Vaccination Centre JaamSim Model
Instructions

Produced: 28th January 2021
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This excel spreadsheet processes the results generated by the vaccine centre discrete event simulation (DES) model.
If you are a github user and you would like to suggest changes or adapt the model we have set up a repository here:
https://github.com/The-Strategy-Unit/Vaccination-Centre-DES

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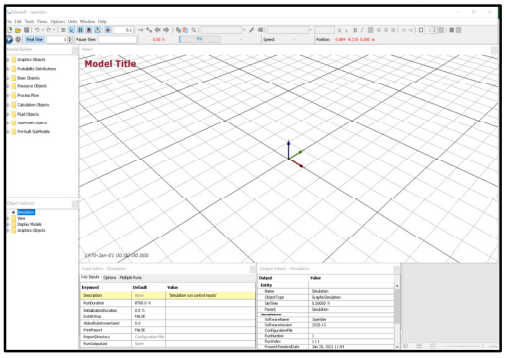
1. Install JaamSim

JaamSim is an open source discrete event simulation software that does not require a license. To run the model you will need to install JaamSim following the instructions in the manual (see link below). Please ensure that you have an appropriate version of Java and your graphics drivers are up to date, (if you have problems please also try the 32 bit JaamSim even if you have a 64 bit machine as this has resolved issues for some people). Once installed when you open JaamSim you should see this default screen: --->



>>>Click this link to download the JaamSim Manual page 6 has the installation instructions
>>>Click this link to choose the appropriate version of the JaamSim program to download

Further info:
JaamSim website: https://jaamsim.com/
JaamSim github: https://github.com/jaamsim

2. JaamSim setting up and running the model

Once JaamSim is installed, you can open the model configuration file "SU VacCentre DES 2021-02-03.cfg" using the menu in the control panel at the top choose “File" then "Open”.

There are 4 views available:

1_Parameters - shows the 'Input Model Parameters' table, where you can change the parameters of the model

2_Model - shows the process flow of the model, when running you can observe where bottlenecks appear

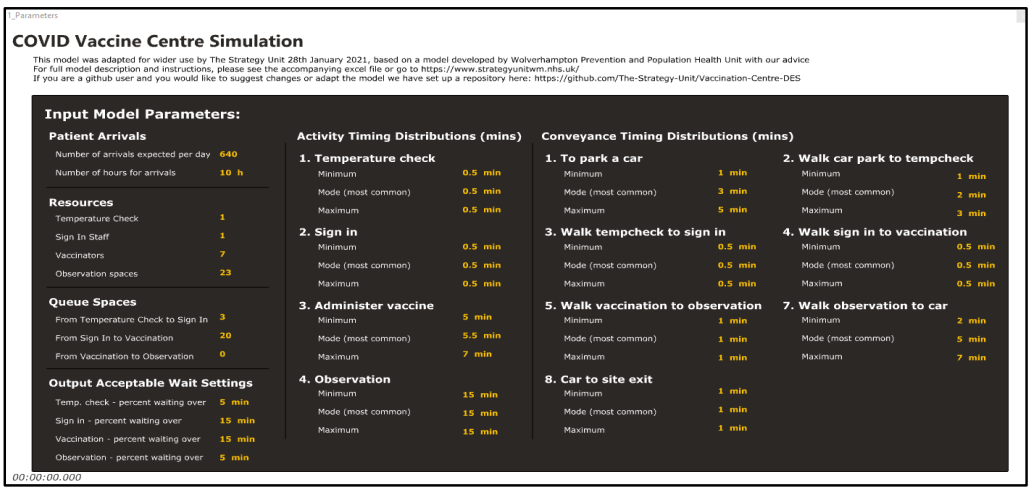
3_Adjustable - allows you to pan around and zoom in on aspects of the whole model.

4_Components - where additional components needed for the model to run are kept, e.g. distributions. Unless you are adapting the model you won't need to change anything here.

You can move between views using ‘Views’ Menu on the Control Panel at the top of your screen.

2.1 Changing the model parameters

The parameters view in the model focuses on the inputs you can customise in the 'Input Model Parameters' table. By double left clicking on the orange text you can type your own settings into the model.



