



**UNIVERSITAT DE GIRONA  
FACULTAT DE MEDICINA**

**CAN A MULTIDISCIPLINARY ATTENTION OF A  
POLITRAUMATIZED PATIENT BE ASOCIATED WITH A  
DECREAS OF MORTALITY? EVALUATION OF  
POLYTRAUMA PROTOCOL OF HOSPITAL JOSEP  
TRUETA**

A cross-sectional study

END OF TERM PROJECT

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# ABSTRACT

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**INTRODUCTION:** Polytrauma is an important cause of mortality and morbidity in our society, especially in adolescents and young adults. The causes of multiple traumas are variable, but traffic accidents are the main cause. In the management of polytraumatized patients, time is very important and the concept of “Golden Hour” reflects the need for a quick evaluation and resuscitation. For that reason, and to organize the multidisciplinary team and the medical procedures to do in a polytraumatized patient, the Polytrauma Committee of Hospital Josep Trueta made a protocol based on the guidelines and with the major evidence available to attend a patient with multiple injuries in the emergency system of this hospital.

**JUSTIFICATION:** the polytrauma protocol is the first one of the Hospital Josep Trueta and has never been evaluated. For this reason it is important to make this project, to evaluate if the application of the polytrauma protocol is associated with a lower mortality of the patients and lower days of hospitalization.

**OBJECTIVES:** to evaluate if the application of Hospital Josep Trueta’s polytrauma protocol is associated with lower mortality and less days of hospitalization of the patients with multiple traumas attended at the emergency system of this hospital.

**METHODOLOGY:** The present study will be an observational cross-sectional study that will be carried out in the emergency system of Hospital Josep Treueta. The sample will be formed by two groups of polytraumatized patients attended at the emergency system of Hospital Josep Trueta: one group will be formed by patients attended in the emergency system of Hospital Josep Trueta before the implementation of the polytrauma protocol (control group) and another after (polytrauma group). Then, we have to compare the mortality rates and hospitalization days of the two groups, to see if there are differences.

**KEY WORDS:** multiple traumas,  
polytrauma, multiple injuries,  
management, outcome.

# ABBREVIATIONS

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**ATLS:** Advanced Trauma Life Support

**HJT:** Hospital Josep Trueta

**MOF:** Multiple Organ Failure

**AIS:** Abbreviated Injury Severity Score

**MaxAIS:** Maximum Abbreviated Injury Severity Score

**ISS:** Injury Severity Score

**NISS:** New Injury Severity Score

**RTS:** Revised Trauma Score

**APACHE:** Acute Physiology and Chronic Health Evaluation

**TRISS:** Trauma and Injury Severity Score

**ASCOT:** Severity Carecterization of Trauma Score

**RISC:** Revised Injury Severity Score

**PHTLS:** Pre-hospital Trauma Life Support

**ATCN:** Advanced Trauma Care for Nurses

**SEM:** Sistema d'Emergències Mèdiques

**WMA:** World Medical Association

# INTRODUCTION

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## **What is a polytrauma patient?**

The term polytrauma is used to describe patients with multiple injuries involving different body regions caused in a single event. One of the injuries or their combination are life threatening. Another characteristic of polytraumatized patients is that the injuries can alter the physiology and cause the failure of uninjured organs taking the patient to a high risk of complications (1,2). However, there isn't an universal accepted and validated definition of the term polytrauma (1,3). It has little importance for the clinical practice but this is a problem to define inclusion and exclusion criteria for the research studies, for the epidemiology monitoring and to compare outcomes from several hospitals (3).

To have multiple injuries has an impact on the mortality and morbidity, because in polytraumatized patients the mortality and morbidity are higher than the summation of the mortality and morbidity of each separately injury (1).

There are a lot of possible combinations of trauma in all body regions, cavities and organs. For that reason, polytrauma patients are very heterogeneous. Nevertheless, there seems to be a systemic response to multiple trauma, regardless of the affected regions (4).

## **Other terms used in literature**

There are many words that have been used in international literature to describe patients with multiple injuries involving different body regions: polytrauma, multiple injured patients, severely injured patients and patients with multiple traumas. Nowadays they are considered synonyms (4).

## Epidemiology of polytrauma

Trauma is an important health problem, because it represents a huge amount of deaths, especially in adolescents and young adults (4–6). Furthermore, traumatic injury is the first cause of death, all over the world, in people from 5 to 44 years old, with two seriously disabled survivors for each death (7) and it represents 10% of all deaths (8). In Catalonia, in 1 year (from July 2012 to July 2013), there were 971 adult patients with multiple traumas, and 57% were aged from 16 to 46 years old (5).

The mortality of patients with severe injuries varies from 7 to 45%. The mortality has a wide range of variability, depending on the hospital and the country observed (4,9). In Catalonia, the mortality of polytraumatized patients is about 10%, but if we categorize the patients depending on their age, we see that the mortality has an exponential growth in patients with more than 75 years old, in which the mortality is 37% (5). As the population ages and older people become healthier and active, older victims of multiple trauma will become more frequent in the near future (10).

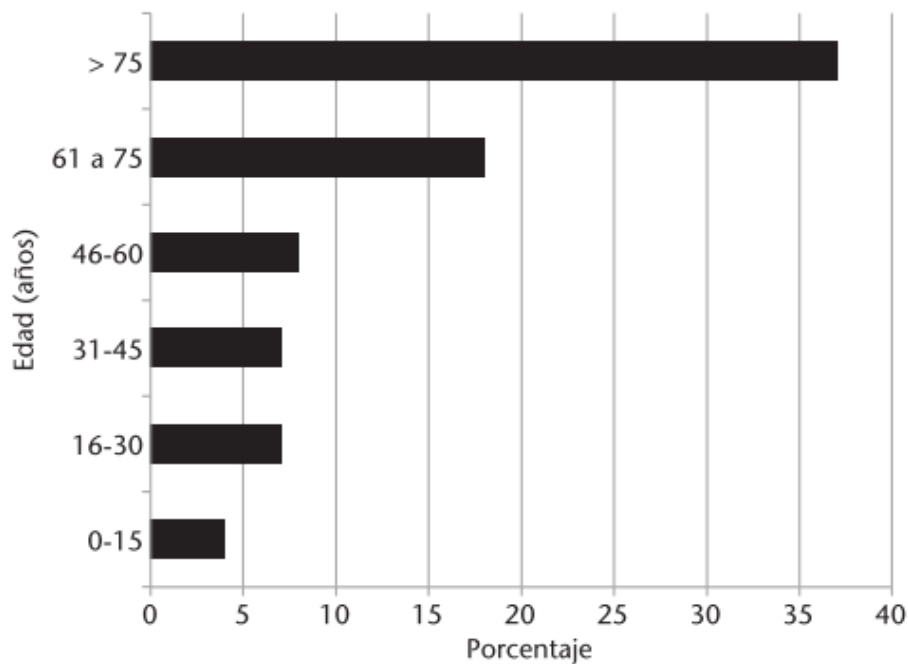


Figure 1: mortality rate by age (5).



The causes of trauma are variable, but the most important worldwide is traffic accidents (25%). Following the traffic accidents, there are many others causes like self-harm (16%), violence with other people (10%), drowning (9%), war (6%), falls (6%), poisoning (6%), fires (5%) and other causes (17%) (11). In Catalonia, the principal causes of trauma are traffic accidents (54'5%) and falls (26'9%) (5).

The management of patients with multiple traumas requires a significant consumption of health resources, because these patients often require massive resuscitation transfusion, extensive imaging, multiple surgeries, extended intensive care unit stay, large hospitalization and complex rehabilitation programs (1). It is estimated that the costs of trauma surpasses \$500 billion dollars per year, all over the world, but only 4% of the money invested to investigation is for trauma's investigation (11). In addition, severe traumatic injury can generate long-term pain and disability, and it's very costly for the sanitary system (12).

## **Distribution of trauma deaths**

The classical distribution of deaths as a consequence of trauma was first described by Trunkey in 1983, and follows a distribution with three peaks, and is classically described as trimodal (11,13–17):

The **first peak** is formed by the immediate deaths. It includes deaths that occur in the first few seconds or minutes after the trauma (< 60 minutes). This peak is caused by nonsurvivable injuries, most frequent by severe injuries of the central neurological system, cardiac or aortic rupture. These patients die on the scene or short time after arrival to the hospital. To reduce the amount of deaths of this peak, prevention is the most effective way (11,14,16), because despite all progress in prehospital care and emergency medical services, the proportion of early deaths remained unchanged at 50-60% (16).

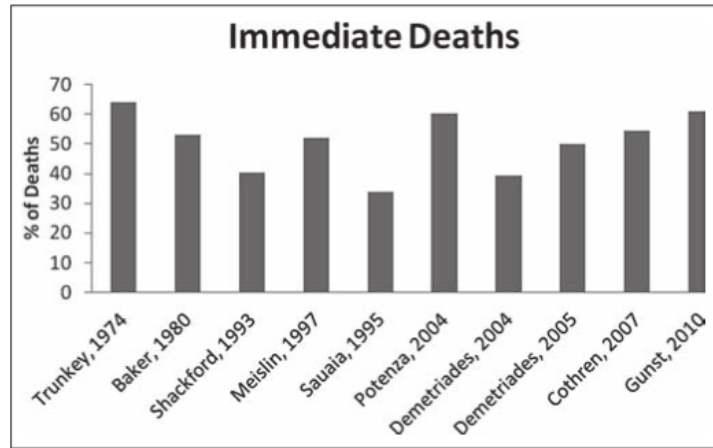
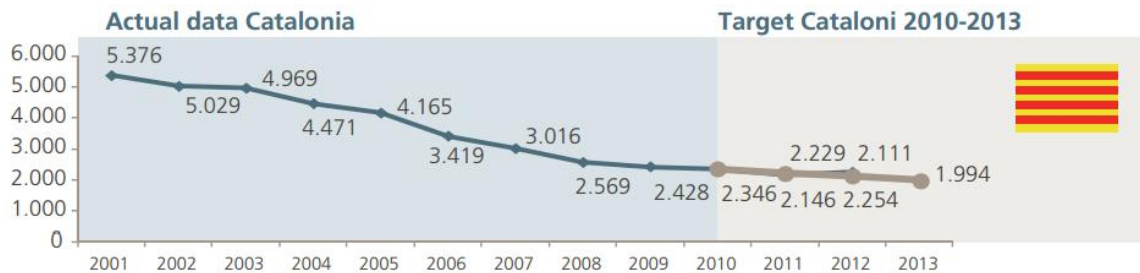


Figure 2: summary of studies evaluating immediate deaths (16).

Since 1999, Catalonia has implemented Road Safety plans. These strategies helped to reduce the number of deaths in traffic accidents. Since the first Road Safety Plan was launched in 1999, the number of deaths in accidents has been reduced a 60%. Nowadays, Catalonia has similar level to some European countries that are considered leaders in this field, like Sweden, the United Kingdom, the Netherlands and Germany (18).

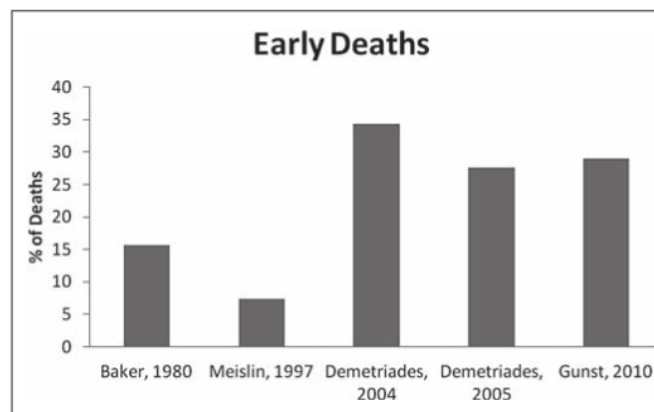


Source: Statistical Yearbook of traffic accidents in Catalonia, 2010 and 2012

Figure 3: changes in the number of deaths and serious injuries in Catalonia (18).

Since January 2014, the 6<sup>th</sup> Road Safety Plan is working, and has the goal of reducing the mortality in traffic accidents a 50% by 2020 (compared with the death toll in 2010). To achieve this goal, Generalitat de Catalunya and Servei Català de Trànsit, marked some objectives and developed Strategic lines and tracking projects (ANNEX 1) (18).

