Lookup table: TRAUMA.ECLSIndicationTraumaCodes 9 = Abdominal trauma
	Great vessel injury is the injury of large vessels that bring blood to and from the heart, including the Superior Vena Cava, Inferior Vena Cava, Pulmonary Arteries, Pulmonary Veins, and Aorta.				Lookup table: TRAUMA.ECLSIndicationTraumaCodes 10 = Great vessel injury
	Crush injury (**cannot be reported as isolated injury*) may occur in avalanche or earthquakes, to victims that have been trapped under fallen snow, soil mass or masonry. Crush injury means compression of extremities or other parts of the body that causes muscle swelling and/or neurological symptoms in the affected areas. Systemic manifestation of crush injury is crush syndrome characterized by shock and renal failure due to traumatic rhabdomyolysis.				Lookup table: TRAUMA.ECLSIndicationTraumaCodes 11 = Crush injury (e.g. avalanche)
	Inhalation injury (**cannot be reported as isolated injury*) Inhalation injury refers to damage to the respiratory tract from heat, smoke, or chemical irritants carried into the airway during inspiration. Toxin exposure in smoke inhalation may be related e.g. to carbon monoxide or cyanide.				Lookup table: TRAUMA.ECLSIndicationTraumaCodes 12 = Inhalation injury

Injury Severity Scores					
Data Field	Definition / Explanation / Example	Data Entry Rules	Collection/ Modification	Table Name	Column Name / Stored Values
Abbreviated Injury Score (AIS) **This is a required field.**	Abbreviated Injury Score (AIS) is an anatomically based consensus-derived global severity scoring system that classifies each injury in every body region according to its relative severity on a six-point ordinal scale: No injury (0), Minor (1), Moderate (2), Serious (3), Severe (4), Critical (5), Maximal (currently untreatable) as (6). **This information is to be obtained from the local Trauma Center Coordinator** The full AIS definitions are available on the AAST website: https://www.aast.org/resources-detail/injury-scoring-scale A complete description of each score is provided in Appendix A **FOR EACH OF THESE FIELDS WE WILL ASK: IS THERE AN INJURY IN THIS AREA?** **AIS Head** **AIS Face** **AIS Neck** **AIS Thorax** **AIS Abdomen** **AIS Spine** **AIS Upper Extremity** **AIS Lower Extremity** **AIS External and other (e.g. skin)** **USER MUST ENTER A 0 T0 6 FROM A DROP DOWN. IF THERE IS NO INJURY FOR THIS AREA 0 SHOULD BE SELECTED**	AIS Score: 0 through 6 for each item according to AIS Definitions of Trauma Registry		TRAUMA.TraumaAddendum	AISHead AISFace AISNeck AISThorax AISAbdomen AISSpine AISUpperExtremity AISLowerExtremity AISExternalOther Lookup values: 0 = 0 1 = 1 2 = 2 3 = 3 4 = 4 5 = 5 6 = 6
Injury Severity Score (ISS)	THIS IS A CALCULATED VALUE AND THE USER DOES NOT ENTER THIS VALUE. WE WILL CALCULATE AND DISPLAY IT ON THE SCREEN AND INCLUDE A LABEL THAT SAYS –	Range 1-75 The ISS score takes values from 1 to 75.		TRAUMA.TraumaAddendum	InjurySeverityScore

This is a required field.	Please check the Injury Severity Score (ISS) and make sure it matches what you expect. If it does not match, please adjust the AIS values above. Injury Severity Score (ISS) is an anatomical scoring system that provides an overall score for patients with multiple injuries. The ISS score is the only anatomical scoring system in use and correlates linearly with mortality, morbidity, hospital stay and other measures of severity. Each injury is assigned an Abbreviated Injury Scale (AIS) score and is allocated to one of six body regions (Head, Face, Chest, Abdomen, Extremities (including Pelvis), External and other). Only the highest AIS score in each body region is used. **This information is to be obtained from the local Trauma Center Coordinator** To calculate an ISS, the highest AIS severity code in each of the three most severely injured ISS body regions is taken and squared, and finally the three squared numbers are added for an ISS (ISS = $A^2 + B^2 + C^2$ where A, B, C are the AIS scores of the three most injured ISS body regions). An example of the ISS calculation and online ISS Calculator: https://www.mdcalc.com/injury-severity-score-iss *References*: 1.Baker SP, O'Neill B, Haddon W Jr, Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. J Trauma. 1974 Mar;14(3):187-96. 2.Copes WS, Champion HR, Sacco WJ, Lawnick MM, Keast SL, Bain LW. The Injury Severity Score revisited. J Trauma. 1988 Jan;28(1):69-77	If any injury is assigned an AIS of 6 (unsurvivable injury, currently untreatable), the ISS score is automatically assigned to 75 IF ANY AIS SCORE IS A 6, THE ISS IS AUTOMATICALLY 75. **Hard Limit: BETWEEN 1 AND 75.**			

