

# Association between trauma severity models and opportunities for improvement: A retrospective cohort study

Victoria Witthoff

## Abbreviations

- KUH - Karolinska University Hospital
- OFI - Opportunities for improvement
- TSM - Trauma severity models

## Introduction

Severe trauma is one of the leading causes of death worldwide, constituting nearly 8% of global deaths annually (1). The global health burden of physical injury has led to trauma being described as a worldwide pandemic. One of the characteristics of this particular pandemic is its demographic spread; trauma is the leading cause of death for people aged 5-29 years and 90% of trauma-related deaths occur in low- to middle-income countries (1). Nonfatal outcomes, such as permanent disability, also comprise a significant health burden and can drastically reduce quality of life and lifespan in survivors of severe trauma. Reduction of trauma morbidity and mortality is therefore both an imperative, considering the great number of people affected, and also a complex, multi-factorial challenge encompassing a broad range of organisations across continents.

Increasing the quality of trauma care necessitates consideration of several key characteristics of trauma. One of these is that trauma is a highly heterogeneous entity due to the variety in its underlying causes, which affect both the type and severity of the injury. Vehicle collisions are the primary cause of mortality due to physical injury worldwide (1), but the list of potential causes of severe physical injury is lengthy, including everything from workplace accidents to physical violence. This heterogeneity makes it poses challenges in comparing trauma outcomes and has spurred the development of multiple trauma severity models (TSM) that aim to overcome this difficulty. These models

One attempt to solve the problem of the heterogeneity of trauma is the development of multiple trauma severity models (TSM). These models differ in their methodology but all have the aim of establishing a standardised system to compare trauma outcomes and thus aid in quality assurance and benchmarking.

One characteristic of trauma care is that management and treatment of severe trauma is dependent on a broad chain of actors that span multiple professions, medical specialties, and sometimes multiple clinics. For example, the management of a single trauma case could involve personnel from EMS, the ER, anaesthesia, radiology, and surgery. Improvement of trauma care therefore requires a multidisciplinary approach that examines all steps in the chain of treatment and identifies weak links. One method of doing this is by holding multidisciplinary morbidity and mortality reviews of selected cases in order to identify opportunities for improvement (OFI).

## Quality assurance and benchmarking

### Trauma severity models

### Morbidity & mortality reviews

## Aims

This study aims to evaluate how trauma severity models are associated with and to what extent they can predict opportunities for improvement.

## Methods

### Study design

This is a single-centre retrospective cohort study, using data from two registries at Karolinska University Hospital (KUH): the trauma registry database and the trauma care quality registry. The trauma care quality registry is a subset of the trauma registry and contains data on trauma patients who were selected for morbidity and mortality (M&M) reviews. These two databases will be linked and then analysis will be performed to estimate the association between the common trauma severity models (TSM) TRISS, NORMIT, and RISCII, and opportunities for improvement (OFI) using logistic regression. The predictive performance of these models will be evaluated using measures of discrimination and calibration.

### Setting

KUH is located in Stockholm, Sweden. KUH's trauma centre is equivalent to a level 1 trauma centre according to American College of Surgeons standards (2). KUH is the primary trauma centre for the region of Stockholm. In addition, KUH has agreements with several other regions to provide trauma care for patients with severe trauma. KUH is thereby the major trauma centre for a population of almost 3 million people (2).

The trauma registry at KUH contains data on 21,000 patients collected between 2012 and 2021. This registry is also submitted to SweTrau, Sweden's national trauma registry database, and therefore meets SweTrau guidelines. The registered data includes prehospital vital signs and management, vital signs and management on arrival at hospital, information about the type of injury, and the primary method of treatment. It also includes tracks follow-up. Follow-up variables include, but are not limited to, survival at 30 days, days in ventilator, GCS at discharge, highest level of care, and transfers to other units.

The trauma care quality register is an internal hospital register and registers the outcome of M&M conferences. M&M conferences are multidisciplinary and their purpose is to review selected patient cases and determine whether an opportunity for improvement existed in each individual case. Examples of opportunities for improvement could be insufficient resources or errors in patient management.

### Participants

Participants include all patients registered in both the trauma registry and the trauma care quality registry at KUH. The trauma registry includes all patients for whom the trauma team was activated after receiving a potentially traumatic injury, regardless of NISS score, and all patients with a NISS score >15, regardless of whether the trauma team was activated. Also included are patients who were transferred to the hospital within 7 days of injury and have a NISS score >15. Patients where the only traumatic injury is a chronic subdural hematoma and patients for whom the trauma team was activated without an underlying traumatic injury are excluded from the register. Since the outcome variable of this study is OF

The trauma care quality registry contains patients from the trauma registry that were selected for M&M review. At KUH, all fatalities are automatically selected for M&M review. In addition to this, the electronic medical records of all trauma patients are evaluated by research nursing staff to identify cases that potentially received sub-optimal care. Cases that two research nurses have evaluated and found to have potential for sub-optimal care are also selected for M&M review.

## **Variables**

The studied outcome is the binary variable “opportunities for improvement” (OFI), as identified by the multidisciplinary review board after a mortality and morbidity review. OFI is coded as either “Yes - at least one opportunity for improvement” or “No - no opportunities for improvement.” The primary exposures of interest are trauma severity scores according to the TRISS, NORMIT, and RISCII models.