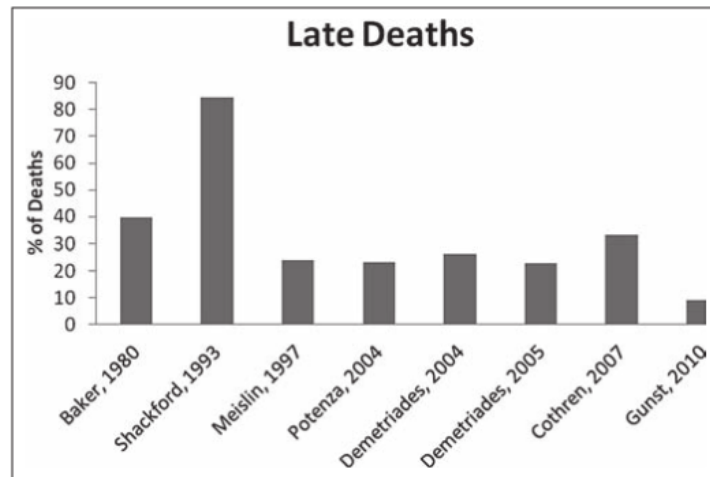
The **second peak** in the trimodal distribution represents early deaths. It includes the deaths that occur in minutes or hours after the trauma (< 4 hours) excluding immediate deaths. The main causes of these deaths are subdural and epidural hematomas, hemopneumothorax, spleen rupture, hepatic lacerations, pelvic fractures and/or other injuries that cause heavy bleeding. These patients arrive alive at the emergency system and are potentially treatable with early care (11,14,16). The proportion of early death has remained relatively unchanged at 25-30% (16).



**Figure 4:** summary of studies reviewing early deaths (16)

The “Golden Hour” for the attention of a traumatized patient is characterized by the need for a quick evaluation and resuscitation in the first hour (11). With a multidisciplinary team, prioritization of the medical procedures and the promptness of the actions, polytraumatized patients will have better outcomes (15). The “Golden Hour” is the main objective of the Advanced Trauma Life Support (ATLS) method (11), and of Hospital Josep Trueta’s (HJT) Polytrauma Protocol (19).

The **third peak** consists of late deaths. It includes deaths that happened several days or weeks after the trauma and is basically due to sepsis and organ failure, that jointly represent 78% of late deaths (11,14–16). The procedures done on the previous periods have impact on the mortality of this stage, because the deaths of this peak have been attributed to crystalloid resuscitation (15). In contrast with the last two peaks, there has been a huge reduction of deaths in this peak since 1980 (16).



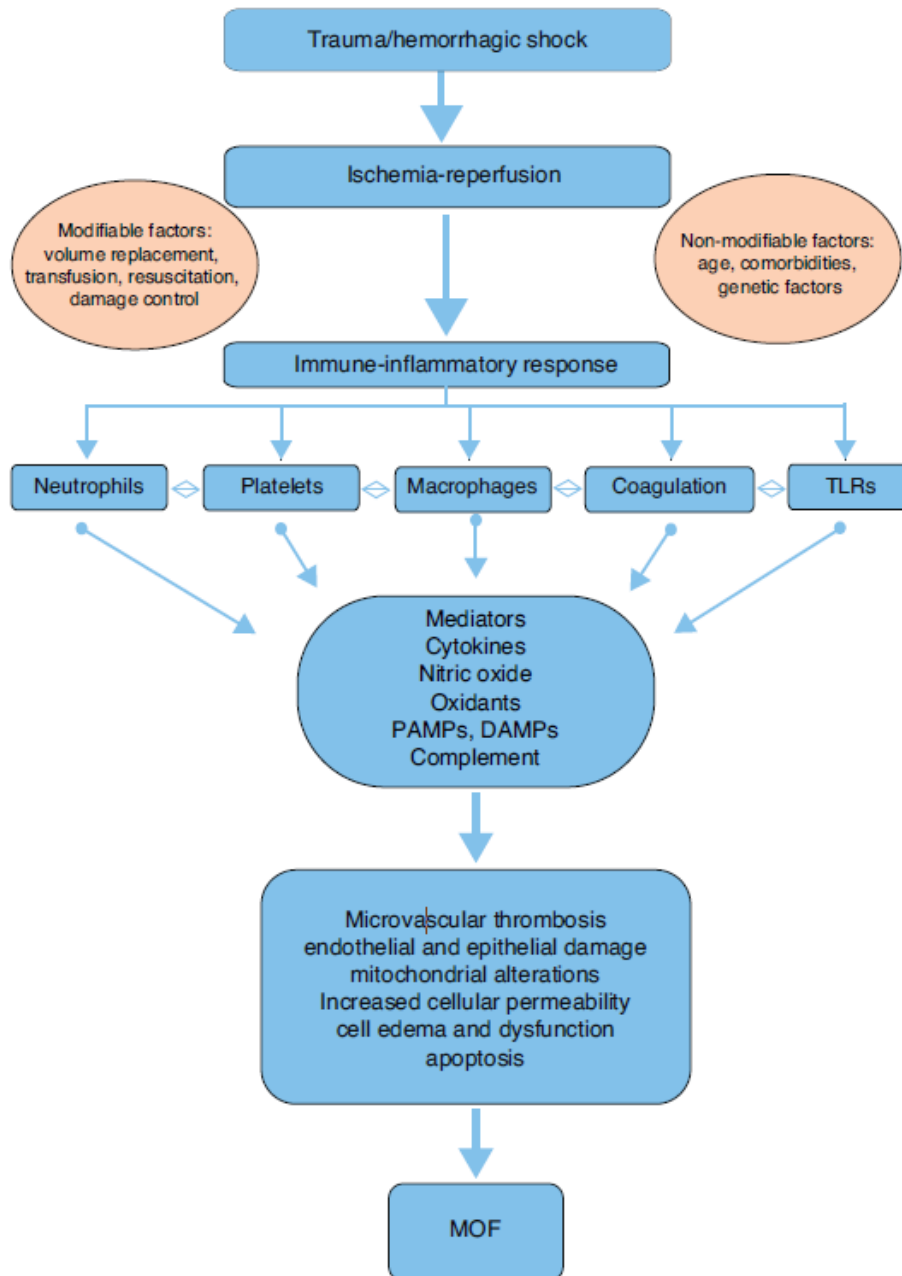
**Figure 5:** summary of studies evaluating late deaths (16).

- The development of multiple organ failure (MOF) after severe trauma is one of the principal causes of late death and is the major cause of post-injury morbidity. The incidence of MOF varies from 7 to 66% and is considered an evolutionary process. The mortality of MOF has been decreasing in the last years due to the advances in treatment and management of the severe injured patients. However, at this moment, mortality is still high (varies from 31 to 80 %) and it is related with the affected organs (20,21).

The development of MOF has two peaks (20):

- The early MOF includes the ones developed in the first 72 hours after trauma, and it seems that the respiratory failure has an important role because usually, it precedes other organ failure. It represents 40% of MOF (20).
- The late MOF are the ones developed beyond the 72 hours after the trauma, and it seems that requires a second aggression that usually is an infection, especially a pulmonary one. It represents 60% of MOF (20).

The physiopathology of MOF is not clear, but it involves the immunologic system, creating endothelial and epithelial damage that decrease the cellular permeability and induce the apoptosis of cells (20).



**Figure 6:** summary of the pathophysiology of MOF following severe trauma (20).

There are some predictors of the development of MOF: age, gender, severity of trauma, traumatic brain injury, use of blood products during the resuscitation, coagulation disorders and thrombocytopenia, hemodynamic status and lactate (20,21).

- The development of sepsis is other of the most important causes of late death in trauma patients (11,14,16). Trauma and subsequent surgical interventions are stress situations, and up-regulate the immunoinflammatory system, inducing, initially, a systemic inflammatory response that frequently is followed by a feedback mechanism of counter-inflammatory response that, in turn, maintains the inflammatory immune homeostasis. This situation seems to contribute to an immunoparalysis that might be responsible for lowering the resistance to nosocomial infections in patients who have survived initial resuscitation, and exposing them to an increased risk of complications (for instance acute respiratory distress syndrome or MOF) secondary to sepsis (22,23).

The distribution of trauma deaths has been changing in mature trauma systems and the classical trimodal distribution of trauma deaths has been questioned by numerous authors (13–16) because of the improvement of the management of trauma patients.

In the last 30 years, the interventions developed with the aim of reducing trauma deaths have been (15,17):

- Injury prevention advancements.
- Prehospital advanced life support interventions.
- Rapid transport to a trauma center with personnel and resources to attend polytraumatized patients.
- Adoption of advanced life support interventions by care providers in the emergency department.
- Evidence-based protocols for acute care of injuries.
- Advances in hospital diagnostics.
- Surgical techniques and critical care.
- Multidisciplinary care of the injured patient.
- Development of treatment strategies and rehabilitation and reintegration of the patient into society(15,17).

With these interventions, in mature trauma systems, the trimodal distribution of trauma deaths seems that have changed to a bimodal distribution (14,15), with a great peak of immediate deaths and another peak of early deaths. There was a dramatic decrease in the number of late deaths (14,15). Nevertheless, the available data of the change to a bimodal distribution is not clear (16,17) and maybe the investigators chose an inconsistent time interval to define the timing of deaths, and this could be a confounding factor (16). The American College of Surgeons still uses the trimodal distribution to teach physicians about the causes of immediate, early and late deaths and some interventions to manage patients with multiple traumas (13).

## Scores used to evaluate polytraumatic patients

**Abbreviated Injury Severity Score (AIS):** AIS is a way to describe the injury and it is not designed on its own to predict mortality or other outcomes. The last revision of AIS lists about 2000 different injuries in six body regions (ANNEX 2). Each injury is coded on a scale from 1 to 6. AIS is the base to calculate other scores (2,4).

INJURY	AIS SCORE
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Unsurvivable

**Figure 7:** punctuation of AIS. Adapted from (4).

AIS-based injury severity measures predict the outcome of trauma patients and have an association with work disability and medical costs (they increase monotonically with injury severity) for work-related injuries (12).

**Injury Severity Score (ISS):** this score is based on anatomical injuries defined in AIS. ISS is calculated as the summation of the squares of the highest AIS in each of the three most severely affected body regions (head, face, chest, abdomen, extremities including pelvis and external structures). To calculate the ISS, it should be used one injury for body region. The punctuation of ISS is from 1 to 75, and 75 is assigned to anyone with an AIS of 6(4). This score is the most widely used by trauma systems and in trauma research, with good agreement inter- and intrarater (2–4,12), and has been validated for the prediction of mortality (12).

**New Injury Severity Score (NISS):** this score is also based on anatomical injuries defined in AIS, but it is a modification of ISS by using the three most severe injuries (instead of body regions like ISS). With this modification the NISS improves the prognostic value of predicting survival rate, especially for penetrating trauma and isolated head injury. NISS is calculated as the summation of the squares of the AIS score of the three most severe injuries. The punctuation of NISS is from 1 to 75, and 75 is assigned to anyone with an AIS of 6 (2,4,12).

There are a multitude of other statistical models that have been developed to predict outcomes in trauma patients and the prediction of the patient risk is not the same, using one score or another (24). Some of them incorporate physiologic data, such as Revised Trauma Score (RTS) and Acute Physiology and Chronic Health Evaluation (APACHE). Others are based in both anatomic and physiologic data, such as Trauma and Injury Severity Score (TRISS), Severity Characterization of Trauma Score (ASCOT) and Revised Injury Severity Score (RISC) (24,25). As the scoring systems become more complex, it is more probable that the data required to calculate it is unavailable on admission (25). Nevertheless of this amount of scores, the scores most widely used are ISS and NISS (2).



## **Background of polytrauma care**

Before 1980 there wasn't a uniform approach to trauma care. Since then, the management of polytraumatized patients has dramatically changed and the factor time has gained a lot of importance (26). The first time that the time factor was taken into account was in 1976 by an orthopedic surgeon who had an accident with his family. He introduced the concept of "First Hour" to attend a trauma patient (11).

The quality of the treatment of most severely injured trauma patients was improved by the introduction of education and training programs for both preclinical and emergency system staff (26). In 1978, the first prototype of the course ATLS was created by a group of USA surgeons and nurses to teach doctors that didn't treat trauma patients in their daily practice, to provide the appropriate care of trauma patients and to improve the prognosis of these patients. This ATLS included conferences and demonstrations of the resuscitation techniques and practical experiences at the laboratory (11).

Since then, a lot of countries offer this course to doctors. In 2007, above 1 million doctors had done the ATLS course. Nowadays, every year ATLS trains above 40.000 doctors all over the world. Every 4 years a revision is done to introduce new evaluation and treatment techniques (11).

The Pre-hospital Trauma Life Support (PHTLS) for pre-hospital emergency medical assistants and the Advanced Trauma Care for Nurses (ATCN) are parallel courses that were created to complement the ATLS course. The formation in trauma of nurses and Pre-hospital staff is very important, because to manage a trauma patient a multidisciplinary team is needed, and all people have to act according to the same action diagram (11).

## **CatSalut's Polytrauma code. Priority of patients.**

CatSalut implemented a Polytrauma code in Catalonia on November 2011. The initial attention of polytraumatized patients requires the urgent attention of a multidisciplinary team and the best way to do that is by using a care network. The care network consists in the categorization of the hospitals in 3 levels depending on the services that they have on call 24 hours (ANNEX 3) and the categorization of the priority of the patients. With these prioritizations a polytraumatized patient is sent to the most useful hospital depending on the solving skills of the hospitals, geographical proximity and resource availability criteria (6,19) (ANNEX 4).

