Improving the Planning for Surgery in t Simulation

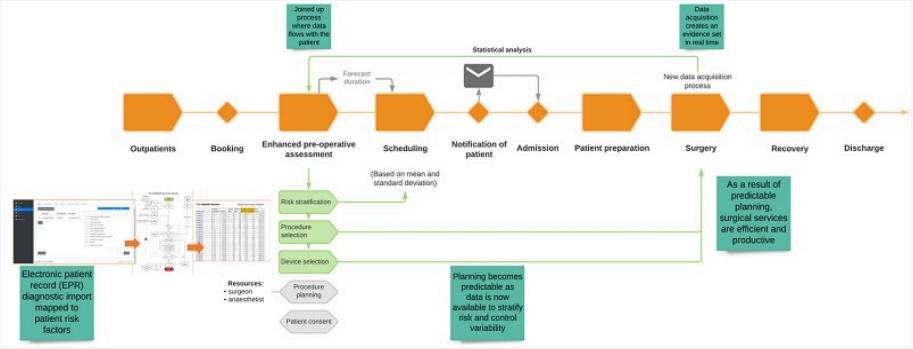
Healthcare

Problem

Using simulation to improve operating room efficiency is not a new concept. This idea has existed for many decades. Recently, discrete-event simulation has been applied to this, but it was not able to reflect real life appropriately. Many assumptions, often with a lack of data, have to be made in surgery and an attempt to reflect the real world was made in a simulation

customer could experiment with all parameters that impact the situation and environment which they are operating in. They could then set those variables as constraints in the system. They could then experiment with those constraints and set the parameters the real world should implement.

In this study the focus was on planning for surgery, and all the factors which impact what happens in the operating room. This is where simulation could be used to experiment with the different variables involved.



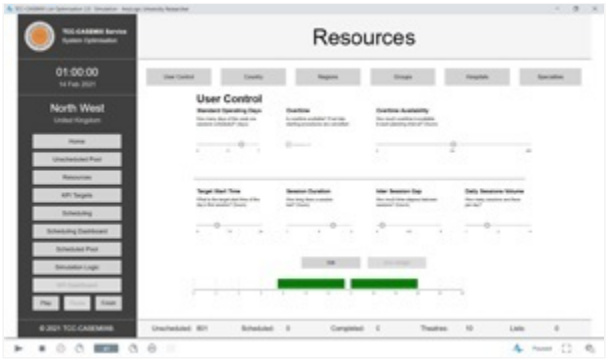
The elective surgery planning process conceived by TCC-CASEMIX (click to enlarge)

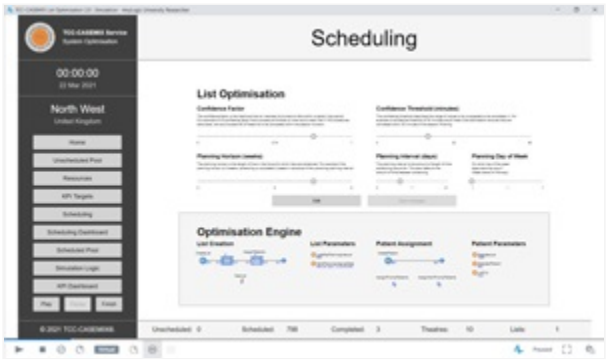
TCC-CASEMIX was able to measure the impact of the inputs to the process, which are the patients and the various aspects of surgery. This included analyzing the dangers involved in order to assign risk levels to the patients relative to each surgery. These two joined together had never been done before, but by using a machine learning algorithm they could create these risk groups.

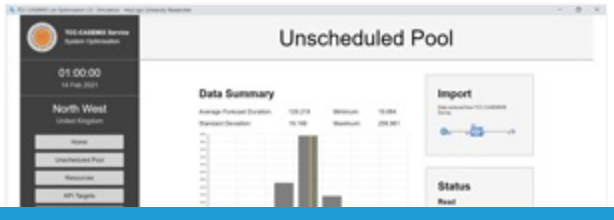
TCC-CASEMIX, the consultants who built the model, and the surgical services teams who are the customers, had different needs and requirements.

Part of the simulation involved using TCC-CASEMIX's custom list optimization engine, compiled in Java and imported directly into AnyLogic. Thanks to this, the developers had complete control over complex behavior in the simulation and, in addition, could change the logic and test alternative optimization engines.

The customers needed the simulation to be operational with an intuitive user interface. Also, the ability to control and examine the simulation outputs without an expert to aid them was very important. Additionally, they wanted to be able to use AnyLogic Cloud to run the simulation directly in their web browser.







Two demonstrations illustrated the power of this tool.

In the first one, the developers needed to evaluate the impact of productivity on planned absences over the summer in an acute care trust. The developers assessed how many additional surgeries could have been performed in a 4-week period if resources were used to full capacity.

In the baseline, where only 5 surgeons were available for two 5-hour lists per day, with a patient target list capped, 82 surgeries were completed. To test the full capacity, there was an uncapped patient target list and three 4-hour lists, which led to 204 completed surgeries. In the simulation, each operating room was used more productively with all surgeons available.

In the second demonstration, developers needed to understand how to best deal with a short-term surgery cancelation. Using TCC-CASEMIX's optimization logic developed in AnyLogic, the optimal patient to replace the canceled one was found using the database output at a lower level. The excel file was given to the surgery clients to use and after running the simulation, it was discovered that 3 patients could be fitted in for surgery instead of the one who canceled. This included two additional short procedures eliminating wasted time.

As a result of using this model, surgical service managers feel empowered to make better decisions which are reflected in their KPIs and the level of predictability that can be acquired. They also feel more confident in the services that simulation can deliver, which can be passed on to others, such as clinicians, patients, and society.

The case study was presented by Dr. Matthew Bacon

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