Prehospital resource optimization

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Summary
Prehospital resource optimization combines Big Data, AI and prehospital expertise. Demographic, structural and technical changes demand that the prehospital care is flexible. The project is driven by questions stated by the prehospital care in Northern Sweden. We have developed a simulation tool which enables us to compere different resource allocations under different future scenarios. The project is financed by Vinnova (UDI) and participating parties.

Background
An aging population, urbanization and medical progress demands that the emergency medical service is customizable so that resources can be used sustainably, efficiently and equitably. This includes an equal care regardless of age, sex and geography.

Our planning tool should address several problems, for example:
- How to place and schedule ambulances?
- How to organize the future prehospital care?
- How to dispatch the ambulances?

The prehospital care in Sweden has about 660 ambulances, respond to about 1.2 million emergency calls per year, and costs more than 4 billion SEK per year. The planning tool creates settings for a systematic quality management, which in the long run can cause large efficiency gains.

Aim
The aim of the project is to develop a broad solution that enables the prehospital care to be organized in an optimal way. The solution makes it easy to highlight the implications for specific patient groups, which is central from a democracy and gender perspective.

Method
The solution combines advanced statistics modelling with large scale data driven simulations and consists of two parts:

I. Statistical modeling and dynamic simulation of alarms, including dispatching alarms and simulating driving times. The modeling is based on unique historical alarm data, detailed description of the resources and high-resolution street maps.

II. Statistical modeling and simulation of alarms. The work includes identification of risk factors, spatiotemperal modeling and simulation of future alarms via demographic prognoses. In addition to alarm data we also include demographic data from SCB and mobile data from Telia.

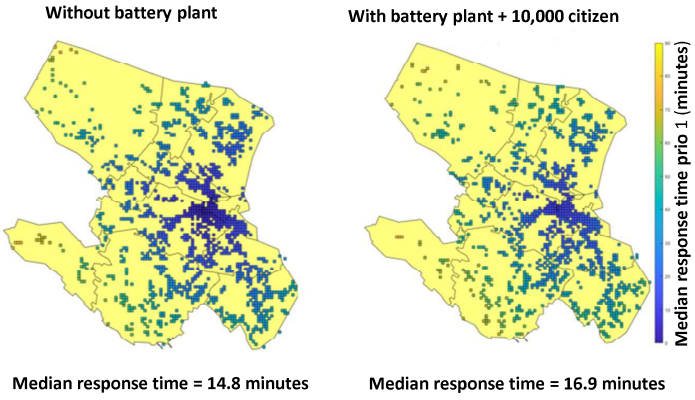

Figure 1: Preliminary simulation results for Skellefteå County 2020.
Northvolt is building a battery plant in Skellefteå, which is expected to lead to a population increase of 10,000 citizen.
We have simulated alarm data for scenarios with and without a battery plant.
For each scenario, we have simulated the prehospital care and calculated median response times locally (*response time= time from alarm until ambulance on site)* and for the whole region. In 2018 the median response time in Skellefteå County was 14,5 minutes.

Results
The planning tool offers a unique solution for the prehospital care that can be used to optimize the resources based on the situation today or for different future scenarios. In addition, the toll enables transparent and fact based decisions. The results will be used on:

I. Strategical level by regional management and politicians for long term planning, for example placement of new resources to meet new alarm scenarios driven by demographical changes.
II. Operative level to organize the ambulances at sudden changes, for example steer ambulance vehicles to the correct placements at temporary load peaks.

We have conducted preliminary simulation study where we have studied how the prehospital care in Skellefteå County will be affected by the building of a new battery plant (Figure 1). The simulation algorithms will gradually be refined and evaluated by comparing historical outcomes with simulated outcomes.

For more information go to www.prehospitalresursoptimering.se