The code consists in a **Pre-Hospital activation** by the Sistema d'emergències Mèdiques (SEM), making the initial evaluation of the patient and advising the physician of the emergency service of the hospital. When SEM alerts the emergency service of the hospital, the following data of the patient is included (6,19):

- Sex
- Age
- Priority of the patient: 0, 1, 2 or 3
- Type of accident
- Affected body area
- Breathing
- Hemodynamic state
- Level of consciousness: evaluated by Glasgow Coma Scale
- Expected time of arrival at the hospital

The politrumatized patients are classified in 4 groups of prioritization depending on the severity of their injuries (6,19):

Priority	Explanation	Criteria
<b>0</b>	<b>Physiologic criteria:</b> patients with hemodynamic instability criteria	<ul style="list-style-type: none"> <li>- Respiratory Rate &lt; 10 bpm</li> <li>- Respiratory Rate &gt; 25 bpm</li> <li>- Systemic Blood Pressure &lt; 90 mmHg</li> <li>- Absence of peripheral pulses</li> <li>- Glasgow Coma Scale ≤ 13</li> </ul>
<b>1</b>	<b>Anatomical criteria:</b> patients who have severe injury, but are hemodynamically stable	<ul style="list-style-type: none"> <li>- Penetrating wound in head, neck, trunk and/or extremities (proximal to knee and elbow)</li> <li>- Open skull fracture or collapse</li> <li>- Instable thorax</li> <li>- Pelvic fracture</li> <li>- ≥ 2 long proximal bone fractures (femur or humerus)</li> <li>- Proximal wrist or ankle amputation</li> <li>- Crushed extremity (catastrophic extremity)</li> <li>- Extremity paralysis</li> <li>- Grade &gt; II burns and extension ≥ 15% of body surface</li> <li>- Completed burn of face or neck</li> </ul>
<b>2</b>	<b>Injury mechanism:</b> patients that only accomplish the criteria of injury mechanism of high energy	<ul style="list-style-type: none"> <li>- Falls of an altitude &gt; 6 meters</li> <li>- Vehicle collision with:                             <ul style="list-style-type: none"> <li>• &gt; 33 cm intrusion to the companion site or &gt; 45 cm to any other part of the vehicle</li> <li>• Partial or complete ejection</li> <li>• Dead of a companion of the vehicle</li> <li>• Vehicle telemetry data that indicate a high risk of injury (in general speed &gt; 60 Km/h)</li> </ul> </li> <li>- Car collision with pedestrian or cyclist with shove, shift or a significant impact (&gt; 30 km/h)</li> <li>- Motorcycle, cycle or another mobile dispositive accident in a significant velocity (&gt;30 km/h)</li> </ul>
<b>3</b>	<b>Special considerations</b>	<ul style="list-style-type: none"> <li>- Old adults: &gt; 55 years</li> <li>- Pregnant women (&gt; 20 weeks of pregnancy)</li> <li>- Anticoagulation or coagulation alteration</li> <li>- Patient with dialysis treatment</li> <li>- Professional criteria</li> </ul>

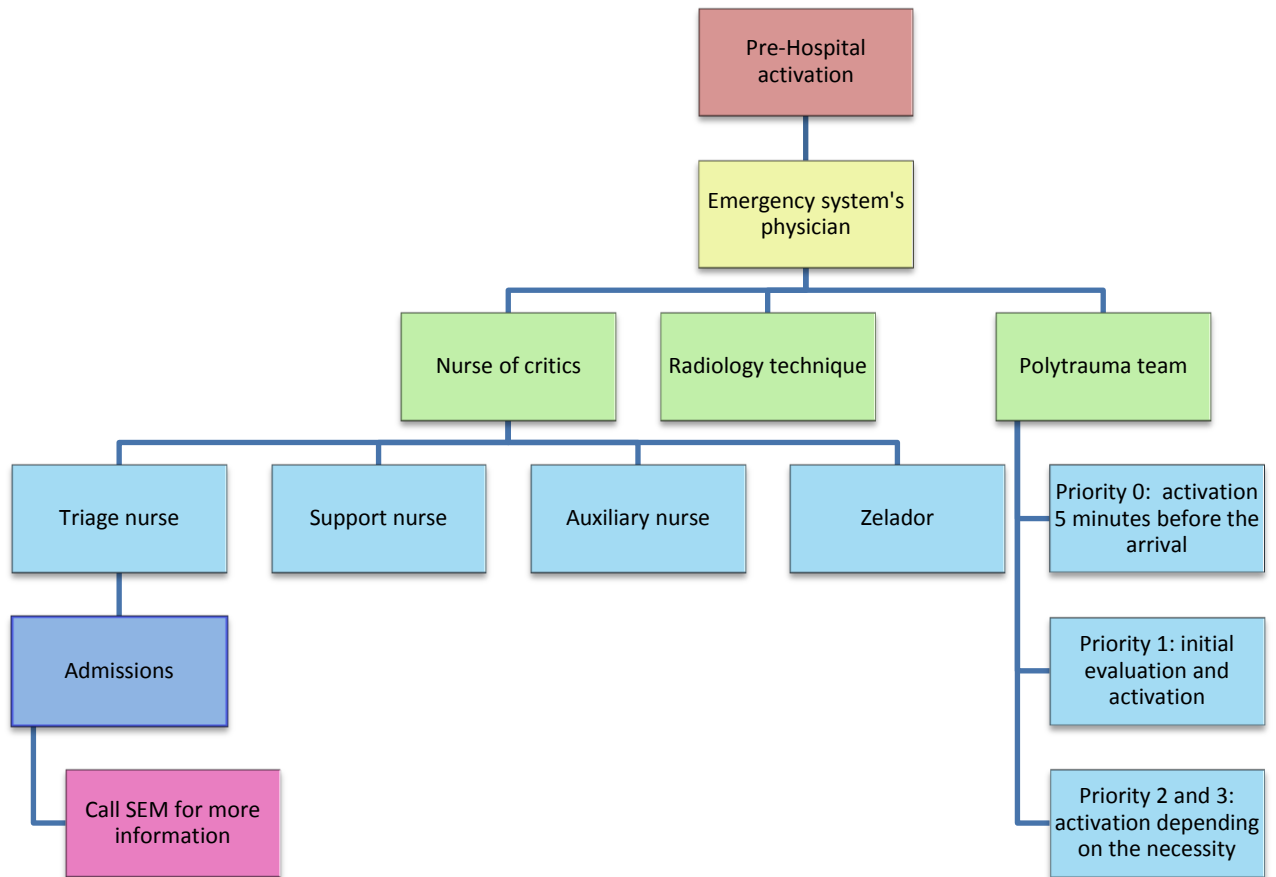
**Figure 8:** criteria for the prioritization of multiple trauma patients. Adapted from (6,19).

## **Doctor Josep Trueta Hospital's Polytrauma protocol**

The polytrauma committee of HJP has been working in the protocol since 2013, and it will finally be implemented in 2015. The polytrauma protocol of HJT was created to define how polytraumatized patients have to be managed in this hospital. This protocol is based on the ATLS guidelines created by the American college of surgeons, adapted to the characteristics of the sanitary system of the country and the hospital. This code provides a multidisciplinary management of the polytraumatized patients to detect and treat faster the different pathologies of the patients (19).

The Polytrauma protocol establishes the actions to take when you found pathology in the primary and secondary evaluation of a polytraumatized patient and also makes a systematization of the serum therapy, transfusions, drugs and additional tests depending on the prioritization of the patient (ANNEX 5) (19).

Once the SEM has made the Pre-hospital activation, there is the activation of **In-Hospital code** that consists in the activation of all the staff required for the polytraumatized patient's attention by the physician of the emergency system (19).



**Figure 9:** diagram of staff activation in HJT's polytrauma protocol. Adapted from (19).

Polytrauma team is formed by (19):

- Emergency system's physician.
  - Anesthesiology physician.
  - General surgery physician.
  - Intensive care physician.
  - Radiology physician and resident.
  - Traumatology physician.
  - Blood bank nurse.
- In priority 0 they will be activated 5 minutes before the expected time of arrival at the hospital and have to go immediately to the emergency system's critical box (19).

- In priority 1 they will be activated after the initial evaluation of the patient by the emergency system's physician (19).
- In priority 2 and 3 they will be activated depending on the need (19).

The leader of the polytraumatized patient's attention will be the physician of the emergency system. In some special cases, depending on the injuries of the patient, the emergency system's physician can delegate to a traumatology physician, general surgery physician or others the position of leadership (19).

## JUSTIFICATION

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Polytrauma is a very important cause of mortality and morbidity in our society, especially in adolescents and young adults (4–6). Because of the importance of polytrauma in our society, the Polytrauma Committee of the emergency system of HJT developed a protocol for the treatment of polytraumatized patients. The application of HJT polytrauma protocol represents a multidisciplinary management of the polytraumatized patient, giving the patient a better and faster evaluation and resuscitation in the first hour (19).

The mortality of the polytraumatized patients of first peak can only be avoided by prevention, but the mortality from the second and the third peaks can be decreased by a better and faster management of the patient (11,14,16). With better management of these patients in the “Golden Hour” they will have lower rates of complications (less MOF and sepsis that are the major complications of polytrauma and cause the third peak of mortality), and the patient will have faster recovery and need less hospitalization days.

For that reason, it is important to make this project to evaluate if HJT’s polytrauma protocol has a relation with the survival and the hospitalization time of the patients with multiple traumas. It is important to remark that this protocol is the first one developed in HJT and has never been evaluated.

# HYPOTHESIS

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## **Primary hypothesis**

There is a link between the application of the HJT's polytrauma protocol and lower mortality of the patients with multiple traumas attended in the emergency system of this hospital.

## **Secondary hypothesis**

There is a link between the application of HJT's polytrauma protocol and fewer days of hospitalization of patients with multiple traumas attended in the emergency system of this hospital.



## OBJECTIVES

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### **Primary objective**

The main aim of this study is to evaluate if HJT's multiple traumas' protocol is associated with lower mortality of the patients with multiple traumas attended in the emergency system of this hospital.

### **Secondary objective**

The secondary aim is to evaluate if HJT's multiple traumas' protocol is associated with fewer days of hospitalization of the patients with multiple traumas attended in the emergency system of this hospital.

# MATERIAL AND METHODS

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## Study design

The present study will be an observational **cross-sectional study**.

The best way to study if HJT's polytrauma protocol is associated with lower mortality of the patients is to analyze the prevalence of the mortality before and after applying the polytrauma protocol. The study design consists in an observational cross-sectional study. The sample will be formed by two groups of polytraumatized patients attended in the emergency system of HJT: one group will be formed by patients attended in the emergency system of HJT before the implementation of the polytrauma protocol (control group) and another after (polytrauma group). Then we have to compare the prevalence of mortality and the hospitalization days of the two groups to see if there are differences.

## Setting

The study will be carried out from data and patients of the emergency system of the HJT in Girona. This hospital is considered by CatSalut a level Cat2b to attend polytraumatized patients (ANNEX 2). With this classification HJT has the capacity to attend polytraumatized patients not only with priority 0 and 1, but also with priority 2 and 3.

## Participants

The participants of the study will be patients admitted to the HJT in Girona with the diagnosis of polytrauma in 2013 - 2014 (control group: patients attended before the implementation of polytrauma protocol) and in 2015 - 2016 (polytrauma group: patients attended after the implementation of polytrauma protocol).

People selected to be part of the study must meet the following criteria:

INCLUSION CRITERIA	EXCLUSION CRITERIA
<ul style="list-style-type: none"> <li>- Patients with severe multiple injuries (including patients with burns, suffocated and drowned patients) that:               <ul style="list-style-type: none"> <li>• Patients defined as priority 0 or 1 in any moment of the attention.</li> <li>• Patients hospitalized in critical care unit or in need of surgery.</li> <li>• Trauma patients who died during the urgent attention at the hospital.</li> </ul> </li> <li>- Patients of 15 years old or more.</li> </ul>	<ul style="list-style-type: none"> <li>- Age &lt; 15 years.</li> <li>- Polytraumatized patients defined as priority 2 or 3.</li> <li>- Patients with isolated fractures.</li> <li>- Patients with simple isolated injuries.</li> </ul>

**Figure 10:** inclusion and exclusion criteria.

## Sample selection

A non-probabilistic consecutive sampling-method is used. The sample is collected from a previous database of CatSalut, called TraumCat. All patients will meet the inclusion criteria.

The study sample will be formed by two groups:

- The first group (control group) will be formed by patients with multiple traumas treated at the emergency system of HJT before the introduction of the polytrauma protocol (years 2013 and 2014).
- The second group (polytrauma group) will be formed by patients with multiple traumas treated at the emergency system of HJT after the introduction of the polytrauma protocol (years 2015-2016).

## **Sample size**

To calculate the sample size the online free application GRANMO was used (27).