Procedures

This section details the trauma related procedures associated with the patient being placed on ECLS. Procedures are listed as either having "occurred" or "not". If "occurred", then check the box next to the procedure and give the "date" and "time" it occurred. Multiple procedures may be entered, however if the same procedure occurred more than once, please enter the first occurrence only. Typically procedures that are pertinent only to the specific admission for ECLS and its associated trauma are entered. Procedures that occur immediately prior to ECLS may be included, if the Center determines they are pertinent to the ECLS run and its associated trauma. Procedures performed after ECLS may also be added, including those associated with discharge and/or death.

Each procedure listed here represents one or more Current Procedural Terminology (CPT) code(s). CPT codes are the United States' standard for how medical professionals document and report medical, surgical, radiology, laboratory, anesthesiology, and evaluation and management (E/M) services. Each CPT code and its corresponding category is listed in "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes". Procedural codes can be obtained from the local Trauma Center Coordinator. Once obtained, these can be matched to the corresponding procedure and entered accordingly.

Data Field	Definition / Explanation / Example	Data Entry Rules	Collection/ Modification	Table Name	Column Name / Stored Values
Did the patient have a surgical procedure while on ECMO. **This is a required field.**	This question refers to whether or not the patient had a surgical procedure immediately prior to, during, or immediately after being placed on ECMO. Only procedures related to the patient's traumatic injury are relevant here. If procedures were immediately prior to or after coming off ECMO, they should be pertinent to the ECMO run. IF THE ANSWER IS YES, THEN AT LEAST ONE SURGICAL PROCEDURE MUST BE COMPLETELY ANSWERED	Indicate "yes" or "no" by checking the box. IF THE ANSWER is "YES", ALL PROCEDURES LISTED BELOW WILL POPULATE.		TRAUMA.TraumaAddendum	PatientSurgicalProcedure 1 = Yes 0 = No
Date / Time of surgical procedure	Date and time a surgical procedure has been performed. **This is a required field if "yes" marked above.** If the exact time is unknown, please estimate a time and check the box marked "estimated".	jjjj/mm/dd hh:mm **Soft Limit**: should be after admission to the ECLS center. **Hard Limit:** Date/Time of		TRAUMA.SurgInvProcedures	ProcDate DateEstimated 1 = Yes 0 = No

		Procedure after Trauma Check box if time estimated			
Surgical or invasive procedures **This is a required field.**	**Intracranial Pressure Monitor:** Includes placement of device for measurement of intracranial pressure via percutaneous approach or via natural or artificial opening. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes	Indicate "yes" by checking the box next to the indication. Each indication has its own corresponding box. By checking the corresponding box, the user affirms that indication is present. If a box is not checked, it means that indication was not present. Multiple indications are possible. At least one of the items in this list must be checked.		TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 1 = Intracranial Pressure Monitor
	External Ventricular Drain: Includes placement of device for drainage of cerebral spinal fluid via percutaneous approach or via natural or artificial opening. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 2 = External Ventricular Drain placement
	Craniectomy or craniotomy: supratentorial or infratentorial exploration (posterior fossa) for evacuation of hematoma, drainage of intracranial abscess, or decompression for treatment of intracranial hypertension. This can be supratentorial or infratentorial, extradural or subdural, intracerebral, extradural subdural, or intracerebellar. Craniectomy or craniotomy, decompressive, with or without duraplasty, for treatment of intracranial hypertension, without evacuation of associated intraparenchymal hematoma; with or without lobectomy See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 3 = Craniotomy / Craniectomy
	Thoracotomy with reconstruction is a surgery opening the chest with the incision in the chest wall between the ribs. The reconstruction or repair of the bronchus to restore the integrity of the lumen can be performed through thoracotomy (e.g., bronchoplasty), graft repair, excision stenosis and anastomosis. Thoracotomy can be performed with or without damage control.			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 4 = Thoracotomy with reconstruction

