Computers supporting experts: A system to assist in logistical decision making

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Abstract

We have developed a computer-based decision support system (CBDSS) which uses machine learning tools to provide time estimates for SA Ambulance Service (SAAS) retrieval of high-level care patients. SAAS is the primary provider of pre- and inter-hospital transport of patients within the state of South Australia.

Where the patient's condition warrants high level care, MedSTAR, SAAS's retrieval arm, is tasked to undertake that transfer.

MedSTAR has multiple modes of transport available with a fleet of road vehicles, fixed- and rotary- wing aircraft to choose from.

The characteristics of each mode of transport and the location of the patient sometimes require judgment decisions to be made with respect to how to send the team. Another consideration is when to send the team – sometimes delaying a team who is near to shift completion will not significantly affect patient outcome. In this case, an estimate of total on-task time will allow the logistician to consider whether there will be shift overrun and the result impact to the roster for subsequent shifts.

The CBDSS we have developed provides decision making support to the experts within MedSTAR. Coordination staff can enter a small number of details known about the patient into a web-based form. The system will then provide a predicted length of time at the retrieval location and total case time. If required, the model can also provide a total case time estimate across a range of transport options for that case.

These estimates can then be used to provide further guidance to the clinicians making these logistical decisions. This poster will outline the process of building the support tool and the benefit it provides to coordination staff.

Introduction

- MedSTAR, the retrieval arm of SA Ambulance Service, is primary retrieval service covering the majority of the population of South Australia.
- Experts decide transport type based on patient location, destination and available aircraft
- An estimation of total case time would assist the logistician when making this decision
- We have developed a web-based case time estimation tool to support the logistician making these decisions

Example Case

An example case:

An 80yo Male, CVA patient, intubated and ventilated in the Riverland General Hospital.

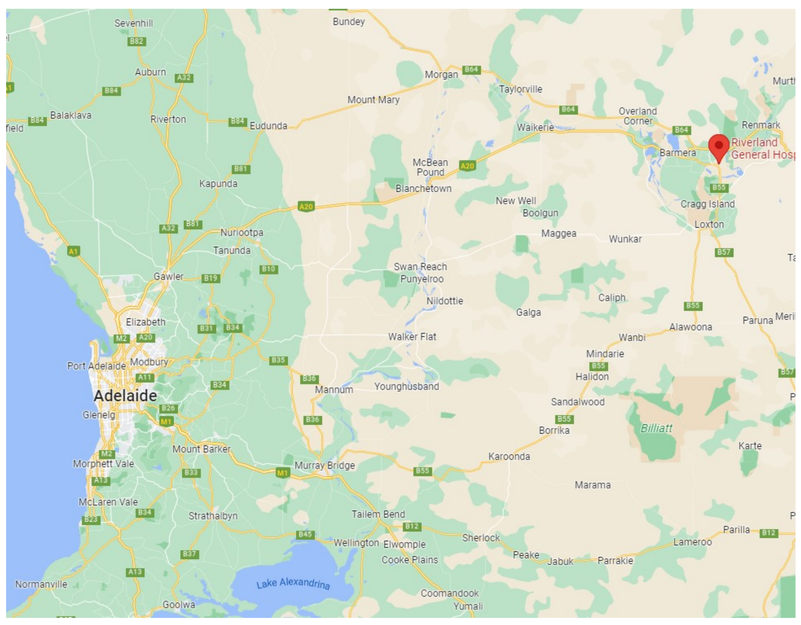

Figure 1: Location of our example patient.

Available transport options are:

- Helicopter. Flight time 1hr, helipads at both source and destination hospitals
- Fixed Wing, Flight time 40mins, requires road legs at both source and destination hospitals

Results

Our model provides a scene time estimation based on the significant predictors input on the web page. The scene time estimate is graphed with the closest 100 actual scene times also plotted on the graph for comparison. Figure 2 shows the scene time estimation (red dashed line) for the example case above, for this example we have also included the actual average scene time (blue dashed line) on the graph.

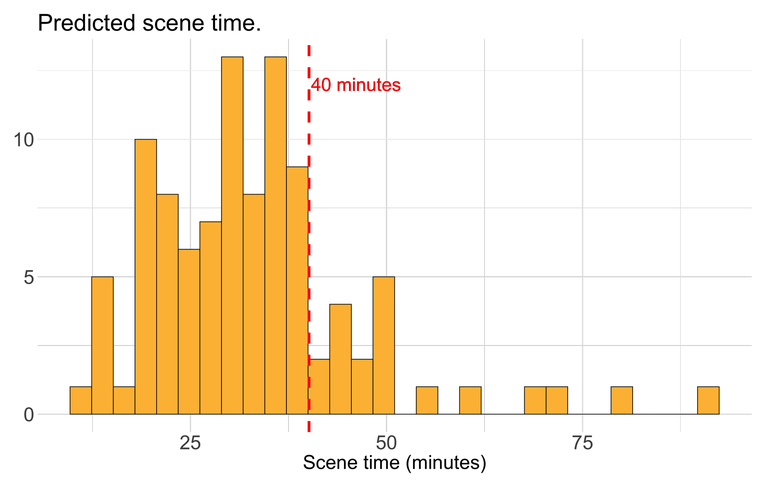

Figure 2: Scene time prediction (red) for the example task at the Riverland General Hospital. The 100 closest matched cases from the database are displayed in orange behind the prediction.