Accepting an alpha risk of 0'05 and a beta risk of 0'2 in a two-sided test, 201 subjects are necessary in first group and 201 subjects are necessary in the second group (402 in total) are necessary to recognize as statistically significant a proportion difference, expected to be of 0'15 in group 1 (average of mortality of polytraumatized patients in HJT) and 0'065 in group 2. It has been anticipated a drop-out rate of 0% because the data will be collected from a previous database.

In the years 2013-2014 the emergency system of HJT attended 208 patients with multiple traumas. Then, the number of patients is estimated to be enough to carry out the study.

If there are more patients than the estimated to be needed by GRANMO, the data of all patients will be used, because by using the data we are not inducing harm to the patient.

## Variables and measure instruments

All variables will be collected retrospectively from TraumCat, a CatSalut database.

### Main variables

- Application of HJT's Polytrauma protocol: it is a nominal dichotomous qualitative variable (Yes / No).

The patients attended between the years 2013-2014 (control group) weren't attended following the HJT's polytrauma protocol. The patients attended between the years 2015-2016 (polytrauma group) will be attended following the HJT's polytrauma protocol.

It will be expressed as a percentage.

- Mortality: it is a nominal dichotomous qualitative variable (Yes / No).

It only includes the patients who died in the hospital. It doesn't include deaths at the scene of the accident and patients in vegetative state or brain death.

It will be expressed as a percentage.

- Days of hospitalization: it is a discrete quantitative variable (number of days).

It is measured from the entrance to the emergency system to the discharge of the hospital and it is calculated by "Date of discharge" minus "Date of admission" from the hospital. It doesn't matter if, at the discharge, the patient goes home, to a rehabilitation center, to the morgue or another hospital (higher or lower treatment level).

It will be expressed as a mean and standard deviation.

### **Confounding variables**

- Age: it is a discrete quantitative variable (number of years).

The patient's age at the time of injury is measured in one year intervals taking in account the date of birth. It will be collected from the ID card of the patient or other official documentation given by the patient at the admission department.

It's important to take the age into account, because in patients older than 75 years, the mortality has an exponential growth (5,10).

It will be expressed as mean and standard deviation.

Gender: it is a nominal qualitative variable (Male/Female/Unknown).

It will be collected from the ID card of the patient or other official documentation given by the patient at the admission department.

It's important to take into account the sex of the patient, because females with menstrual cycle (aged 15-44 years) have lower incidence of MOF after trauma and also have a better response to standardized resuscitation. Nevertheless, mortality differences haven't been observed (28). In general in the polytraumatized patients, there is an important predominance of men (29).

It will be expressed as percentages.

- Drug abuse before the trauma: it is a nominal qualitative variable with different groups of drugs, but will be analyzed as a nominal dichotomous qualitative variable (Yes/No), because we want to analyze if the politraumatized patients took drugs, but not what type of drug.

It is measured with a qualitative urine test. The drugs that the test detects are:

- Amphetamines
- Barbiturates
- Benzodiazepines
- Cannabinoids
- Cocaine
- Phencyclidine
- Methadone
- Methamphetamine
- MDMA.

It will be expressed as percentages.

- ISS: it is an ordinal qualitative variable that will be analyzed in 3 groups depending on the punctuation: <15, 15-24, >24.

It will be measured with the punctuation of AIS that will be measured by the physical exploration of the patient.

It will be expressed as percentages.

- NISS: it is an ordinal qualitative variable that will be analyzed in 3 groups depending on the punctuation: <15, 15-24, > 24.

It will be measured with the punctuation of AIS that will be measured by the physical exploration of the patient.

It will be expressed as percentages.

- Mechanism of the trauma: it is a nominal qualitative variable. It will be 10 groups:

- Unknown
- Traffic accident
- Push: include pedestrian and cyclist
- Low and high energy falls: defined as the person's height
- Stabbed by knife, sword, dagger, other pointed or sharp object
- Shot by handgun, shotgun, rifle or other firearm of any dimension
- Aggression for other mechanisms
- Burned
- Drowned: in freshwater, saltwater or others
- Rail accident
- Others

This information will be obtained from the SEM or from the anamnesis of the patient.

It will be expressed as percentages.

VARIABLE	TYPE OF DATA	CATEGORIES OR VALUES	MEASURE INSTRUMENT
<b>Application of HJT polytrauma protocol</b>	Nominal dichotomous qualitative	Yes/No	
<b>Mortality</b>	Nominal dichotomous qualitative	Yes/No	Alive or death at the discharge.
<b>Days of hospitalization</b>	Discrete quantitative	Number of days	Calculate the "Date of discharge" minus "Date of admission" from the hospital
<b>Age</b>	Discrete quantitative	Number of years	ID card or other documentation of the patient
<b>Gender</b>	Nominal qualitative	- Male - Female - Unknown	ID card or other documentation of the patient
<b>Drug abuse before trauma</b>	Nominal qualitative	Yes /No	Detection of toxics in urine
<b>ISS</b>	Ordinal qualitative	Analyzed by groups: - < 15 - 15-24 - >24	Data from AIS, obtained by physical exploration
<b>NISS</b>	Ordinal qualitative	Analyzed by groups: - < 15 - 15-24 - >24	Data from AIS, obtained by physical exploration
<b>Mechanism of the trauma</b>	Nominal qualitative	- Unknown - Traffic accident - Push - Falls - Aggression with knife or firearm - Aggression by other mechanisms - Burned - Drowned - Rail accident - Others	Data from SEM or anamnesis of the patient

Figure 11: variables of the study and measure instruments



## **Methods of data collection**

We will work with a pre-existent database, called TraumCat, which was created by CatSalut in July of 2012 with the aim of evaluating different aspects of the medical attention of the polytraumatized patients and their outcome in Catalonia. This database was created by experts of different specialties involved in the attention of polytraumatized patients, working together with computer systems technicians. The team designed the database following international recommendations and national and local experiences and based of Utstein model. This database meets the highest level of security established by the *“Ley Orgànica de Protección de Datos”* (LOPD 15/1999), both in audit and access system.

All the patients from our sample were prospectively included in this database.

# STATISTICAL ANALYSIS

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## **Univariant description**

A descriptive analysis of the variables will be performed using SPSS version 20 (IBM, Armonk, NY, US).

Qualitative variables will be described using frequencies (n) and percentages for each category. Quantitative variables will be described using frequencies (n), mean and standard deviation (in case of variables with normal distribution) and using frequencies (n), median and interquartile range (in case on variables without normal distribution).

## **Bivariate analysis**

For the analysis between the main variable application of HJT's Polytrauma protocol (qualitative) and the main variable mortality (qualitative) it will be applied a Chi-square test. For the analysis between the main variable application of HJT's Polytrauma protocol (qualitative) and the main variable days of hospitalization (quantitative) it will be applied a Student's T test.

## **Multivariate analysis**

The analysis of the mortality rate of patients treated before and after the implementation of the polytrauma protocol in HJT (main objective of the proposal) will be performed by Logistic Regression Model adjusted for the co-variables.

The analysis of the different hospitalization days of patients treated before and after the implementation of the polytrauma protocol in HJT (the secondary objective of the proposal) will be performed by General linear model adjusted for the co-variables.

It will be considered that a significant difference between both groups exists when p-value <0.05.

## ETHICAL CONSIDERATIONS

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The present study will be performed in accordance with the ethical principles for medical research described by the World Medical Association (WMA) on the Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects. June 1964. Last revision was on October 2013 (30).

Also, according to *“Ley Orgánica 15/1999, de 13 de Diciembre, de Protección de Datos de Carácter Personal”*, all patient data will be anonymous and codified when collected. The database uses the medical record number instead of the names of patients to guarantee the anonymity of all patients’ data (31).

This study protocol will be presented to the Clinical Research Ethics Committee of HJT in order to be evaluated and get its approval. To include the patient’s data on the CatSalut database TraumCat the informed consent is not needed. For that, reason the patient’s will not sign any consent for the study. Then, an exemption for the informed consent will be requested to the Clinical Research Ethics Committee.

The investigators of this project declare that there are no conflicts of interests.

## WORK PLAN

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The research team will carry out all the tasks of coordination, interpretation and dissemination of the results. The sequence of activities developed individually or for the entire research team is detailed below:

- **Stage 0: study design: November 2014 – January 2015. This step is completed.**
  - Bibliographic research and protocol elaboration.
  - Investigator 1.
  
- **Stage 1: ethical evaluation of the protocol: February 2015.**
  - Clinical Research Ethics Committee of IAS.
  
- **Stage 2: first meeting and inform the professionals about the study: March 2015.**
  - First meeting for task organization.
  - Meeting with the professionals of HJT involved in the attention of polytraumatized patients about the study.
  - Investigators 1, 2 and 3.
  
- **Stage 3: patient recruitment: January 2015 – December 2016.**
  - Physicians of the emergency system of HJT.
  - The patients from the fist group (2013-2014) are already recruited by the physicians of the HJT's emergency system.
  
- **Stage 4: data collection: January 2017.**
  - Collection of the patients' data of the control group and the polytrauma group in the previous database. The data will be introduced in the database from 2013 to 2016, before and after the implementation of the polytrauma protocol. Selection of the patients for our study according to the exclusion/inclusion criteria.
  - Investigator 1

- **Stage 5: second meeting: February 2017.**
  - Second meeting to review all the data.
  - Investigators 1, 2 and 3.
  
- **Stage 6: statistical analysis: March - April 2017.**
  - A qualified statistician will process the data with the adequate software.
  - Qualified statistician.
  
- **Stage 7: interpretation of the results: May - June 2017.**
  - The investigation team will keep in contact and meet to analyze and interpret the results.
  - Investigators 1, 2 and 3.
  
- **Stage 8: publication of the results: July 2017.**
  - The results will be presented in national and international conferences. We will also attempt to publish it in an emergency journal.
  - Investigators 1, 2 and 3.

TASK	Nov 2014- Jan 2015	Feb- Apr 2015	May- July 2015	Aug- Oct 2015	Nov 2015- Jan 2016	Feb- Apr 2016	May- July 2016	Aug- Oct 2016	Nov 2016- Jan 2017	Feb-Apr 2017	May-July 2017
Stage 0: study design											
Stage 1: ethical evaluation											
Stage 2: meeting 1											
Stage 3: patient recruitment											
Stage 4: data collection											
Stage 5: meeting 2											
Stage 6: statistical analysis											
Stage 7: interpretation of results											
Stage 8: publication											

# BUDGET

<u>STUDY BUDGET</u>	<u>COST</u>
<u>Staff costs</u>	0 €
<u>Goods and services costs</u>	
- Qualified statistician:	
• 30€/h x 4h/day x 2 day/week x 4 weeks .....	960€
	<b>Subtotal: 960 €</b>
<u>Travel and subsistence costs</u>	
- National conferences attendance	
• Inscription .....	450€
• Transport costs .....	150€
• Accommodation .....	350€
- International conferences attendance	
• Inscription .....	450 €
• Transport costs .....	550€
• Accommodation .....	350€
	<b>Subtotal: 2300 € pp</b>
<u>Publication costs</u>	1000€
	<b>Subtotal: 1000 €</b>
	<b><u>TOTAL: 4260 €</u></b>

There won't be additional costs.

Investigators 1, 2 and 3 will not receive any financial compensation for their contribution to the study.

## STUDY LIMITATIONS AND BIASES

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This is a cross-sectional study. Due to the study type, it can demonstrate that two or more factors occur simultaneously, but cannot make assumptions about what factor precedes the other factor. Then, we can assign association of the factors but not causality. To attribute causality, a prospective study is needed.

Also due to the study design, and because the data of the patients is from a previous database, it is difficult to control the possible confounding variables. In order to avoid this problem we will analyze the confounding variables in a multivariate analysis to reduce the confusion.

The study is a retrospective review of preexisting data and some data points may be subject to information bias, but we believe that the data is reliable, as it was obtained from prehospital providers and personnel of the emergency department.

Despite all the limitations, the better type of study type to evaluate if the application of HJT's polytrauma protocol is associated with lower mortality is a cross-sectional study. A prospective study like a clinical trial won't have all this limitations, but it won't be ethical, because a tool to manage better the polytraumatized patients, in some of them (control group), won't be applied, and it is unacceptable.

## CLINICAL AND HEALTHCARE IMPACT. OPORTUNITIES

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Polytrauma is an important cause of mortality in our society, especially in young people. A better, faster and multidisciplinary management of these patients will be associated with a reduction of mortality. Because of young people are more affected by multiple traumas, this reduction of mortality will affect the population's Life Expectancy.

This better management will also be associated with a faster recovery with a reduction of the incidence of serious complications like MOF or sepsis. This will reduce the hospitalization days in Cat2b level hospital. With this faster recovery, promptly return to work and less days of hospitalization, the costs for the sanitary system will be reduced.