## **Bias**

The method and data analysis model will be written using simulated data to reduce the risk of research bias. Real-world data will only be used once the data analysis model is completed and found to work correctly on simulated data.

## **Study size**

Since all eligible participants must exist in both the trauma and the trauma care quality register, and the trauma care quality registry is a subset of the trauma registry, the number of participants is limited to the number of cases registered in the trauma care quality database. The trauma care quality database includes around 2200 patients who were selected for review between 2014 and 2021.

## **Quantitative variables**

### **Statistical methods**

R, a programming language for statistical computing, will be used for compilation and analysis of data. Variables will be handled according to the SweTrau manual.

## **Ethical considerations**

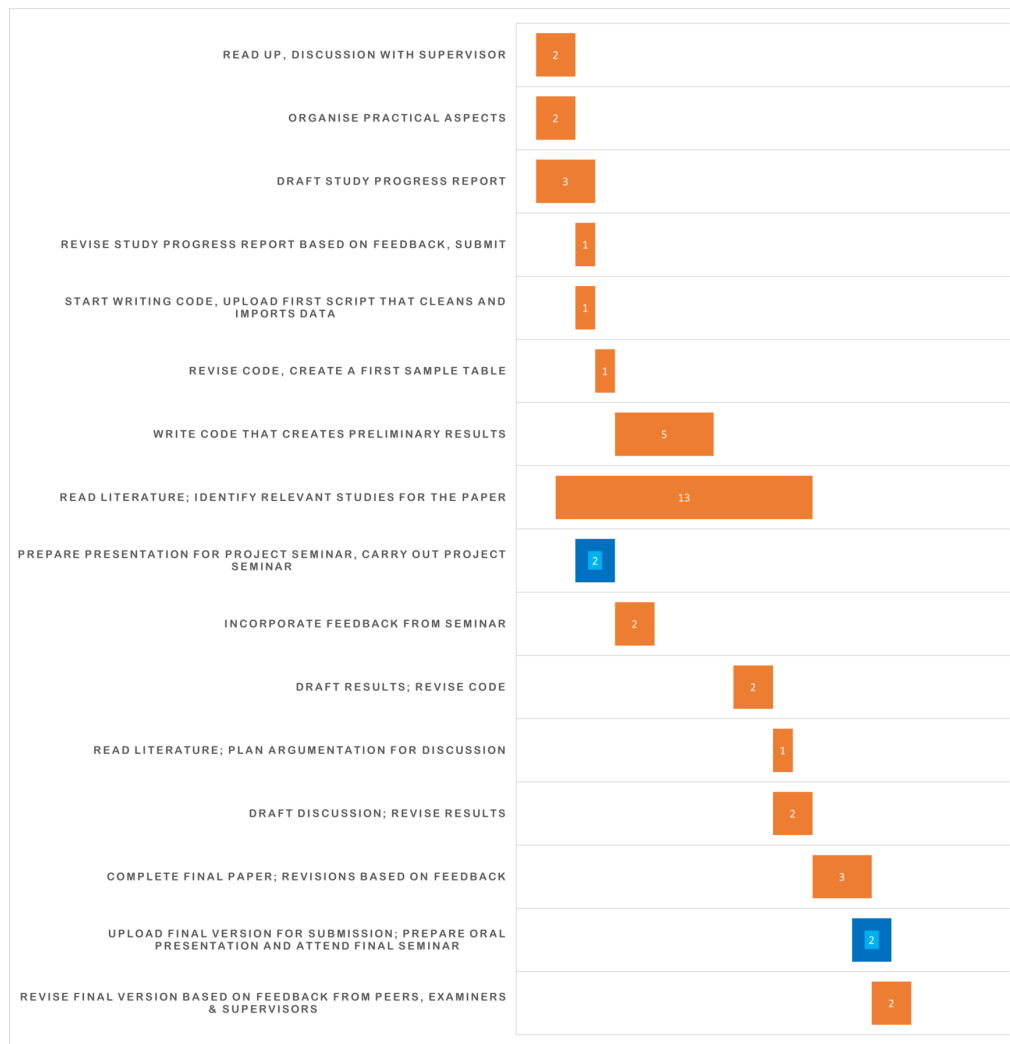
**Stockholm Research Ethics Review Board approval number 2021-02541 and 2021-03531.**

Potential things to mention here:

- The study doesn’t affect treatment of patients in any way
- The data is stored in a secure database (I assume)
- I don’t have access to patient journals; only the info in the register

## **Development and time plan**

All data required for this project were collected and available prior to the project beginning. Therefore, the data only need to be analysed.



## Reserve plan

Since all of the data has already been collected at the commencement of this project, there is no need for an elaborate back up plan. However, some details of the project may be subject to change during the analysis (?)

## References

1. WHO. Injuries and violence. [https://www.who.int/news-room/fact-sheets/detail/injuries-and-violence#:~:text=Of%20the%204.4%20million%20injury,1.25%20million%20people%20every%20year.](https://www.who.int/news-room/fact-sheets/detail/injuries-and-violence#:~:text=Of%20the%204.4%20million%20injury,1.25%20million%20people%20every%20year.;); 2021.
2. Melbin H. Karolinska university hospital becomes sweden's first trauma centre. <https://www.karolinska.se/en/karolinska-university-hospital/news/2020/12/karolinska-university-hospital-becomes-swedens-first-trauma-centre;> 2020.