

Background

The mathematics predictions of different occurrences are no longer science fiction. Complex mathematical models are used to help to anticipate and optimize different industries. Designing mathematical models which describe the past, we are able to anticipate the future. Our aim is to use this into pre-hospital field.

Today staffing and capacitating method for SMURD Romanian EMS is rather static. Our goal is to use a multidisciplinary approach to improve this process by finding a pattern and predict the needs.

Patterns can be identified everywhere. We came upon a predictable pattern to demonstrate this in pre-hospital to understand when o this extra staff and ambulances are needed.

The objective of this study is to prove a mathematical model based on historical contextual factors and apply this for forecasting. Prediction models may provide an efficient way of ambulance distribution, based on historical needs.

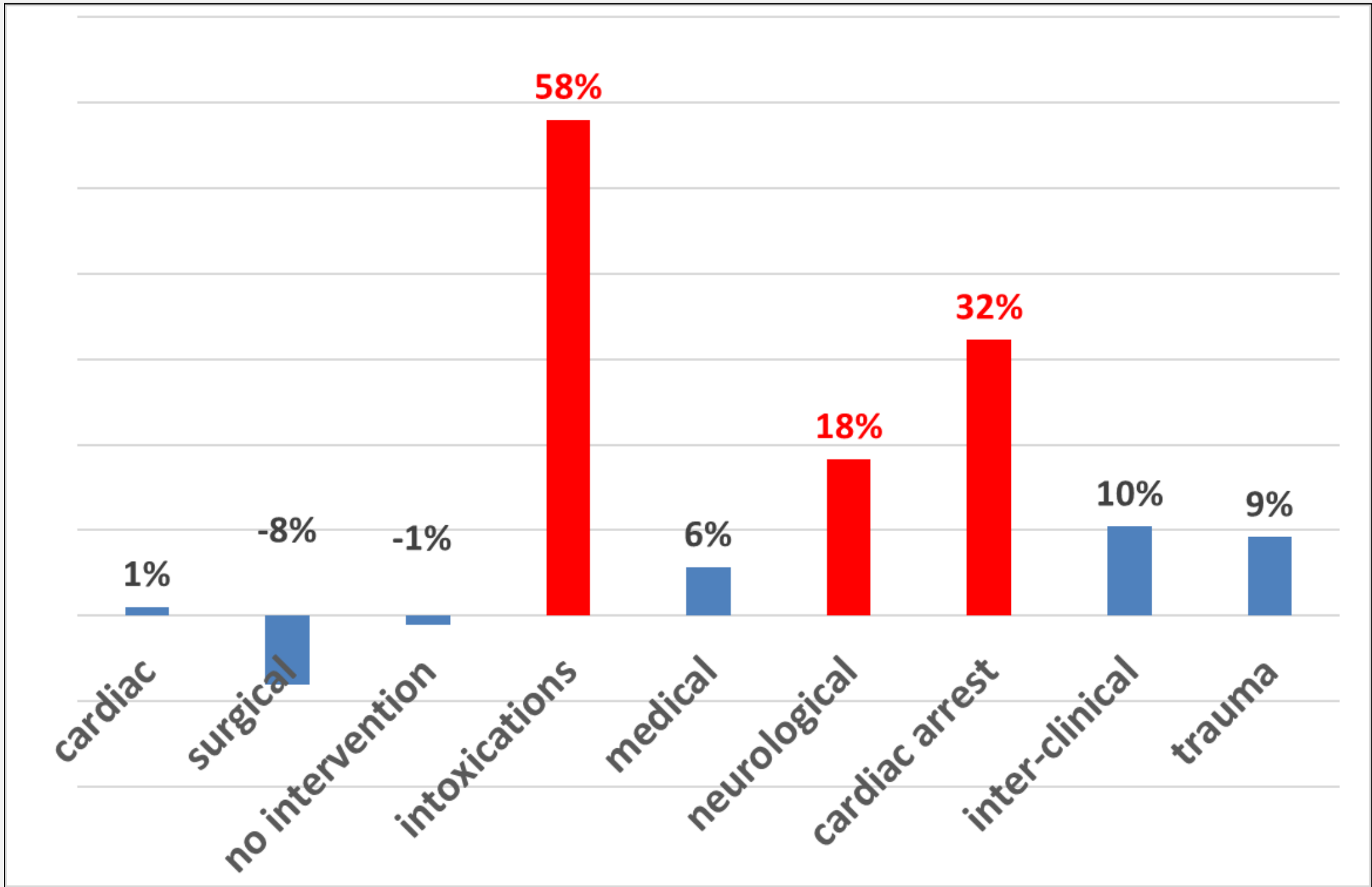
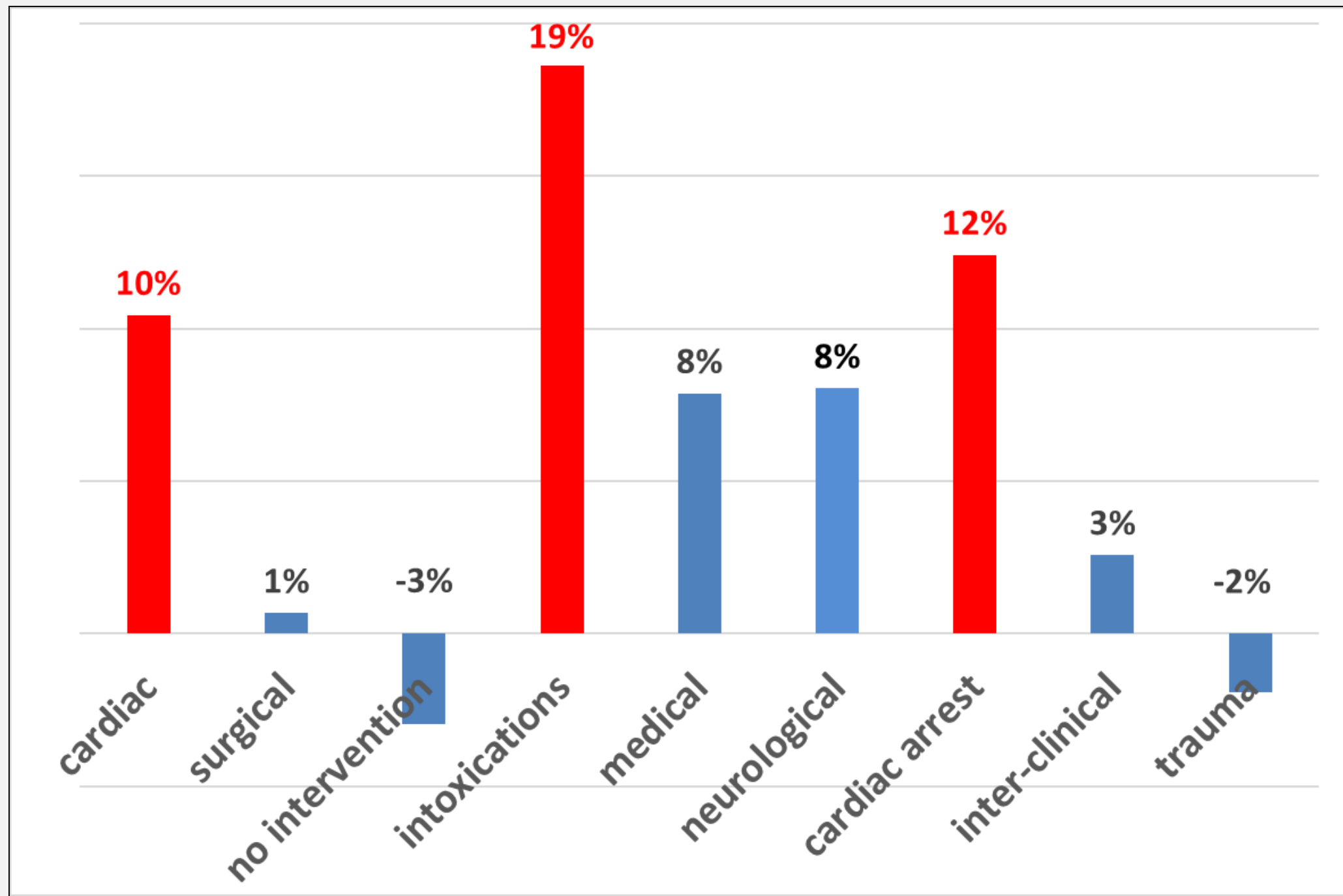
Methods

