

# In what trauma patient subgroups are oppotunities for improvement most frequent?

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##
## Attaching package: 'table1'
## The following objects are masked from 'package:base':
##
##   units, units<-
##
## Attaching package: 'dplyr'
## The following objects are masked from 'package:stats':
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##   filter, lag
## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union
## -- Attaching packages ----- tidyverse 1.3.2 --
## v ggplot2 3.3.6      v purrr  0.3.4
## v tibble  3.1.8      v stringr 1.4.1
## v tidyr   1.2.1      v forcats 0.5.2
## v readr   2.1.2
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
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## Attaching package: 'testthat'
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## The following object is masked from 'package:purrr':
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##   is_null
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##   edition_get, local_edition
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## The following object is masked from 'package:tidyr':
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##      matches
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## Background

Trauma, defined as the clinical entity composed of physical injury and the body's associated response.(1) It is one of the leading causes of mortality and morbidity in the world, representing about 9 % of annual global deaths. Among people under the age of 45 trauma is the most common cause of death. Over the last decade almost 50 million people worldwide have died from trauma.(2).

Not only does trauma represent a large share of the global mortality rate, but studies have also shown a significant difference in outcome depending on where patients are treated. It has for example been shown that trauma patients in Sweden who were treated at a trauma center rather than a non-trauma center have a 41 % lower 30-day adjusted mortality rate. (3)

Some studies indicate that the number of trauma-related deaths that potentially could have been prevented are as high as 20 to over 50 %. (4–6) Preventable deaths varies not only between trauma centers and non-trauma centers. There is a significant difference between high income countries and low and middle income countries (LMICs). It is estimated that 2 million lives could be saved annually if LMICs and high income countries had equal fatality numbers for severe injuries.(7)

## Advanced Trauma Life Support and Primary Trauma Care

Several different systems are being used in Trauma care. Such as Advanced Trauma Life Support (ATLS) and Primary Trauma Care (PTC), where ATLS is the more established system. The purpose of these systems is to secure a time-efficient, standardized and structured way of treating trauma patients.(8,9)

ATLS is practiced in over 80 countries and 1 million doctors have gone thru this training.(8)

PTC is also used in over 80 countries, however more frequently in low and middle-income countries. One reason for this could be that the PTC program is free while ATLS is not.(9)

## New Injury Severity Score

The NISS is an anatomic severity scale developed to assess multiple-injured patients. The NISS score a patient get is based on the Abbreviated Injury Scale (AIS) points from the injured body regions. The higher NISS score the more serious injury the patients suffers from.(10)

NISS takes injuries in 6 different body regions into account. Those are head/neck, face, chest, abdomen, extremities and external. The NISS is the sum of the squares of the highest AIS codes in these regions, meaning that all three injuries can be in the same region or in separate regions. AIS can vary from 1-5, and the NISS from 1-75.(10)

## **Trauma registry**

In Sweden there is a national trauma registry (SweTrau) holding records of trauma cases from 48 out of 49 hospitals who receives major trauma. To meet the inclusion criteria for SweTrau you must be over 15 years of age, been exposed to a traumatic event leading to trauma team activation, or have a NISS over 15 without trauma team activation. Or patients moved to a hospital within 7 days of a traumatic event with NISS over 15. (11)

## **Morbidity and Mortality Conferences**

An important part of trauma care evaluation and improvement is Mortality and Morbidity Conferences (M&M). This is a multidisciplinary conference with representatives from all medical specialties and professions in the trauma team. The purpose of M&M is to learn from the care provided, identify opportunities for improvements, and implement corrective actions.(12) As it is not possible to analyze every trauma case in detail audit filters are often used to decide which cases that are to be reviewed at M&M. Such audit filter can be time frames in which a test should be taken or a specific treatment provided.(13).