	See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes	**This information is to be obtained from the local Trauma Center Coordinator**			
	Thoracotomy or thoracoscopy without reconstruction is a surgery opening the chest with by incision in the chest wall between the ribs (e.g. for exploration of penetrating wound), with exploration for control of traumatic hemorrhage and/or repair of lung tear, with removal of intrapulmonary foreign body. Thoracotomy can be performed with or without damage control. Further indications for thoracotomy are: -Removal of lung, pneumonectomy; with resection of segment of trachea followed by broncho-tracheal anastomosis -Repair lung hernia through chest wall -Closure of major bronchial fistula **Thoracoscopy,** (VATS) means video assisted thoracic surgery done with a thoracoscope, a thin flexible tube with a light and a video camera on the end. The tube is put in through a cut made near the lower end of the shoulder blade between the ribs for exploration of chest. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 5 = Thoracotomy or thoracoscopy without reconstruction
	Thoracic drainage with or without thoracotomy is a procedure that places a tube in the space between the lung and chest wall (pleural space). It includes connection to drainage system. It is done to drain fluid, blood, or air from the area around the lungs. Thoracentesis is a procedure performed with needle or catheter for aspiration of the pleural space with or without image guidance. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 6 = Thoracic drainage with or without thoracotomy
	Cardiac Surgery includes but is not limited to: *Thoracoscopy (VATS):* video assisted thoracic surgery with a thoracoscope, a thin flexible tube with a light and a video camera on the end. Thoracoscopy in cardiac surgery is indicated for removal of clot or foreign body from pericardial sac; with creation of pericardial window or partial resection of pericardial sac for drainage.	The following choice is listed only as "Cardiac Surgery", but may include any of the listed examples.		TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 7 = Cardiac Surgery

	Pericardiectomy: with or without cardiopulmonary bypass is a surgical procedure in which all or part of the pericardium is removed. *Repair of cardiac wound with or without cardiopulmonary bypass* *Cardiotomy;* an exploratory incision is made in the heart e.g. for removal of foreign body, atrial or ventricular thrombus. It can be performed with or without cardiopulmonary bypass *Coronary artery bypass grafting (CABG):* procedure to restore or improve the blood flow to the heart. It may be needed when the coronary arteries, are injured, narrowed or blocked. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes				
	Pericardial drainage (pericardiocentesis) is done to relieve fluid (e.g. blood in case of injury) and its pressure on the heart by creation of pericardial window or partial resection for drainage and catheter which is inserted into the pericardial space. It can also be performed following needle insertion with ultrasound or fluoroscopic guidance. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 8 = Pericardial drain placement
	Great vessel repair is surgical reconstruction with bypass graft of vein subclavian- brachial, subclavian-axillary, axillary-axillary, axillary-femoral, axillary-brachial, brachial-brachial, axillary-femoral-femoral, femoral-popliteal, femoral-femoral configuration. Great vessels are superior vena cava, inferior vena cava, pulmonary arteries, pulmonary veins, aorta. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 9 = Great Vessel repair (surgical reconstruction)
	Great vessel repair (stenting) is minimally-invasive procedure inserting a stent graft (a tube supported by metal wire stents that reinforces the weak spot, e.g. the dissection or small injury in the aorta) is through small incisions in the groin. It's shorted as EVAR which means an endovascular repair. The angioplasty			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes

	stenting can be performed for aorta traumatic aneurysm, pseudoaneurysm, dissection, penetrating injuries, traumatic disruption) See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes				10 = Great Vessel repair (stenting)
	Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA): vascular occlusion for treatment of traumatic non-compressible chest, abdomen, or pelvis hemorrhage. This technique involves rapidly introduction of a flexible catheter via the femoral artery into the aorta and inflating a balloon at its tip. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 11 = REBOA
	Pelvic stabilization (fixateur) is an external fixation of the pelvis indicated for temporary or definitive stabilization of unstable pelvic ring injuries, pelvic ring fracture, dislocation, diastasis or subluxation. External fixation of the pelvis is indicated for temporary or definitive stabilization of unstable pelvic ring injuries and is not fracture-specific. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 12 = Pelvic stabilisation (fixateur)
	Radiological embolization of hemorrhage. Vascular embolization or occlusion for arterial or venous hemorrhage or lymphatic extravasation means to place medications or synthetic materials called embolic agents through a catheter into a blood vessel to block blood flow to an area of the body, used to control the bleeding closing off vessels supplying blood to abdominal, pelvic, or extremity vessels. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 13 = Radiological embolization of hemorrhage
	Laparotomy is a surgical procedure involving a large incision through the abdominal wall to gain access into the abdominal cavity. Laparotomy can be performed with or without damage control. Laparotomy is performed for exploration, repair, management of hemorrhage, extensive debridement, coagulation and/or suture, with or without packing,			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 14 = Laparotomy