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# ANNEXES

## ANNEX 1: objectives, developed strategic lines and tracking projects of road safety plan

Objectives	Strategic lines	Tracking projects
1 Protect users of mobility and effective control of risk behaviours	1.1 Reduced consumption of alcohol, drugs and psychotropic drugs while driving	1.1.1 Implement preventive information actions and tests for the consumption of alcohol, drugs and psychotropic drugs while driving
		1.1.2 Consider the possible implementation of Alcolock for certain groups
	1.2 Monitoring and control of risk behaviours and particularly speed as the main cause of injuries in accidents	1.2.1 Monitor compliance with regulations through specific campaigns for the monitoring and control of these behaviours, propose policy reforms and improve the effectiveness and efficiency of disciplinary proceedings for traffic offences
		1.2.2 Anti-speeding plan
	1.3 Protection of the most vulnerable users of mobility	1.3.1 Foster atmospheres and attitudes of good citizenship and mutual respect among car drivers, lorry drivers, motorcyclists, cyclists and pedestrians
		1.3.2 Improve the safety of motorcyclists
	1.4 Continuous improvement of care for accident victims	1.4.1 Enhancement of the Service of Information and Assistance to Accident Victims
		1.4.2 Incorporation of new technologies in the emergency care system in traffic accidents
2 Promote a continuous road safety area (urban and inter-urban areas)	2.1 Improving traffic safety in urban areas	2.1.1 Create a representative forum of road safety to analyse accidents on road network within the Road Safety Observatory and facilitate the exchange of best practices in urban road safety
		2.1.2 Promote the drafting, monitoring and assessment of results of local road safety plans at local level to reduce urban accidents
	2.2 "Integration of road safety in the planning of land use and mobility"	2.2.1 Develop technical road safety standards to be incorporated in the development of land management plans
		2.2.2 Work with private organizations operating in the field of land use planning and mobility (e.g. professional associations) in the dissemination of best practices in this field
	2.3 Achieve a safer and more efficient road network for users	2.3.1 Safer design of road infrastructure (road safety impact assessments, road safety audits)
		2.3.2 Use of smart transport and traffic management systems: management of traffic demand on ITS support, improved information on traffic conditions throughout the network, cooperative systems (V2V, V2I communications)
		2.3.3 Improved consistency in road travel times (long journeys and foreseeable disruptions, eurovignette and pay per use, protocols for dealing with traffic disruptions, etc.)
		2.3.4 Promotion of preventive action programmes, road safety inspections, maintenance and road assistance and work on sections of the existing road network with the highest risk of accidents
		2.3.5 Promoting improvements, variants, splits and new roads
	2.4 Promoting a modal shift in transport towards safer and more sustainable modes (electric car, public transport)	2.4.1 Make public transport more competitive compared to private transport
3 Involve and coordinate public and private entities to improve safe mobility	3.1 Reorientation of the Catalan Traffic and Road Safety Commission and the Interdepartmental Commission for the Improvement of Road Safety	3.1.1 Include the setting and monitoring of commitments/objectives and the demanding of results from other public and private organizations in the activity of the commissions
		3.1.2 Establish coordination and monitoring structures with the Catalan Traffic Service. Creation of working groups according to road issues
	3.2 Development of agreements with other organisations (associations) to implement joint actions to improve road safety	3.2.1 Promote the activity of associations for the promotion of road safety activities
		3.2.2 Define a plan of action in collaboration with associations and establish formal coordination and monitoring mechanisms (commission, work sessions, transfer of information)
	3.3 Promoting road safety in the company	3.3.1 Promote the development of road safety plans in companies, focused on prevention, awareness and information
	3.4 Promoting the active presence of the CTS at an international level	3.4.1 Creation of the Road Safety Observatory to have an impact in the urban setting, projecting the policies of the CTS at a European and global level and becoming a leader in safe mobility

4	Procure the road safety management structures, tools and mechanisms that allow the achievement of results	4.1 Continuous improvement of the legal framework for road safety	4.1.1 Improve of the legal framework for road safety
			4.1.2 Managing road safety responsibilities in Catalonia
			4.1.3 Development of a road safety plan based on a new framework of shared responsibility
			4.1.4 Creation and implementation of the Traffic Authority to implement the road safety strategy in Catalonia
		4.2 Implementing mechanisms aimed at achieving excellence in management	4.2.1 Implement road safety management systems in accordance with the ISO 39001 Standard
			4.2.2 Set road safety targets in the action plans of all public authorities and other institutions, in the framework of the 2014-2020 Strategic Plan, and monitor compliance with commitments
			4.2.3 Developing road safety plans (RSP) with quality objective indicators decision-making in the field of road safety
			4.2.4 Informing users about traffic conditions
			4.2.5 Optimize disciplinary proceedings in the field of traffic and improve their efficiency
		4.3 Promoting a safe fleet of vehicles	4.3.1 Promote the demand for active and passive safety systems in vehicles
4.3.2 Campaigns to raise users' awareness about the importance of proper technical maintenance of vehicles for the purposes of road safety			
5	Provide lifelong road safety education	5.1 Deployment and promotion of a safe mobility curriculum to accompany people in their experience as mobility users	5.1.1 Promotion of education for safe mobility and other measures to prevent traffic risk through the involvement of schools
			5.1.2 Ensure road safety training as occupational risk prevention <i>in mision and in itinere</i>
			5.1.3 Promoting a model of educational values and responsibilities for safe mobility
		5.2 Design of communication strategies that promote a road safety culture	5.2.1 Conduct communication campaigns on risk factors (speed, alcohol/drugs and passive safety systems) along with surveillance and control activities
			5.2.2 Continue awareness campaigns to generate a positive opinion about road safety
			5.2.3 Develop a transparency policy in relation to the road safety policies implemented and the results obtained
		5.3 Improving driver skills	5.3.1 Promotion of measures to ensure that drivers have the necessary skills to drive safely
			5.3.2 Creation and development of processes to ensure that individuals with risk factors or behaviours do not cause traffic accidents
6	R&D&i in road safety	6.1 Incorporation and promotion of external knowledge	6.1.1 Creation of academic specializations
			6.1.2 Ongoing collaboration with universities and scientific institutes
			6.1.3 Presentation of R&D&i awards in traffic and road safety
			6.1.4 Creation of a Chair in Road Safety
			6.1.5 Research with the Chair for Road Safety Education and Training
		6.2 Joint analysis and decision-making between interdependent areas	6.2.1 Creating combined information systems (accidents, mobility, information on penalties, etc.)
		6.3 Promotion of the private sector and economic activation	6.3.1 Creating the HighWay Lab as the start of a data set for researchers. Continuation as a physical laboratory. Design and definition. Collaboration with the private sector
		6.4 Proactivity in performing preventive actions based on modelling and prognosis	6.4.1 Allocation of resources to develop knowledge based on modelling
		6.5 International presence, lobbying, publications and branding plan	6.5.1 Implementation of various actions to promote the R&D&i activities promoted by the Catalan Traffic Service

## ANNEX 2: calculation of abbreviated injury score (AIS)

AIS: ABBREVIATED INJURY SCORE.

### TRAUMATISME TANCAT

AIS Score	1 Lleu	2 Moderat	3 Greu, no perilla vida	4 Greu, vida en perill	5 Critic
C u t a n e a  o  e x t e r n a	<ul style="list-style-type: none"> <li>• Abrasions/Contusions                             <ul style="list-style-type: none"> <li>◦ Superficials o no específiques;                                     <ul style="list-style-type: none"> <li>▪ 25 cm<sup>2</sup> a la cara</li> <li>▪ 50 cm<sup>2</sup> al cos</li> </ul> </li> <li>• Laceració superficial o no específica                                     <ul style="list-style-type: none"> <li>◦ Fora del teixit subcutani independent de la longitud</li> <li>◦ Dins del teixit subcutani pero;   <ul style="list-style-type: none"> <li>▪ 5 cm a la cara</li> <li>▪ 10 cm al cos</li> </ul> </li> </ul> </li> <li>• 1 cremades fins al 100%</li> <li>• Cremades 2º o 3º &lt; 6% del total del cos</li> </ul> </li></ul>	<ul style="list-style-type: none"> <li>• Abrasions/Contusions                             <ul style="list-style-type: none"> <li>◦ &gt; 25 cm<sup>2</sup> a la cara</li> <li>◦ &gt; 50 cm<sup>2</sup> al cos</li> <li>• Laceració profunda dins del teixit subcutani i;                                     <ul style="list-style-type: none"> <li>◦ &gt; 10 cm al cos o &gt; 5 cm a la cara</li> </ul> </li> <li>• Cremades 2º o 3º: 6-15% del total del cos</li> </ul> </li></ul>	<ul style="list-style-type: none"> <li>• Cremades 2º o 3º: 16-35% del total del cos</li> </ul>	<ul style="list-style-type: none"> <li>• Cremades 2º o 3º: 26-35% del total del cos</li> </ul>	<ul style="list-style-type: none"> <li>• Cremades 2º o 3º: 36-90% del total del cos</li> </ul>
C a p  (i n c l o s a l  c a r a)	<ul style="list-style-type: none"> <li>• Despert en el moment de l'admissió o l'observació inicial                             <ul style="list-style-type: none"> <li>◦ Concient a l'inici, pero amb mal de cap / Vèrtic secundari a TLE (traumatisme craneocefàlic)</li> </ul> </li> <li>• Condute auditiu afectat</li> <li>• Ulls                             <ul style="list-style-type: none"> <li>◦ Abrasió conjuntival / contusió / laceració</li> <li>◦ Cremada a la còrnia / Contusió</li> <li>◦ Cremada a la parpella / Contusió / Laceració</li> <li>◦ Cristal·li / Retina / Laceració del conducte llagrimal</li> <li>◦ Trencament de Coroides</li> <li>◦ Ferida de uvea</li> </ul> </li> <li>• Geniva                             <ul style="list-style-type: none"> <li>◦ Contusió / Laceració</li> </ul> </li> <li>• Llavi                             <ul style="list-style-type: none"> <li>◦ Contusió / Laceració (no importa l'extensió)</li> </ul> </li> <li>• Mandíbula                             <ul style="list-style-type: none"> <li>◦ Fractura no específica</li> <li>◦ Fractura de la branca mandibular</li> </ul> </li> <li>• Nas                             <ul style="list-style-type: none"> <li>◦ Fractura</li> </ul> </li> <li>• Dents                             <ul style="list-style-type: none"> <li>◦ Avulsió / Dislocació / Fractura</li> </ul> </li> <li>• Llengua                             <ul style="list-style-type: none"> <li>◦ Laceració superficial</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Despert en el moment de l'admissió o l'observació inicial                             <ul style="list-style-type: none"> <li>◦ Inconsciència anterior per un període de temps no específic</li> <li>◦ Amnesia (no recorda el cop)</li> <li>◦ Inconscient &lt; 15 min.</li> <li>• Adormilat, estupuros, confús en el moment de l'admissió o observació inicial (pot ser despertat mitjançant estímuls verbals)</li> <li>◦ Ninguna inconsciència anterior</li> <li>◦ Inconscient &lt; 15 min.</li> </ul> </li> <li>• Quan el nivell de consciència es desconegut en el moment de l'admissió o en l'observació inicial.</li> <li>◦ Inconscient &lt; 15 min.</li> <li>• Diagnòstic mèdic de commoció cerebral sense cap altre detall.</li> <li>• Fractura de vobeda cranial                             <ul style="list-style-type: none"> <li>◦ Frontal, occipital, parietal, esfenoides, temporal o inespecífic) tancat, desplaçat, diastàtic, lineal, simple, inespecífic</li> </ul> </li> <li>• Orelles                             <ul style="list-style-type: none"> <li>◦ Oïde intern / Fractura d'oïde mitg</li> <li>◦ Dislocació ossicular de l'os</li> <li>◦ Crencament del timpa</li> <li>◦ Avulsió del pavelló(oïde extern)</li> </ul> </li> <li>• Ulls                             <ul style="list-style-type: none"> <li>◦ Laceració de la còrnea.</li> <li>◦ Laceració escleral / Crencament</li> </ul> </li> <li>• Os alveolar                             <ul style="list-style-type: none"> <li>◦ Fractura amb o sense dents afectades</li> </ul> </li> <li>• Avulsió del llavi</li> <li>• Fractura Mandibular                             <ul style="list-style-type: none"> <li>◦ Branca mandibular si es oberta / desplaçat / comminuta</li> <li>◦ Cos amb o sense implicació de la branca mandibular</li> <li>◦ Subcondilar</li> <li>• Fractura maxil·lar                                     <ul style="list-style-type: none"> <li>◦ Tancada / No específica / Le fort I / Fractura zigomàtica</li> </ul> </li> </ul> </li> <li>• Llegua                             <ul style="list-style-type: none"> <li>◦ Profunda + / o laceració extensiva</li> </ul> </li> <li>• Nas                             <ul style="list-style-type: none"> <li>◦ Fractura oberta / Desplaçament / Comminuta</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Despert en el moment de l'admissió o l'observació inicial                             <ul style="list-style-type: none"> <li>◦ Inconsciència anterior per un període de temps no específic / Amnesia</li> <li>◦ Inconscient 15 min amb deficit neurològic</li> <li>◦ Inconscients 15-59 min</li> <li>• Adormilat, estupuros, confús en el moment de l'admissió o observació inicial (pot ser despertat mitjançant estímuls verbals)</li> <li>◦ Ninguna inconsciència anterior / Inconcient &lt; 15 min amb deficit neurològic</li> </ul> </li> <li>• Inconcient 15-59 min</li> <li>◦ Inconsciència anterior / Perdua no específica de la consciència</li> <li>• Inconcient en el moment de l'admissió (no respon a estímuls verbals)</li> <li>◦ Temps de inconsciència no específica</li> <li>◦ Inconcient &lt; 1hora</li> <li>• Quan el nivell de consciència es desconegut en el moment de l'admissió o en l'observació inicial                             <ul style="list-style-type: none"> <li>◦ Inconcient 15-59 min</li> <li>◦ Inconsciència anterior / Inconcient &lt; 15 min amb deficit neurològic</li> </ul> </li> <li>• Fractura de la base                             <ul style="list-style-type: none"> <li>◦ (base del etmoides vora orbitaria, esfenoides, temporal) sense fuga de LCR(líquid cefalorraquidi)</li> </ul> </li> <li>• Component comminut, esfonsat o fractura de la vobeda craneal desplaçada</li> <li>• Cerebel o cervell                             <ul style="list-style-type: none"> <li>◦ Contusió</li> <li>◦ Lesió afectant alguns del següents òrgans (hemorràgia subracnoïdea, edema, swelling, hematoma subdural, igroma, infart, tumefacció cerebral)</li> </ul> </li> <li>• Fractura zigomàtica                             <ul style="list-style-type: none"> <li>◦ Oberta / Desplaçada / Comminuta</li> </ul> </li> <li>• Ulls                             <ul style="list-style-type: none"> <li>◦ Avulsió</li> <li>◦ Avulsió del nervi òptic / Laceració</li> <li>◦ Llagrima</li> </ul> </li> <li>• Fractura de mandíbula                             <ul style="list-style-type: none"> <li>◦ Rama mandibular afectada / Fractura de mandíbula</li> <li>◦ Subcondilar / Cos amb o sense implicació del ramus per qualsevol desplaçament/ Comminut</li> </ul> </li> <li>• Fractura d'òrbita oberta / Desplaçada, comminuta</li> <li>• Le fort II</li> </ul>	<ul style="list-style-type: none"> <li>• Despert en el moment de l'admissió o l'observació inicial                             <ul style="list-style-type: none"> <li>◦ Inconscient 15-59 min amb deficit neurològic</li> <li>◦ Adormilat, estupuros, confús en el moment de l'admissió o observació (pot ser despertat mitjançant estímuls verbals)</li> <li>◦ Inconscient 15-59 min / Inconsciència anterior durant un període de temps no específic / Inconcient &lt; 1hora amb deficit neurològic</li> </ul> </li> <li>• Inconscient en el moment de l'admissió (no respon a estímuls verbals)</li> <li>◦ 1-24 hores (1 dia quan les hores no van poder ser estimades)</li> <li>◦ Moviments apropiats, pero sol estímuls dolorosos (independent del temps d'inconsciència)</li> <li>◦ Inconcient durant un període no específic / Inconcient &lt; 1hora amb deficit neurològic</li> <li>• Quan el nivell de consciència es desconegut en el moment de l'admissió o en l'observació inicial, pero inconscient per a:                             <ul style="list-style-type: none"> <li>◦ 1-24 hores (1 dia quan les hores no poden ser estimades)</li> <li>◦ Inconscient 15-59 min amb deficit neurològic</li> </ul> </li> <li>• Fractura de la base                             <ul style="list-style-type: none"> <li>◦ (base del etmoides vora orbitaria, esfenoides, temporal) amb fuga de LCR o pneumoencèfal</li> </ul> </li> <li>• Fractura de la vobeda cranial                             <ul style="list-style-type: none"> <li>◦ (Occipital frontal, parietal, esfenoides, temporal, inespecífic) obert, duramadre, fuga de LCR (líquid cefalorraquidi), pneumoencèfal o cervell exposat</li> </ul> </li> <li>• Cerebel o cervell                             <ul style="list-style-type: none"> <li>◦ Laceració</li> <li>◦ Hematoma, epidural / Subdural &lt; 100cc o no específic</li> <li>◦ Hematoma intracraneal, intracerebral (amb hematoma de peteüal i subcortical)</li> </ul> </li> <li>• Le fort III</li> </ul>	<ul style="list-style-type: none"> <li>• Inconscient en el moment de l'admissió o l'observació inicial. (no respon a estímuls verbals)</li> <li>◦ Moviments innapropiats</li> <li>◦ 1-24 hores (1 dia quan les hores no van poder ser estimades) / Moviments apropiats, pero sol a estímuls dolorosos (independent de la duració amb deficit neurològic)</li> <li>• Quan el nivell de consciència es desconegut en el moment de l'admissió o en l'observació inicial, pero inconscient per a:                             <ul style="list-style-type: none"> <li>◦ 1-24 hores (1 dia quan les hores no van poder ser estimades) amb deficit neurològic</li> <li>◦ &gt; 24 hores</li> </ul> </li> <li>• Tronc cerebral                             <ul style="list-style-type: none"> <li>◦ Compressió / Contusió / Ferida que implica hemorràgia</li> </ul> </li> <li>• Cerebel o cervell                             <ul style="list-style-type: none"> <li>◦ Hematoma, epidural Subdural &gt; 100cc</li> <li>◦ Ferida contusa al cervell</li> </ul> </li> </ul>

