Trauma epidemiology research has guided the development of trauma systems and helped to inform policy makers, pre-hospital personnel, resource allocation and trauma center staffing.

Here we describe, in greater detail, patterns within the temporal distribution of trauma, and we develop an Artificial Neural Network (ANN) to predict trauma volume, severity, and the resources required to treat these trauma patients.

INTRODUCTION

Trauma Epidemiology

Overview

• All adults from TRACS: 7/2013-6/2016

Trauma Epidemiology

• 10,695 of 10,740 patients had sufficient data

• All adults from TRACS: 7/2013-6/2016

• Mean daily admissions was plotted by day of the week; red=greater frequency, blue=fewer.

• The ANN was constructed that takes four input variables, see fig. It predicts the number of daily traumas, penetrating traumas and operative cases, as well as the mean daily ISS.

METHODS

The Temporal Distribution of Trauma: informing a prediction model using artificial intelligence

1Vanderbilt University School of Medicine, Nashville TN, USA, 2Department of Surgery, Division of Trauma and Surgical Critical Care Vanderbilt University Medical Center, TN, USA

David P. Stonko, MS1; Bradley M. Dennis, MD, FACS2; Richard D. Betzold, MD, MS1; Oscar D. Guillamondegui, MD, MPH, FACS2

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Temporal Epidemiology:

The Temporal Distribution of Trauma

Relative frequency of trauma by time of day and day of week; red=greater frequency, blue=fewer.

Daily trauma distribution by ED disposition. OR cases present later than ICU and Step-Down patients, which present later than floor patients.

Predicting Trauma:

We developed an artificial neural network that can predict trauma parameters for any given day with good accuracy (r = 0.902 for training, 0.890 for validation).

Here we show the actual (black X) number of traumas (10) and the average ISS score (13.12) of all of the traumas from June 30, 2016, with the predicted (green X) number (9.93) and predicted mean ISS (15.99) from the same day.

CONCLUSION

• We present new graphical and numeric analysis showing greater detail of the trauma distribution.

• There are unique patterns among high, medium and low resource trauma, which together make up the overall patient flow: patients leaving the ED for immediate operation arrive later than patients who arrive and go to the ICU and Step-Down units, which arrive later than those that arrive and go directly to the floor. These patient populations should be thought of as distinct, from a resource allocation perspective.

• We have developed a novel, accurate machine-learning algorithm for predicting the timing and severity of trauma at the daily level.

REFERENCES