	anastomosis, reconstruction, placement of drains, drainage of peritoneal abscess or localized peritonitis, subdiaphragmatic or subphrenic abscess, retroperitoneal abscess, also reopening of recent laparotomy (re-laparotomy). See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes				
	Open reduction and internal fixation (ORIF) or spinal stabilization is a 2-part surgical procedure to fix broken bones. First, the broken bone is reduced or put back into place. Second, an internal fixation device is placed on the bone. This can be done with screws, plates, rods, or pins that are used to hold the broken bone together. This open treatment of fractures includes internal fixation, arthrodesis, laminectomy with exploration and/or decompression of spinal cord. Decompression surgery (laminectomy) opens the bony canals through which the spinal cord and nerves pass, creating more space for them. See: "ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes" for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 15 = ORIF, spinal stabilisation
	Surgical debridement or Fasciotomy: Surgical Debridement is a surgical procedure for exploration of penetrating wound chest, abdomen, flank, back, postoperative hemorrhage, thrombosis or infection. Fasciotomy is the incision of the fascia to release of compartment syndrome on extremities. The below knee leg is the most likely compartment to develop acute compartment syndrome, followed by the forearm, thigh, and arm. Compartment syndrome occurs when the pressure within a defined compartmental space increases past a critical pressure threshold, thereby decreasing the perfusion pressure to that compartment.			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 16 = Surgical debridement/Fasciotomy
	Escharotomy is a surgical procedure of fractional fenestration of burn and traumatic scars for functional improvement, performed by making an incision through the eschar to release the pressure. Deep dermal and full thickness burns develop a rigid and inelastic tissue termed "Eschar". In deep circumferential or near circumferential burns of limbs or chest, as edema forms the inelastic eschar can cause a buildup of pressure and act like a tourniquet. This pressure can lead to			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 17 = Escharotomy

	significant complications such as respiratory compromise requiring a surgical procedure known as an “Escharotomy”. See: “ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes” for complete list of codes				
	Others (e.g. disarticulation, amputation): This category includes any surgical procedures relevant to the ECMO run not captured above. They include but are not limited to: Disarticulation: traumatic separation of two bones at their joint (shoulder, hip, knee) and/or Amputation: total removal of a limb (arm, forearm, thigh, leg) by trauma or by a surgeon in case of severe injury or it’s complications (impaired circulation, infection, sepsis) See: “ELSO Registry Trauma Addendum, Appendix B: Procedures and CPT codes” for complete list of codes			TRAUMA.SurgInvProcedures	CodeId Lookup table: TRAUMA.SurgInvProcedureCodes 18 = Others (e.g. disarticulation, amputation)
Damage Control Surgery **This is a required field.**	**Damage Control Surgery:** Did the Surgical or invasive procedures above, include Damage Control Surgery**?** **Damage Control Surgery** (DCS) The approach provides a limited surgical intervention in order to control both hemorrhage and contamination. This subsequently allows to focus on reversing the physiologic insult prior to completing a definitive repair.	“yes”, “no” or “unknown” by checking the box. If yes is checked then at least one of the above procedures must be indicated		TRAUMA.TraumaAddendum	DamageControlSurgery 1 = Yes 2 = No 3 = Unknown