## **Opportunity for improvement**

Whether there is opportunity for improvement for a specific case or not is decided during M&M where selected trauma cases are reviewed. Opportunity for improvement (OFI) is defined as when the trauma care for a patient does not match the best practice guidelines in at least one aspect.(14)

OFI can be a more nuanced measure for trauma care improvement than the more established terms preventable deaths and non preventable deaths. This is because there can be OFI in a case where a patient has died, even if the death was not preventable.(15) Furthermore there is no consensus for classification of preventable and non preventable death, leading authors to use different classifications.(16). The term OFI also has the advantage over the term preventable death by sounding more positive and encouraging, preventing review board members from having to classify colleagues patient care as inappropriate.(14)

## **Trauma subgroups**

Since trauma patients is a heterogeneous group, it is important to have a sufficient understanding of OFIs for different trauma subgroups.(17). Some examples of subgroups are men and women, blunt and penetrating trauma, geriatric, major and minor trauma and traumatic brain injury.(18)

In Sweden almost two thirds of trauma patients are men and just over 60% are in the age between 18-64. For example, traumatic injuries from stabbing and from shooting violence are more common in men while women are over represented in fall traumas. There is a lot of existing data about subgroups regarding transportation time to hospital, NISS score at the Emergency department, rehabilitation, morbidity and mortality rate and so on. (18)

## Knowledge gap

Despite having all this data about the trauma patients it is poorly understood whether different subgroups have greater opportunities for improvement (OFI) than others. The most common cause of death after injury is hemorrhage. Among these patients, problem in decision making, technical skills and making decisions between surgery and radiology were some of the areas where OFIs were found.(19) However we do not know whether the same OFI areas apply for the trauma subgroups, or in what frequency.

## Aim

In this study we aim to assess the frequency of opportunity for improvement in the following important clinical subgroups: men and women, blunt and penetrating injuries, minor and major trauma, and across body regions injured.

## Methods

### Study design

This is a registry based cohort study that uses data from two different Swedish trauma registries.

The first registry is the Trauma registry at the Karolinska University Hospital in Solna, which includes about 21000 patients between the years 2012 and 2021.

The second registry is the the trauma Quality Database which is a subset of the trauma registry and includes about 2200 patients selected for review between 2014 and 2021. The trauma care quality database includes details and conclusions from the M&M.

By linking these databases together the opportunity for improvement in the trauma subgroups mentioned in the introduction will be assessed.

### Setting

The Karolinska University Hospital in Solna, Stockholm, is the leading trauma center in Sweden, and ranked as one of the best hospitals in the world. The hospital is also a level 1 trauma center.(20) The Trauma department at the Karolinska University Hospital in Solna handles about 1800 trauma cases every year, out of which about 200 are children. KUH is the primary trauma center for a population of 2,8 million people.(21)

Trauma patients are divided into priority one and two by the paramedics using certain criteria, such as trauma mechanism, GCS points and blood pressure. To Karolinska Solna only those who are classified as a priority one by the pre hospital professionals are admitted. (22)

A trauma priority one is considered directly life threatening. Therefore when arriving to Karolinska Solna every patient is taken care of by a full trauma team. This team consists of a trauma leader who is a general surgeon or a resident in general surgery and an anesthetist with a nurse specialized in anesthesiology. The team also has an orthopedic surgeon, radiologist, radiology nurse, emergency medicine nurse, surgical nurse and assistant nurses.(22)

At KUH all trauma patients are included in the KUH trauma registry. The KUH trauma registry is a part of the Swedish Trauma Registry, with the same eligibility criteria. Audit filters then identify certain trauma cases in which the care might have deviated from the golden standard treatment

based on different criteria. Such criteria are GCS 8 or less but the patient was not intubated, time to CT longer than 20 minutes, time to Surgery and so on. Then a manual selection is done by a nurse, during which some cases are removed from the group of potential OFI cases because obvious reasons for the deviation can be found. The patients who are then left are discussed at a M&M where doctors and nurses from several specialties participate. At this conference every case is reviewed. When OFI is found in a case, that specific OFI is described in the trauma quality database. Then it is recoded as “Yes, at least one OFI identified” or “No, no OFIs identified”

## **Participants**

All patients from KUH trauma registry and from the Trauma Quality Database. To be eligible for the study all patients had to meet the inclusion criteria. The criteria were as following: Patients over 15 year old. No missing information in crucial columns in the registries. If information was missing for age, gender, trauma mechanism, NISS, or AIS code the patient was excluded.