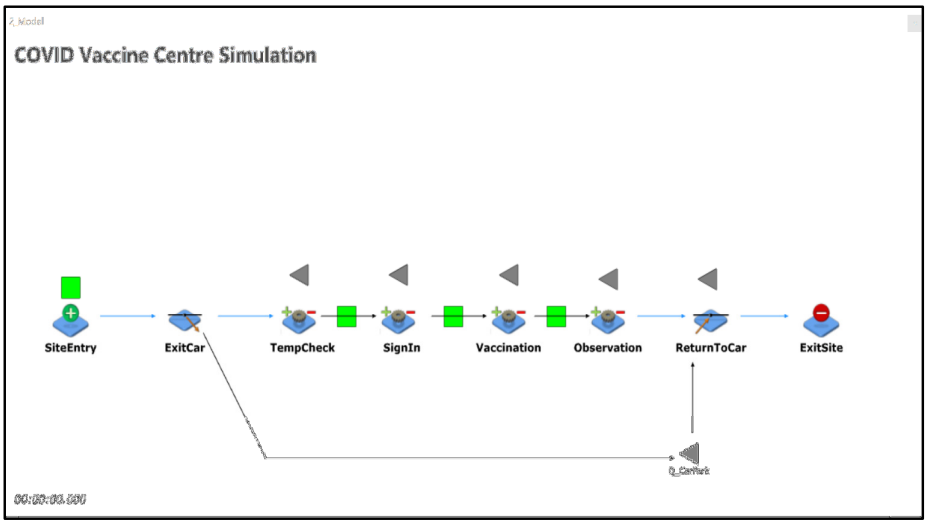
In the first column you can update:
Patient Arrivals - how many people on average you aim to see in one day and how many hours they arrive over, make sure to state the number of hours with a space and the letter h afterwards to ensure the model knows it is in hours.
Resources - This is the number of patients that can be consequtively processed at each activity(Temperature check stations, sign in stations, vaccination bays and observation places). The model currently assumes there are sufficient staff that there is no gap in service.
Queue Spaces - the number of people able to queue whilst maintaining social distancung each of the activities may be limited by physical space constraints. Here you can enter how many people can fit betweenthe activities in the centre you are modelling. The model will use these to pause activities when patients are unable to move forward until there is a space ahead of them. The model currently assumes that those waiting for temperature check are able to queue outside with out a limit to maximum length.
Output Acceptable Wait Settings - If you are interested in what percentage of patients wait longer than a certain length of time at each activity you can enter it here and it will change these measures int the output file. For example if patients are in a standing queueing outside you may want to aim for a shorter wait than inside with chairs provided. Please ensure you enter the figures in minures with space min afterwards e.g. "5 min" or it will cause an error.

In the second column:
Activity Timing Distributions - For each of the 4 activities (temperature check, sign in, vaccination and observation) supply the timing parameters. These currently use triangular distributions until more detailled distribution data is available, enter the minimum, the mode (most common) and the maximum time these activities take to perform. If the values entered are the same for the minimum, mode and maximum a fixed rate that doesn't vary presumed. Please ensure that you enter the figures followed by space min e.g. "5 min" and that the minimium is less than or equal to the mode and that the mode is less than or equal to the maximum or it will cause an error.

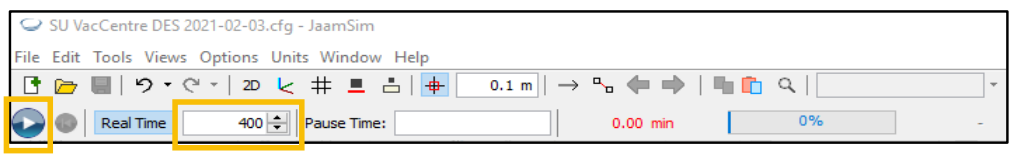
In the remaining section of the table:
Conveyance Timing Distributions - The times it takes to move from one activity to another (e.g. from parking a car to the temperature check area). There are 7 conveyance timings set up in this version of the model, the model allows patients to over take each other when finding a car park space, getting to the temperature check and then when leaving the building and the car park (the blue arrows in the model, see diagram in the next section) but not once they have entered the temperature check queue (black arrows in the model, see diagram in the next section).
Currently the model assumes that everyone comes by car, one person per car. This is something you may want to develop in a future development of the model to suit your local situation. These currently use triangular distributions until more detailled distribution data is available, enter the minimum, the mode (most common) and the maximum time these activities take to perform. If the values entered are the same for the minimum, mode and maximum a fixed rate that doesn't vary presumed. Please ensure that you enter the figures in minutes followed by space min e.g. "0.5 min" and that the minimium is less than or equal to the mode and that the mode is less than or equal to the maximum or it will cause an error.