Evaluation transfusion, blood products, anticoagulation					
Field Name	Definition / Explanation / Example	Data Entry Rules	Collection/ Modification	Table Name	Column Name / Stored Values
Pre-ECLS Course Hemoglobin Non mandatory field	Hemoglobin: refers to the lowest hemoglobin parameter within the **24 hours before** ECLS cannulation. **Example**: In 26yo female was hit by a truck and suffered blunt chest and abdominal trauma and subtotal amputation of her lower extremity. She was intubated and admitted to the ER with a tourniquet on her leg. First arterial blood gas (ABG) analysis showed a Hb 4.7 g/dl. Focused assessment with sonography for trauma (FAST) detected ruptured spleen. Her next **Hb was 3.8 g/dl (lowest Hb parameter before ECLS cannulation).** The patient was cannulated for VA-ECMO and transferred to OR for emergency laparotomy.	Units= g/dl **Range soft limit:** **3.0 g/dl to 18.0 g/dl** **Range hard limit:** **0.1 g/dl to 20.9 g/dl** **ONE DECIMAL PLACE ONLY**		TRAUMA.TraumaAddendum	Hemoglobin
Pre-ECLS Course Transfusion / blood products **This is a required field.**	**DID THIS PATIENT RECEIVE ANY BLOOD PRODUCTS IN THE 24 HOURS PRIOR TO ECLS CANNULATION?** This question refers to whether or not the patient had any blood product transfusions in the 24h prior to ECMO cannulation. Blood products include: Packed Red Blood Cells, Fresh Frozen Plasma, Platelets, or Cryoprecipitate.	Indicate "yes" or "no" by checking box. If the answer is "YES", all options listed below will populate and one or more options in this section must be entered. If "No", the next section is hidden.		TRAUMA.TraumaAddendum	ReceivedBP24 1 = Yes 0 = No
	Transfusion / blood products: refers to the type and amount (where applicable) of blood products transfused in the **24 hours prior to** ECLS cannulation. Cryoprecipitate requires a **YES OR NO ONLY** Please give the exact amount transfused in mL. If unable to determine, then estimate the total volume of blood	Units: mL Indicate "yes" by checking box. Multiple indications are possible **FFP** - **Soft Limits: 0 to 15,000 mL** **Hard Limits: 0 to 25,000 mL** **PRBC** **Soft Limits: 0 to 15,000 mL** **Hard Limits: 0 to 15,000 mL**		TRAUMA.TraumaAddendum	PRBC24 PRBCEstimate24 FFP24 FFPEstimate24 Platelets24 PlateletsEstimate24 Cryoprecipitate24 1 = Yes 0 = No

	product transfused the 24 hours prior to ECLS in mLs. **If this is an estimation, please indicate. Use the following amounts to estimate mL from Units.** Typically, a unit of PRBC's or FFP contains approximately: 1U Packed Red Blood Cells (PRBC)=350 mL 1U Fresh Frozen Plasma (FFP) = 200 – 250 mL 1U Platelets = 250 – 350 mL Example: 26yo female was cannulated VA-ECMO during circulatory arrest due to bleeding and received 25 Units PRBC, 40 Units FFP, 10 Units of Platelets, and 4 Units of Cryoprecipitate. The user should check the box for PRBC, FFP, Platelets, and Cryoprecipitate. Put the amounts of transfused products in mL: 25 x 350 mL = 8.750 mL PRBC, 40 x 250 mL = 10.000 mL FFP, 10 x 250 mL = 2.500 mL Platelets and 4 x Cryo. Consult the blood bank at your hospital (or department where blood is stored and preserved for later use in blood transfusion) to know the amounts of mL in each unit.	**Platelets** **Soft Limits 0 to 7,000mL** **Hard Limits 0 to 15,000mL** **PRBC - Packed Red Blood Cells (TEXT BOX in mL WITH ESTIMATED CHECK BOX AFTER IT)** **FFP - Fresh Frozen Plasma (TEXT BOX in mL with estimated check box after it)** **Platelets (TEXT BOX in mL with ESTIMATED CHECK BOX AFTER IT)** **Cryoprecipitate requires a YES OR NO ONLY**			
	Please indicate by checkbox if Amicar or Tranexamic Acid (TXA) was used in the first 24h prior to ECMO cannulation.	**DID THE PATIENT RECEIVE AMICAR OR TRANEXAMIC ACID (TXA) IN THE 24 HOURS PRIOR TO ECLS CANNULATION? YES OR NO**		TRAUMA.TraumaAddendum	AmicarTXA24 1 = Yes 0 = No