## **Variables and data sources/measurements**

The data from the trauma registries were analyzed for OFI in separate cohorts. The cohorts were: men and women, blunt and penetrating injuries, minor and major trauma, and across body regions injured. The location of injuries will be analyzed based on AIS codes and AIS scores will be used to group patients into fitting cohorts. OFI was treated as a binary variable, with “yes” and “no” as the only possible outcome. For the M&M conference to put a “yes” in the OFI section at least one of the following areas needed to differ from the best practice guidelines for trauma care: emergency department triage; tertiary survey; processing; communication; time to computed tomography; time to surgical intervention; level of physician and nursing competency; level of care; neurosurgical intervention; hospital staff routine; resource management; logistics and technology; overall management and documentation.

## **Bias**

To prevent research bias all data will be scrambled while used to write the analysis model.

## **Study size**

### **Quantitative variables**

### **Statistical methods**

Rstudio. Bootstrapping.

Results

## **Participants**

All patients from KUH trauma registry and from the Trauma Quality Database. To be eligible for the study all patients had to meet the inclusion criteria. The criteria were as following: Patients over 15 year old. No missing information in crucial columns in the registries. If information was missing for age, gender, OFI, trauma mechanism, NISS, or AIS code the patient was excluded.

After merging the Karolinska trauma registry and the Trauma quality data base there was x patients. After applying the inclusion criteria the number of patients was reduced to xxxx.

## Descriptive data

You can also mix text and code, so called inline code, like this: 7.->

Discussion

Conclusion

## Ethical considerations

People who are included in the registers we use have not given their consent. However measures have been taken to prevent personal information to leaked about the patients. For example all data was scrambled for as long as possible, and to get access to the unscrambled data a VPN had to be used.

This is a study based on data from severely injured and deceased people. But since trauma patients were the patient group that needed to be studied, no other patient group would have been sufficient.

As this is a registry based study no interventions were made that could effect the patients.

Possible benefits from these type of studies are the possibility that the result can improve the trauma care and by that decrease morbidity and hopefully save lives. Therefore the possible benefits exceeds the risks.

Ethical permission has been granted for this project. Dnr number for this permission is 2021-02541 and 2021-0253.

## En skriftlig redogörelse av projektets utveckling

All data är redan insamlad från start och finns tillgängliga i de register som beskrivs i projektredogörelsen. Datan kommer delas in efter olika trauma-subgrupper. De variabler som kommer användas är "Ja" där det finns "Opportunity for improvement" samt "nej" där det inte finns "opportunity for improvement."

Hittills har jag - Läst in mig på ämnet - Skrivit Introduktion - Påbörjat materiella och metod - Börjat sätta mig in i R som är det program som kommer användas för att sammanställa data. - Genomfört en online-utbildning inom R. - Laddat ner all data till Rstudio - Börjat programmera filter som tar ut den data som jag kommer behöva använda.

Datan kommer presenteras i en tabell med de aktuella subgrupperna. Där kommer det beräknas i vilken uträkning det finns OFI hos varje individuell subgrupp. Det kommer även redovisas hur skillnaderna mellan de olika subgrupperna ser ut.

Ingen reservplan behövs enligt handledare då all data finns insamlad. Handledaren har haft studenter som gjort liknande projekt tidigare och han bedömer risken för att projektet inte går att genomföra som planerat som minimal.

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