The scene time estimate is combined with a second model to estimate total case time. Logisticians can request scene time estimations for multiple, appropriate transport options and use these estimations as part of their decision making.

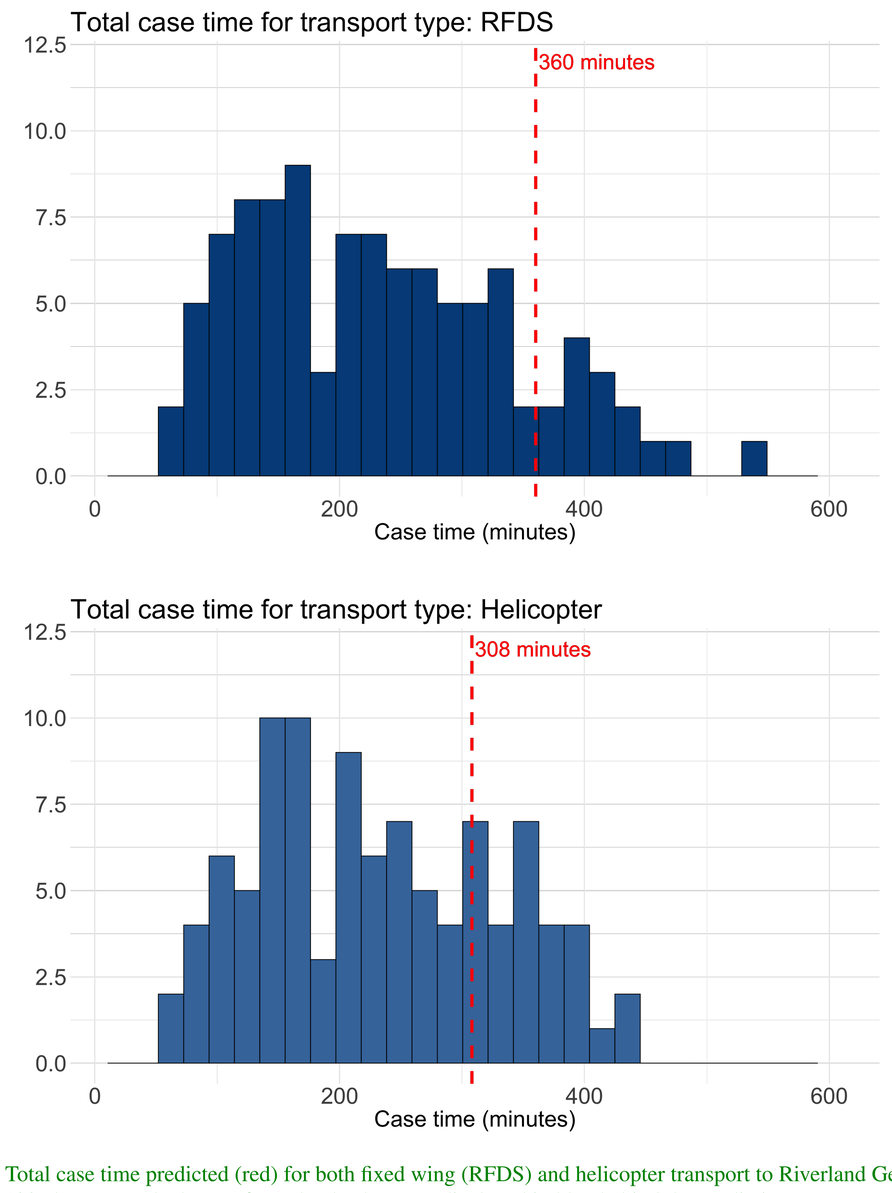

Figure 3: Total case time predicted (red) for both fixed wing (RFDS) and helicopter transport to Riverland General Hospital. The 100 closest matched cases from the database are displayed in blue behind the prediction.

Although fixed wing flights are faster, the location of the airport at both ends of the journey require significant road legs. These legs increase the total case time beyond the time saved by using the faster air platform. Although this might make helicopter transport more attractive, other factors might dictate the use of the plane: they have pressurised cabins, ability to fly above weather etc.

Conclusions

- It is possible to estimate scene and total case time using two-stage models.
- The models provide an estimate which can be used to support experts in decision making around which resource to send on a retrieval.
- An easy to use web interface allows the logistician to gain some insight when comparing transport modes.

Forthcoming Research

Further work with the coordination staff is being undertaken to integrate this model into the coordination work flow.

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