C o l l i	<ul style="list-style-type: none"> <li>• Faringe <ul style="list-style-type: none"> <li>◦ Contusió / Laceració / Perforació / Trencament</li> </ul> </li> <li>• Gola <ul style="list-style-type: none"> <li>◦ Abrasió / Contusió / Laceració (no afectada arteria major)</li> </ul> </li> <li>• Traquea <ul style="list-style-type: none"> <li>◦ Contusió</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Faringe <ul style="list-style-type: none"> <li>◦ Contusió amb hematoma / Laceració amb hemorragia</li> </ul> </li> <li>• Contusió <ul style="list-style-type: none"> <li>◦ Esòfag / Laringe / Glandula tiroides</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Traquea <ul style="list-style-type: none"> <li>◦ Aplastament</li> </ul> </li> <li>• Glandula tiroides <ul style="list-style-type: none"> <li>◦ Laceració</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Laceració <ul style="list-style-type: none"> <li>◦ Traquea / arteria caròtida / arteria subclavia</li> </ul> </li> <li>• Laringe <ul style="list-style-type: none"> <li>◦ Aplastament / Fractura / Laceració</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Esòfag / Laringe / Traquea <ul style="list-style-type: none"> <li>◦ Avulsió / Trencament</li> </ul> </li> </ul>
T o r a x	<ul style="list-style-type: none"> <li>• Costella <ul style="list-style-type: none"> <li>◦ Contusió / Fractura</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Costella <ul style="list-style-type: none"> <li>◦ Fractura oberta / Desplaçada / &gt; 2 costelles sense volet costal</li> </ul> </li> <li>• Fractura d'esternó</li> </ul>	<ul style="list-style-type: none"> <li>• Pulmó / Pericardi <ul style="list-style-type: none"> <li>◦ Contusió amb o sense hemotorax unilateral</li> </ul> </li> <li>• Pulmó <ul style="list-style-type: none"> <li>◦ Laceració superficial o no especifica</li> </ul> </li> <li>• Hemotorax unilateral / Pneumotorax <ul style="list-style-type: none"> <li>◦ Amb torax o ferida de la cavitat toràctica</li> </ul> </li> <li>• Fractura d'esternó <ul style="list-style-type: none"> <li>◦ Obert / Desplaçat / Comminuted</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Pared toràctica <ul style="list-style-type: none"> <li>◦ Perforació / Punxada</li> </ul> </li> <li>• Contusió pulmonar <ul style="list-style-type: none"> <li>◦ Amb hemomediasti / Pneumomediasti / Hemotorax bilateral o pneumotorax</li> </ul> </li> <li>• Miocardi <ul style="list-style-type: none"> <li>◦ Contusió</li> </ul> </li> <li>• Pericardi <ul style="list-style-type: none"> <li>◦ Contusió amb hemomediasti o tamponament / perforació / Punxada / Trencament / Laceració / Hemotorax o pneumotorax bilateral</li> </ul> </li> <li>• Hemotorax bilateral / Pneumotorax</li> <li>• Hemomediasti / Pneumomediasti</li> <li>• Volet costal</li> <li>• Laceració pulmonar <ul style="list-style-type: none"> <li>◦ Superficial o no especifica amb hemotorax / Pneumotorax</li> </ul> </li> <li>• Inhalació de fum</li> </ul>	<ul style="list-style-type: none"> <li>• Laceració <ul style="list-style-type: none"> <li>◦ Aorta / Bronquis / Arteria coronaria / Pulmó (profunda+o extensa) / Miocardi(totes les cavitats) / Arteria pulmonar / Vena pulmonar / Vena cava superior o inferior / Pericardi si afecta l'hemomediasti / Pneumomediasti o tamponament</li> </ul> </li> <li>• Punxada / Trencament <ul style="list-style-type: none"> <li>◦ Aorta / Valvula intracardiaca o septum / Miocardi / Arteria o vena pulmonar / Vena cava superior o inferior / Pericardi si afecta l'hemomediasti / Pneumomediasti o tamponament</li> </ul> </li> <li>• Perforació <ul style="list-style-type: none"> <li>◦ Aorta / Bronquis / Miocardi / Pericardi si afecta l'hemomediasti / Pneumomediasti o taponament</li> </ul> </li> <li>• Trencament dels bronquis</li> <li>• Inhalació de fum <ul style="list-style-type: none"> <li>◦ Requereix suport respiratori</li> </ul> </li> <li>• Contusió miocàrdica <ul style="list-style-type: none"> <li>◦ Si es severa o afecta l'hemomediasti o pneumomediasti</li> </ul> </li> </ul>
A b d o m e n / P e l l i s	<ul style="list-style-type: none"> <li>• Laceració superficial o no especifica / Perforació <ul style="list-style-type: none"> <li>◦ Pared abdominal (òrgans no involucrats)</li> </ul> </li> <li>• Abrasió / Contusions / Laceració superficial o no especifica o perforació <ul style="list-style-type: none"> <li>◦ De l'escrot / Vagina / Vulva / Perineu</li> </ul> </li> <li>• Contusió del penis</li> <li>• Trencament del escrot</li> </ul>	<ul style="list-style-type: none"> <li>• Avulsió de la paret abdominal</li> <li>• Profunda / o extensa laceració o perforació <ul style="list-style-type: none"> <li>◦ De la paret abdominal (òrgans no involucrats) / Escrot</li> </ul> </li> <li>• Contusió al estomac</li> <li>• Ureter <ul style="list-style-type: none"> <li>◦ Contusió / Laceració superficial o no especifica</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Trencament de la paret muscular abdominal</li> <li>• Contusió <ul style="list-style-type: none"> <li>◦ Vesícula biliar / Conducte biliar comú / Colon / Duodé / Jèju / ileu / Ronyó (amb o sense hematoma) / Bufeta / Messentèri / Pancrees / Peritoni / Recte / Bazo / Uretra / Uter</li> </ul> </li> <li>• Laceració superficial o no especifica/Perforació <ul style="list-style-type: none"> <li>◦ Bufeta / Penis / Ureter / Diafragma</li> </ul> </li> <li>• Molt profunda / o extensa laceració o perforació <ul style="list-style-type: none"> <li>◦ Del Perineu / Ureter / Vagina / Vulva</li> </ul> </li> <li>• Avulsió <ul style="list-style-type: none"> <li>◦ Del Escrot / Ureter</li> </ul> </li> <li>• Retroperitoni <ul style="list-style-type: none"> <li>◦ Lesió que implica hemorragia o hematoma</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Laceració superficial o no especifica/Perforació <ul style="list-style-type: none"> <li>◦ Tracte biliar / Colon / Duodé / Jèju / ileu / Ronyó / Fetge / Pancrees / Peritoni / Recte (Sobre tota la superfície de la paret extraperitoneal)</li> </ul> </li> <li>• Profunda + / o extensa laceració o perforació <ul style="list-style-type: none"> <li>◦ De la Bufeta / Messentèri / Penis / Estomac / Uretra / Uter</li> </ul> </li> <li>• Avulsió <ul style="list-style-type: none"> <li>◦ De la Bufeta / Messentèri / Penis / Bazo / Estomac / Testicles / Uretra / Uter (no embarassada o primer trimestre) / Ovari</li> </ul> </li> <li>• Trencament <ul style="list-style-type: none"> <li>◦ Del Bazo / Estomac / Uretra / Uter no embarassada o primer trimestre) / Bufeta (intra-peritoneal)</li> </ul> </li> <li>• Trencament/Desgarrament <ul style="list-style-type: none"> <li>◦ Ovàric / Trompes de fal·lopi</li> </ul> </li> <li>• Laceració del bazo</li> </ul>	<ul style="list-style-type: none"> <li>• Avulsió / Profunda + / o extensa laceració o perforació <ul style="list-style-type: none"> <li>◦ Del Tracte biliar / Colon / Duodé / Jèju / ileu / Ronyó / Fetge / Pancrees (amb o sense implicació del duodé)</li> </ul> </li> <li>• Profunda / o extensa laceració / Trencament <ul style="list-style-type: none"> <li>◦ Del Peritoni / Recte</li> </ul> </li> <li>• Laceració greu dels vasos intra-abdominals o intrapèlvics</li> <li>• Uter <ul style="list-style-type: none"> <li>◦ (Al 2 on o 3 er trimestre) avulsió / Trencament</li> </ul> </li> </ul>
C o l u m n a v e t e b r a l	<ul style="list-style-type: none"> <li>• Dolor muscular sense fractura o dislocació <ul style="list-style-type: none"> <li>◦ Cervical / Toràctic / Espina dorsal lumbar</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Dislocació subluxació + / o Fractura <ul style="list-style-type: none"> <li>◦ Apòfisis espinosa o transversal (o no especificat) cervical, Toràctic, Espinal dorsal lumbar</li> </ul> </li> <li>• Fractura amb compressió lleu <ul style="list-style-type: none"> <li>◦ T<sub>1-12</sub>/L<sub>1-5</sub> (&lt;=20% pèrdua de l'alçada del cos vertebral anterior) / No especifica</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Cordó cervical <ul style="list-style-type: none"> <li>◦ Contusió amb les mostres neurològiques transitoris (debilitat muscular, paràlisi, pèrdua de sensació)</li> </ul> </li> <li>• Hèrnia amb el nervi afectat <ul style="list-style-type: none"> <li>◦ Cervical / Toràctic / Espina dorsal lumbar</li> </ul> </li> <li>• Dislocació subluxació + / o Fractura <ul style="list-style-type: none"> <li>◦ Làmina / Cos / Faceta / Pedicle / Odontoides de cervical / Toràctic / Espina dorsal lumbar</li> </ul> </li> <li>• Arrel nerviosa / Plexe braquial / Plexe lumbar / Plexe del sacro <ul style="list-style-type: none"> <li>◦ Avulsió / Laceració / Trencament, lesió amb lesió desconeguda</li> </ul> </li> <li>• Fractura amb compressió de més d'una vertebra + / o &gt;20% de pèrdua de l'alçada de anterior del cos T<sub>1-12</sub>/L<sub>1-5</sub></li> </ul>	<ul style="list-style-type: none"> <li>• Lesió de la mèdul·la cervical <ul style="list-style-type: none"> <li>◦ Incompleta amb la preservació de la sensació + / Funció del motor</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Mèdul·la cervical <ul style="list-style-type: none"> <li>◦ Trencament / Laceració o transecció total amb o sense fractura + / o dislocació C<sub>4</sub> o per sota</li> </ul> </li> <li>• Lesió completa de la mèdul·la cervical <ul style="list-style-type: none"> <li>◦ Quadriplegia o paraplegia</li> </ul> </li> <li>• Aplastament / Laceració / Seccionament total (paraplegia) <ul style="list-style-type: none"> <li>◦ Mèdul·la cervical / Cauda equina</li> </ul> </li> </ul>