	Please indicate by checkbox Factor VIIa was used in the first 24 hours prior to ECMO cannulation.	**DID THE PATIENT RECEIVE FACTOR VIIa IN THE 24 HOURS PRIOR TO ECLS CANNULATION? YES OR NO**		TRAUMA.TraumaAddendum	FactorVIIa24 1 = Yes 0 = No
First 72 h ECLS Course Transfusion / blood products **This is a required field.**	**DID THIS PATIENT RECEIVE ANY BLOOD PRODUCTS IN THE 72 HOURS AFTER ECLS CANNULATION?** This question refers to whether or not the patient had any blood product transfusions in the 72 hours after ECMO cannulation. Blood products include: Packed Red Blood Cells, Fresh Frozen Plasma, Platelets, or Cryoprecipitate.	Indicate "yes" or "no" by checking box. If the answer is "YES", all options listed below will populate and one or more options in this section must be entered. If "No", the next section is hidden.		TRAUMA.TraumaAddendum	ReceivedBP72 1 = Yes 0 = No
	Transfusion / blood products: refers to the type and amount (where applicable) of blood products transfused in the 72 **hours** after ECLS cannulation. Cryoprecipitate requires a **YES OR NO ONLY** Please give the exact amount transfused in mL. If unable to determine, then estimate the total volume of blood product transfused the 72 hours after ECLS in mLs. **If this is an estimation, please indicate. Use the following amounts to estimate mL from Units.** Typically, a unit of PRBC's or FFP contains approximately: 1U Packed Red Blood Cells (PRBC)=350 mL 1U Fresh Frozen Plasma (FFP) = 200 – 250 mL 1U Platelets = 250 – 350 mL	Units: mL Indicate "yes" by checking box. Multiple indications are possible **FFP** - **Soft Limits: 0 to 15,000 mL** **Hard Limits: 0 to 25,00 0mL** **PRBC** **Soft Limits: 0 to 15,000 mL** **Hard Limits: 0 to 15,000 mL** **Platelets** **Soft Limits 0 to 7,000 mL** **Hard Limits 0 to 15,000 mL** **PRBC - Packed Red Blood Cells (TEXT BOX in mL WITH ESTIMATED CHECK BOX AFTER IT)** **FFP - Fresh Frozen Plasma (TEXT BOX in mL with estimated check box after it)**		TRAUMA.TraumaAddendum	PRBC72 PRBCEstimate72 FFP72 FFPEstimate72 Platelets72 PlateletsEstimate72 Cryoprecipitate72 Cryoprecipitate72 1 = Yes 0 = No

	Example: 26yo female was cannulated VA-ECMO during circulatory arrest due to intraabdominal bleeding. Emergency laparotomy with intraabdominal packing was performed immediately. Intraoperatively and during the first 72 hours after the VA-ECMO cannulation, she received 5Units PRBC, 4Units FFP, 2Units Platelets and 2Units Cryoprecipitate. The user should check the boxes PRBC, FFP, Platelets, and Cryoprecipitate "yes". Put the amounts of transfused products in mL: 5 x 350 mL = 1.750 mL PRBC, 4 x 250 mL = 1.000 mL FFP, 2 x 250 mL = 500 mL Platelets and 2 x Cryo. Consult the blood bank at your hospital (or department where blood is stored and preserved for later use in blood transfusion) to know the amounts of mL in each unit.	**Platelets (TEXT BOX in mL with ESTIMATED CHECK BOX AFTER IT)** **Cryoprecipitate requires a YES OR NO ONLY**			
	Please indicate by checkbox if Amicar or Tranexamic Acid (TXA) was used in the first 72h after ECMO cannulation.	**DID THE PATIENT RECEIVE AMINO CAPRIOC ACID (AMICAR) OR TRANEXAMIC ACID (TXA) IN THE 72 HOURS AFTER ECLS CANNULATION? YES OR NO**		TRAUMA.TraumaAddendum	AmicarTXA24 1 = Yes 0 = No
	Please indicate by checkbox Factor VIIa was used in the first 72 hours after ECMO cannulation.	**DID THE PATIENT RECEIVE FACTOR VIIa IN THE 72 HOURS AFTER ECLS CANNULATION? YES OR NO**		TRAUMA.TraumaAddendum	FactorVIIa24 1 = Yes 0 = No
Anticoagulation free ECLS Course **This is a required field.**	Anticoagulation-free ECLS for more than first 24 hours after ECLS cannulation Example: 26yo female suffered blunt chest and abdominal trauma and was cannulated VA-ECMO during circulatory	**DROP DOWN BOX FOR YES, NO, UNKNOWN**		TRAUMA.TraumaAddendum	Anticoagulationfree24 1 = Yes 2 = No 3 = Unknown

	arrest due to intraabdominal bleeding (liver rupture). Emergency laparotomy with intraabdominal packing was performed immediately. No heparin was given during the first 48 hours of ECMO run. This patient received anticoagulation-free ECLS for > 24 hours after ECLS cannulation was performed. Indicate “yes” by checking box.				