The study investigates the number, type and gravity of emergencies, correlating them with days of the week and types of cases. Data source is **SMURD Sibiu county** database on a period of **8 years (2010 - 2017)** numbering over **75000** cases. The number emergencies addressed by EMS is calculated for different pathologies, time intervals and type of ambulances.

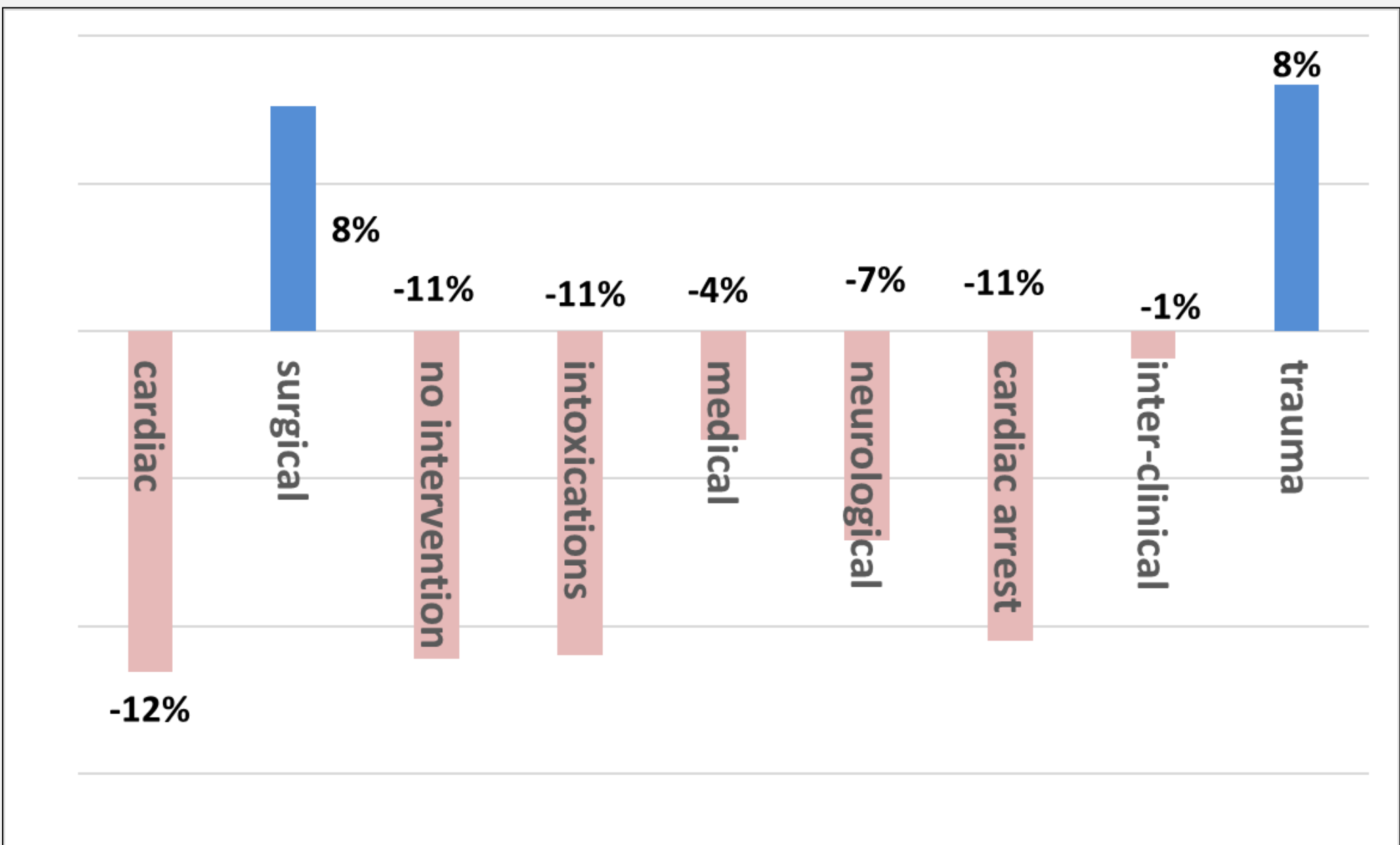
An auto-regressive integrated moving average (ARIMA) mathematical model is chosen as this model works with time series data in order to predict future points in the series (forecasting).

Results

National holidays generate an increase of the number of all types of emergencies. Medical cases involving toxic increase by 58% (we speculate to be ethanol consumption), cardiac arrest by more than 30%, trauma cases also multiply by 9%, involving aggression and road accidents. Neurological cases multiply as well..



The pattern is during religious fasting. Toxics cases increase by 19% followed by cardiac arrest with 12% and cardiovascular afflictions with **10%**. Trauma cases are lower during these periods.



Amazing results are characterized by periods with school holidays when most incidents of all types significantly decrease. Trauma and surgical cases increase during school holidays.

Conclusions

This mathematical model is able to predict the pre-hospital emergency calls. We are able to forecast a rise of medical incidents based on contextual and social events.

The old planning techniques, which assume that the demand of ambulances is known upfront, are proven not reliable in certain circumstances because there is a need of a dynamical and contextual tuning.

Emergency call patterns tend to be highly busy and time and location dependent. A scientific approach bring the experience and competence of other fields to emergency medicine to simply save lives.