POLYTRAUMA: evaluation of polytrauma protocol of Hospital Josep Trueta

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">E x t r e m i t a t s / p e l v i s  ò s s e a</p>	<ul style="list-style-type: none"> <li>• Contusió / Esguinç             <ul style="list-style-type: none"> <li>◦ Unió acromioclavicular / Colze, Hombro (unió gleohumeral) / Unió esternoclavicular / Canell / Turmell</li> </ul> </li> <li>• Contusió             <ul style="list-style-type: none"> <li>◦ Peroné / Maluc</li> </ul> </li> <li>• Esguinç             <ul style="list-style-type: none"> <li>◦ Dit, Peu, Cadera, Dit del peu</li> </ul> </li> <li>• Fractura / Dislocació             <ul style="list-style-type: none"> <li>◦ Dit, Dit del peu</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Dislocació/Laceració conjunta             <ul style="list-style-type: none"> <li>◦ Unió acromioclavicular / Colze / Mà (laceració amb els flexors o els tendons del extensor implicats) / Unió esternoclavicular / Canell / Taló (dislocació subtalar, laceració amb el tendó d'aquiles implicat) / Ròtula (laceració o ruptura del tendó patellar)</li> </ul> </li> <li>• Fractura             <ul style="list-style-type: none"> <li>◦ De clavícula / Acromi / Mà (carps i metacarps) / Húmer / Radi / Omòplat / Cúbit / Peroné / Peu / Taló / Ròtula / Pelvis / Tibia</li> </ul> </li> <li>• Laceració conjunta             <ul style="list-style-type: none"> <li>◦ Hombro / Turmell / Genoll</li> </ul> </li> <li>• Muscul             <ul style="list-style-type: none"> <li>◦ Avulsió o laceració del tendó mes important del muscul alt i baix (excepte patella i aquiles) extremitats</li> </ul> </li> <li>• Laceració del nervi             <ul style="list-style-type: none"> <li>◦ Del tendó distal del bíceps</li> </ul> </li> <li>• Dislocació             <ul style="list-style-type: none"> <li>◦ Del peu</li> </ul> </li> <li>• Bíceps             <ul style="list-style-type: none"> <li>◦ Ruptura muscular</li> </ul> </li> <li>• Amputació / Esguinç             <ul style="list-style-type: none"> <li>◦ Dit / Dit del peu</li> </ul> </li> <li>• Acromioclavular             <ul style="list-style-type: none"> <li>◦ Separació</li> </ul> </li> <li>• Contusió             <ul style="list-style-type: none"> <li>◦ Del peroné amb el nervi peroneal afetat</li> </ul> </li> <li>• Trencament             <ul style="list-style-type: none"> <li>◦ Lligaments colaterals o creuats del genoll</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Aplastament             <ul style="list-style-type: none"> <li>◦ De la unió acromioclavicular / Braç / Colze / Mà / Hombro / Unió esterno clavicular / Canell / Tormell / Peu / Taló / Genoll / Sota el genoll</li> </ul> </li> <li>• Amputació             <ul style="list-style-type: none"> <li>◦ Extremitat superior o sota el colze / Mà / Peu / Taló / Extremitat inferior sota el Genoll / traumatic (parcial o complet)</li> </ul> </li> <li>• Dislocació             <ul style="list-style-type: none"> <li>◦ Hombro / Canell / Turmell / Genoll / Colze / Cadera</li> </ul> </li> <li>• Fractura             <ul style="list-style-type: none"> <li>◦ De húmer / Radi / Cúbit / Femur</li> </ul> </li> <li>• Fractura             <ul style="list-style-type: none"> <li>◦ Tibia / Peroné / Pelvis</li> </ul> </li> <li>• Sacroilíaca             <ul style="list-style-type: none"> <li>◦ Fractura + / o Dislocació</li> </ul> </li> <li>• Pubis de la sínfisis             <ul style="list-style-type: none"> <li>◦ Separació (fractura)</li> </ul> </li> <li>• Genoll             <ul style="list-style-type: none"> <li>◦ Trencament coleral o lligaments creuats</li> </ul> </li> <li>• Turmell             <ul style="list-style-type: none"> <li>◦ Trencament colateral + / o tendó d'aquiles</li> </ul> </li> <li>• Laceració             <ul style="list-style-type: none"> <li>◦ Axil·lar / Femoral braquial / Arteria poplítea</li> </ul> </li> <li>• Laceració del nervi             <ul style="list-style-type: none"> <li>◦ Superior (punt mig, part radial, cubital) o inferior (femoral, tibial, ciàtic peroneal). Extremitat implicada &gt;= 2 nervis a cada extremitat</li> </ul> </li> <li>• Laceració o avulsió del nervi             <ul style="list-style-type: none"> <li>◦ Multiples tendons del muscul superior o inferior (excepte ròtula o aquiles) extremitats</li> </ul> </li> <li>• Tendó rotulià complet             <ul style="list-style-type: none"> <li>◦ Laceració o trencament</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Aplastament de pelvis</li> <li>• Aplastament superior del turmell/Amputació</li> </ul>
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## TRAUMATISME PENETRANT