2.2 Running the model

Once you have set up your model you are ready to run it. If you wish, you can watch the patients going through the model in the 2_Model view:



To run the model you need to press 'Run' button in the Control Panel (blue circle with white triangle in).

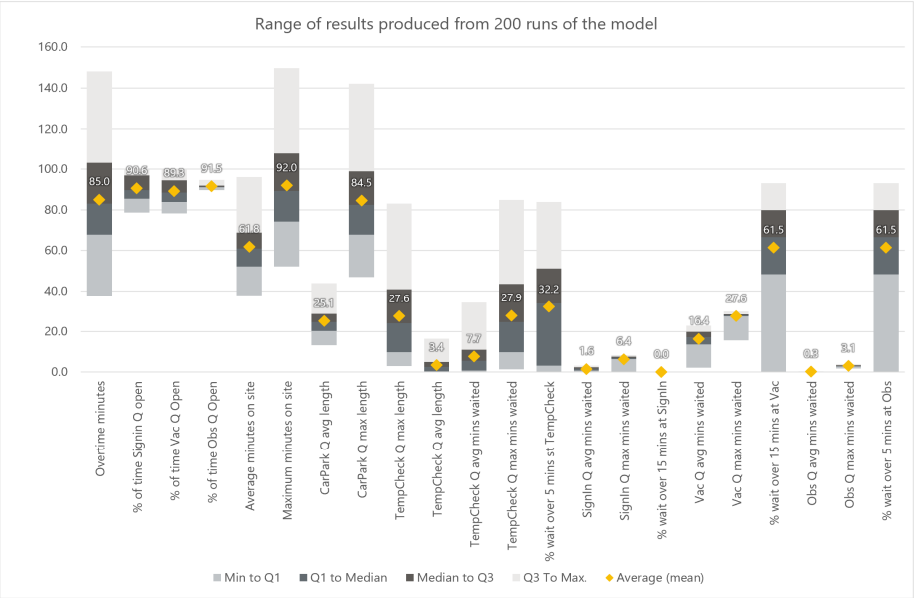


You can adjust speed of the run using the speed multiplier in the box next to real time, we suggest starting at a speed around 400 initially so you can visually check the model is running as you would expect and view where bottlenecks might be. You may then want to increase the speed 1000000 times real time using the up arrow next to the box or by typing it in. The model is set to run 200 iterations at the higher speed this should not take long, each one samples from the distributions to account for the variability seen and so produces different results on each run.

3. Processing the model results

This excel template has been provided to help with formatting and processing the results, it produces a chart and a table from the model output.

Once model has finished running, it will save a **.dat** file to the same folder as you have the model configuration file with the same name as the **.cfg**. Open the .dat file in excel.
Copy the contents into the "Paste ,Dat file here" worksheet.
The "Outputs Table and Chart" will update automatically.



The chart represents the range of results produced from the iterations of the model (default is 200 runs).
The average of the runs is shown by the orange diamond and the figures shown in the labels are this average.
The light grey bars top and bottom show the range between the highest and lowest results.
The interquartile range is shown in the middle of the bars by the darker greys, the interquartile range is the difference between Quartile 1, the 25th percentile, and Quartile 3, 75th percentile i.e. if all results for the runs are ranked from lowest to highest the 25th percentile is 25% of the way through the ranking and the 75th is 75%. Hence the two dark grey bars together show where 50% of the values fall between the minimum and the maximum.
Where the dark grey bars meet is the median, the value separating the higher half from the lower half of the data sample.

The table, below the chart, shows a summary of results for the outputted metrics from 200 runs. The listed metrics are not exhaustive and it is possible to further adapt the output list within JaamSim. The table includes the average (mean), 95% confidence interval of the average, the minimum, maximum, median and interquartile range for each metric. The confidence interval gives a 95% probability that the value of the true mean (if the model could be run infinitely) lies within the range between the lower (95% LCL) and upper limit (95% UCL).

It is possible to change which metrics appear in the chart, to do this enter a 1 in column N next to the indicators you want to include.

The Health Foundation

NHS
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Commissioning Support Unit

[1] The original Wolverhampton model was developed by participants in the Primary Care Discrete Event Simulation Programme funded by an Advancing Applied Analytics grant from the Health Foundation. The Health Foundation is an independent charity committed to bringing about better health and health care for people in the UK.
Further development of the generic model was funded by NHS Midlands and Lancashire CSU.