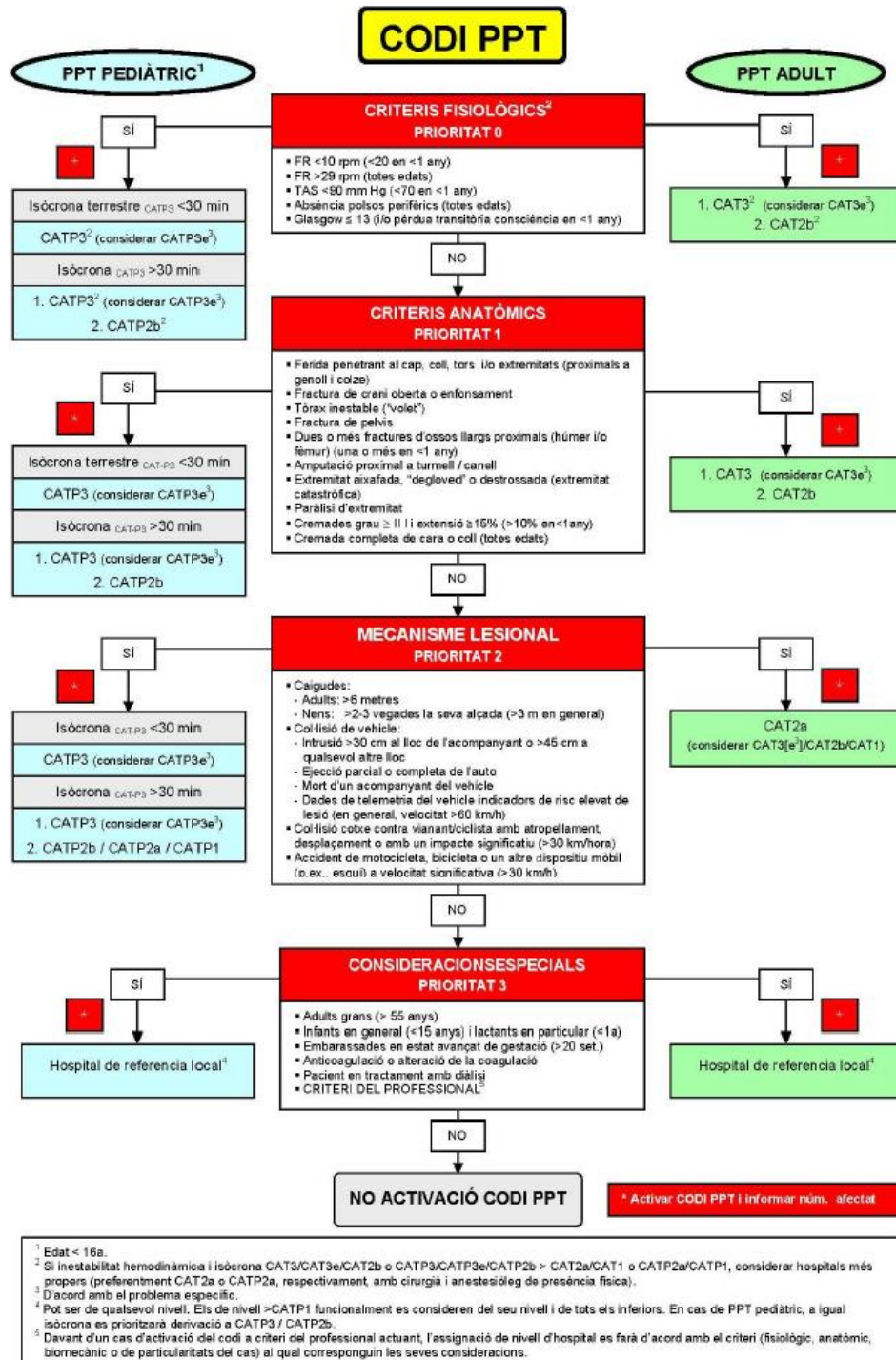
AIS Score	1 menor	2 moderat	3 sever (no perill vida)	4 sever (perill vida)	5 Crític (supervivència incerta)
C a p / C o l l i	<p>●</p> <ul style="list-style-type: none"> <li>Injúria Penetrant (IP)</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>IP coll sense òrgan involucrat</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>IP complexa coll pèrdua tissular, òrgan involucrat</li> <li>Laceració menor de: caròtida, vertebral; v. jugular interna</li> <li>Secció segmentaria de v jugular</li> <li>Laceració tiroideia</li> <li>Laceració superficial: Faringe, laringe</li> <li>Contusió pulmonar dèficit transitori</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>Laceració menor de a caròtida, vertebral amb dèficit neurològic</li> <li>Secció: aa caròtida, vertebral; vv jugular int</li> <li>Pèrdua segmentaria v. jugular</li> <li>Perforació laringe / Faringe</li> <li>Contusió medul·lar con síndrome medul·lar incomplet</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>IP con orifici de entrada i sortida</li> <li>IP de cerebel / cervell pèrdua de segment de a. caròtida / vertebral</li> <li>Laceració complexa faringe / laringe</li> <li>Laceració medul·lar</li> <li>Lesió medul·lar completa</li> </ul>
F a c i a l	<p>●</p> <ul style="list-style-type: none"> <li>IP sense pèrdua de teixit</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>IP pèrdua teixit superficial</li> <li>Laceració corneal, escleral</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>IP con important pèrdua de teixit</li> </ul>		
T ò r a x	<p>●</p> <ul style="list-style-type: none"> <li>IP sense penetració a pleura</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>Laceració de conducte toràcic</li> <li>Laceració pleural</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>IP complexa sense violació cavitat pleural</li> <li>Laceració superficial: vv innominada, pulmonar, subclàvia</li> <li>Laceració superficial: Esòfag, tràquea, bronquis</li> <li>Laceració pulmonar &lt; 1 lob</li> <li>Hemotòrax o pneumotòrax unilateral</li> <li>Laceració diafragmàtica</li> <li>Contusió pulmonar amb signes neurològics transitoris</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>Laceració aòrtica superficial</li> <li>Laceració major de: aa innominada / pulmonar / subclàvia</li> <li>vv cava, braquicèfal, pulmonar, subclàvia</li> <li>Secció. + pèrdua teixit altres venes</li> <li>Perforació de tràquea bronqui i esòfag</li> <li>Laceració multilobar</li> <li>Hemo-pneumo mediastino</li> <li>Hemo-pneumotòrax bilateral</li> <li>Pneumotòrax a tensió</li> <li>Hemotòrax &gt; 1000cc</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>Laceració aòrtica major</li> <li>Secció + pèrdua segmentaria: vv cava / pulmonar / braquicèfal</li> <li>Laceració + pèrdua teixit: tràquea, bronquis, esòfag</li> <li>Laceració pulmonar multilobar + pneumotòrax a tensió &gt; 1000cc</li> <li>Laceració de miocardi +valvular</li> <li>Laceració medul·lar</li> <li>Lesió medul·lar completa</li> </ul>
				<ul style="list-style-type: none"> <li>Tamponament cardíac</li> <li>Contusió medul·lar + sd med incomplet</li> </ul>	
A b d o m e n	<p>●</p> <ul style="list-style-type: none"> <li>IP sense penetració peritoneal</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>IP + pèrdua superfície tissular sense penetració peritoneal</li> <li>Laceració superficial: estomac, ID, mesenteri, vesícula, urèter, ronyó, fetge, baso, pàncrees</li> <li>Laceració peritoneu</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>IP + gran pèrdua de teixit sense penetració peritoneal</li> <li>Laceració superficial vv cava, ilíaca i altres arteries i venes petites</li> <li>Laceració supf duodè, colon i recte</li> <li>Laceració ID mesenteri, vesícula, urèter</li> <li>Laceració major o menor +: lesió gran baso / hemoperitoneo &gt; 1000 cc fetge, pàncrees, baso, ronyó</li> <li>Contusió medul·lar + sg neurològics transitoris</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>Laceració aòrtica menor</li> <li>Laceració major: vv. cava, ilíaca, altres aa i vv petites</li> <li>Pèrdua segm d'ilíaca i altres vv petites</li> <li>Laceració complerta de: estómac colon, duodè, recte</li> <li>Pèrdua tissular mes contaminació de estomac, ID, mesenteri, vesícula, urèter</li> <li>Contusió medul·lar amb sd medul·lar incomplet</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>Laceració aòrtica major</li> <li>Secció /pèrdua de segment vv cava, ilíaca, i altres petites</li> <li>Pèrdua teixit mes gran contaminació duodè, colon recte</li> <li>Pèrdua de teixit ronyó, fetge, baso, pàncrees</li> <li>Laceració medul·lar</li> </ul>
E x t r e m i t a t	<p>●</p> <ul style="list-style-type: none"> <li>Laceració supf de vv braquial i altres vv</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>IP simple sense estructures internes afectes</li> <li>Laceració supf aa braquial, humeral, poplità</li> <li>Laceració vv axilar, femoral, poplità</li> <li>Laceració major + pèrdua de segment: vv braquial i otras aa i vv menors</li> <li>Laceració aa. mediana, radial, femoral, tibial, peronea</li> <li>Laceració major de músculs i tendons</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>IP complexa + estructures internes afectes</li> <li>Laceració superficial aa femoral</li> <li>Laceració major: aa axil·lar, poplità; vv axil·lar, femoral i poplità</li> <li>Pèrdua segment.: vv axil·lar, femoral i poplità</li> <li>Laceració nervi ciàtic</li> <li>Laceració &lt; 1 nv en mateixa extremitat</li> <li>Laceració múltiples músculs i tendons en mateixa extremitat</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>Laceració major aa braquial, femoral</li> <li>Pèrdua segmentaries aa axil·lar, braquial, poplità</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>Pèrdua segmentaria aa femoral</li> </ul>
E x t e r n	<p>●</p> <ul style="list-style-type: none"> <li>Laceració superficial: &lt; 5 cm cara o ma; &lt; 10 cm en cos</li> <li>IP sin pèrdua tissular</li> </ul>	<p>●</p> <ul style="list-style-type: none"> <li>Laceració: &gt; 5 cm cara o ma; &gt; de 10 cm en cos</li> <li>IP + pèrdua tissular superficial</li> </ul>			

## ANNEX 3: categorization of the hospitals

Persona pacient adulta	
<b>Centre d'Atenció al Trauma nivell 1 (CAT-1)</b>	
Hospital	Hospital comarcal
Funció	Atenció urgent, estabilització i derivació a un centre d'atenció al trauma de nivell superior.
Serveis	Cirurgia General 24 h COT 24 h Radiologia convencional amb/sense TC 24 h
Requeriments	Equipament del centre i formació suficient dels professionals per estabilitzar i tractar la persona pacient prèviament al trasllat.
<b>Centre d'Atenció al Trauma nivell 2 (CAT-2)</b>	
Hospital	Hospital referent territorial
Funció	Atenció urgent, estabilització, ingrés i, si escau, derivació a un centre d'atenció al trauma de nivell superior.
Serveis	Cirurgia general 24 h COT 24 h Radiologia convencional amb TC 24 h  <b>Nivell 2a :</b> Unitat de crítics  <b>Nivell 2b:</b> Unitat de crítics Neurocirurgia 24 h
Requeriments	Equip assistencial organitzat per donar atenció al trauma greu durant 24 h Quiròfan d'urgències disponibles 24 h Els centres CAT 2b: <ul style="list-style-type: none"> <li>- han de tenir experiència en el tractament de pacients amb ISS&gt;15 (nombre de pacients desitjable <math>\geq 100</math>/any);</li> <li>- han de tenir programa de formació de residents i recerca científica en l'àmbit del trauma greu.</li> </ul>

Persona pacient adulta	
<b>Centre d'Atenció al Trauma nivell 3 (CAT-3)</b>	
Hospital	Hospital amb activitat terciària
Funció	Atenció urgent, estabilització, ingrés i atenció especialitzada. Eventualment, derivació a unitat especialitzada CAT3e o derivació de retorn al CAT de nivell inferior corresponent.
Serveis*	Cirurgia general 24 h COT 24 h Radiologia convencional i intervencionista, i TC 24 h Unitat de crítics Cirurgia del raquis Neurocirurgia 24 h Cirurgia toràcica 24 h Cirurgia vascular 24 h Cirurgia maxil·lofacial 24 h
Requeriments	Experiència en el tractament de pacients amb ISS>15 (nombre de pacients desitjable $\geq 100$ /any). Equip assistencial organitzat per donar atenció al trauma greu durant 24 h. Quiròfan d'urgències disponibles 24 h. Existència d'un programa d'atenció al trauma greu, amb un coordinador, i que inclogui formació de residents, la formació continuada i la recerca en l'àmbit del trauma greu.
* L'existència en els hospitals d'aquest nivell de serveis altament especialitzats com l'atenció a cremats, atenció a lesionats medul·lars (24 h), reimplantació de membres (24 h) o d'altres, determinen la seva catalogació com a <b>centre d'atenció al trauma especialitzat (CAT 3e)</b> .	

## ANNEX 4: pre-hospital polytrauma code



## ANNEX 5: HJT polytrauma protocol

### CODI POLITRAUMA



### CODI POLITRAUMA

#### COMUNICACIÓ UNITATS-CECOS CODI PPT:

- SEXE (dona, home).
- EDAT
- PRIORITAT (0,1,2,3)
- TIPUS D'ACCIDENT (**ALFA**): 0-desconegut, 1-tràfic, 2-atropellat, 3-precipitat/caiguda, 4-agressió arma blanca o foc, 5-agressió altres mecanismes, 6-cremat, 7-ofegat, 8-accident ferroviari, 9-altres.
- ZONA DEL COS AFECTADA (**CHARLIE**): 10-no lesions, 11-cap, 12-cara, 13-coll, 14-tòrax, 15-abdomen, 16-pelvis, 17-raquis, 18-extremitats.
- RESPIRACIÓ (**ROMEIO**): 0-maneig invasiu de VA, 1-dificultat respiratòria, 2-normal.
- ESTAT HEMODINÀMIC (**HOTEL**): Adult: 0-sense pols o TA < 50 mmHg, 1-TAS 50-90 mmHg, 2-TAS > 90 mmHg. Nen: 0-PC(no)PP(no), 1-PC(1) PP(no), 2-PC(si)PP(si) mala perfusió, 3-PC(si) PP(si) bona perfusió.
- NIVELL DE CONSCIÈNCIA (**GOLF**): Glasgow (xifra total, no desglossada).
- TEMPS PREVIST D'ARRIBADA (en minuts).

#### PROVES COMPLEMENTÀRIES:

- PACIENT HEMODINÀMICAMENT ANORMAL:
  - Anàlítica (pre-configurat PPT 0-1) Proves creuades.
  - Rx tòrax portàtil.
  - Rx pelvis portàtil.
  - Eco-FAST
  - Body-TAC (segons consideració de l'equip de politrauma).
- PACIENT HEMODINÀMICAMENT NORMAL:
  - Anàlítica (pre-configurat segons prioritat). Proves creuades.
  - Body-TAC.
  - Si IOT o traumatisme toràcic: Rx tòrax portàtil.
  - Si inestabilitat pèlvica: Rx pelvis portàtil.

#### CONTROL HEMODINÀMIC:

- 1000-2000 ml de cristal·loides escalfats:
  - Sèrum fisiològic.
  - Plasmalyte®
- Objectiu:
  - TAM > 65 mmHg o TAS > 90 mmHg. En TCE TAM > 80 mmHg.
  - FC < 130 x'
- Si no s'aconsegueix considerar transfusió:
  - Ràtio 2:2:1
  - hematies:plasma:plaquetes)

#### PROFILÀXI ANTIBIÒTICA:

- Fractura oberta o ferida contaminada: Amoxi-clav 2 gr o Clindamicina 600 mg + gentamicina 240 mg o ciprofloxacino 400 mg
- Perforació viscera o trauma penetrant: Amoxi-clav 2 gr o vanco 1 gr + cipro 400 mg o genta 240 mg (+ metro 500 mg si colon o recte).
- Broncoaspiració: Amoxi-clav 1 gr ev o levo 500 mg + clinda 600 mg.

#### FÀRMACS RECOMANATS PER IOT EN ADULT:

- Hipnòtic:
  - Hemodinàmicament normal:
    - Fentanil 3-5 µg/kg + Propofol 2 mg/kg o
    - Fentanil 3-5 µg/kg + Midazolam 0'15-0'2 mg/kg
  - Hemodinàmicament anormal:
    - Fentanil 3 µg/kg + Propofol 1 mg/kg o
    - Fentanil 3 µg/kg + Etomidat 0'3 mg/kg
- Relaxant:
  - Succinilcolina 1-2 mg/kg o
  - Rocuronil 1 mg/kg
    - Indicant en situacions especials com hipercalemià.
    - Té antídot: Sugammadex 4 mg/kg.
- Profilaxi de pneumònia associada a VM:
  - Cefuroxima 1'5 cada 8 hores (3 dosis).
  - Vancomicina 1 gr cada 12 hores (2 dosis).

#### REGISTRE CATSALUT PACIENT TRAUMÀTIC GREU:

- Tots els pacients en prioritat 0 o 1.
- Tots els pacients que ens han activat com a prioritat 0 o 1 i després són 2.
- Tots els pacients que ingressen en una unitat de crítics.
- Tots els pacients PPT que són èxits durant l'assistència a urgències.

**IMMOBILITZACIÓ:** collaret cervical, faixa pèlvica (s/p) i fusta espinal.