Welcome to the model walkthrough for the NHS England and NHS Improvement Demand and Capacity Model for type 1, 2 and 3 emergency departments.

This model is designed to aid operational planning for emergency departments, identifying expected attendances over the next seven days, and comparing it against the available staff rota.

This model walkthrough is designed to help users understand the configuration of the model, understand the data requirements for the model, populate the model, and interpret the outputs. We will walkthrough the model tab by tab using an example populated model.

The first screen that will be visible when opening the model is the get started screen. It is important to read through the information on this sheet, as it explains the steps to complete the model, and some of the key terms that are used throughout. These may vary from local nomenclature, but will reflect common concepts.

The next tab available is the notes sheet. This is a useful tab for recording notes on data collection, actions to be done and assumptions that have been made when completing the model. This is particularly important if the model is refreshed frequently, to ensure consistency in the completion of the model.

Next, we can move on to the Setup tab. This is used to define the layout of the model. A provider and site name can be given.

Next, the number of streams is configured. As stated in the get started page, streams are groups of patients that require a similar amount of time for a clinical decision to be made for them. This does not necessarily have to work along standard resus, majors, minors divisions, and could instead be based on clinical dependency. This will be a decision that has to be made on a department by department basis, depending on what makes sense operationally.

Once the number of streams has been decided, the streams can be named. In this example, we have named them Majors, Minors and Resus. We then set a priority for the different streams. The priority option is used where capacity resources can be allocated to multiple streams, and a decision has to be made on where these shared resources should be prioritised in case of competing demand. For example, if a doctor can see patients in both majors and minors, they should first be seeing higher priority patients in the majors department before lower priority patients in the minors department.

Next we can see the historic demand information sheet. A start date and start hour should be entered. The model requires hourly attendance data, grouped by stream. Up to three years of historic information can be entered in to the model. Beneath the stream name, the number of minutes required to make a clinical decision on patients should be entered.

Once the demand information has been entered, the data is to be exported in a format that the prediction app can use. Save the files in a convenient place.

The model will then ask if you want to open the forecasting app. Click yes to open the forecasting app.

Within the forecasting app, upload the file that you saved earlier. If the department that is being modelled is not a twenty four hour service, such as a minor injuries unit, then the opening times for the department can be set. This will ensure that no demand is forecasted for the time periods in which the department is not open.

Once this has been set, the Predict button can be pressed. The forecasting app will create the forecast, and will generate a graph on the right hand side. The outputs can then be downloaded, ready to be imported back in to the model.

The created forecast can then be imported back in to the model. Once the data has been successfully imported, you will be taken to the demand analysis tab.

The demand analysis tab recreates the forecast output graph from the forecasting app. You can change the stream displayed in the graph, and also view as either attendances or decision making time in hours. Decision making time in hours is calculated by multiplying the forecasted attendances by the number of minutes required to see patients within that stream. This can also be considered the required capacity for the service.

Now that the required capacity has been calculated, we can start to define the available capacity. This is completed in a number of steps.

First, the capacity shift config sheet is used to define shift patterns that are used within the department. For example, an all day shift may be between 8am and 9pm, and should be configured as shown. If you wish to account for meal or other breaks, one break can be entered in to the model by setting a break start and break end value.

Next, in the capacity role config sheet the types of staff that are in the department are configured, alongside their rate of clinical decisions per hour, per stream. For example, you may have multiple ENPs that work solely in the majors department that make clinical decisions at a rate of one clinical decision per hour. This is shown in the highlighted example. If a resource can be expected to work across multiple streams, values for clinical decisions per hour should be entered in to all of the relevant streams, such as this flexible consultant. This resource will be shared between these different streams based on the priority settings in the setup sheet.

Once the roles and shift patterns have been configured, they are linked together in the rota setup table. First, select a role type name. If you want to create a rota based on specific people rather than a role, you can enter a resource name to help identify who will be filling these shifts. Next, select a resource type from core or ad-hoc. Although this will not affect the calculations, it can provide a useful insight in to the balance of contracted and locum staff, which will be visualised in the core adhoc balance tab. Once these initial settings have been configured, the shift patterns are matched between the roles and the days of the week. To ensure that the staffing in the early morning of the first day is recorded, enter any night shifts from the previous day in the previous week column. After this, enter the shift patterns that each role is working for the next seven days.

If the service runs a number of different configurations of roles and shift patterns, the rota templates can be saved and reloaded to speed up the model completion process. Use the buttons on the right hand side to save, open and delete rota templates. If you are using templates, it may also be useful to indicate that particular lines of capacity, or particular daily shifts, are unavailable for the particular week being modelled. This can be done by selecting ‘shift unfilled’ in either the Role Type Name selection, or on individual shifts. This will reduce the capacity accordingly.

The next tab shows a summary of the balance between core and adhoc capacity as identified in the capacity role config sheet. This can be viewed as either decision making hours, or as resources. This can be operationally informative, to understand the value of plus cost capacity within the department.

Following the completion of the rota template, the capacity summary tab provides a summary of the entered capacity. The first graph shows the count of resources, the number of clinical decision makers in the department, for each hour of the day for the next week. This is then converted in to decision making time in the second graph. The key below the graph shows the colour for each of the different stream represented in the chart. Any shared resource between two streams is shown as a striped bar, and will be flexed between the available streams depending on the required capacity and priority of the streams.

The Parameters tab is used to account for any changes to the demand or capacity for the department over the next 7 days that would not be captured by the forecasting app or the rota template. For example, you may know that a particularly hot spell will increase the attendances to the department by approximately 10 percent. This information would not be captured in the forecast from your historic data, as the forecasting app does not know when a hot day may occur in the next seven days, but can be captured by the service here. Enter the reason why the change is being made, for example an expected delay in the pathology department for non-critical samples. The change percentage can then be entered, as either a positive number for an increase or as a negative for decreases. Changes in demand can either be in the number of attendances or in the amount of time it takes for a clinical decision to be made. This could be increased by, for example, poor flow in the hospital expected for a particular time period. The model can apply these changes either to the entire department, or to a particular stream, as appropriate. Then define the start date and time and end date and time for the change.

Similarly, the available capacity in the department may need to be adjusted from the rota, and this can be done in the table below the second chart.

With all of the data entered in to the model, we can now view the outputs. The summary sheet will show a number of outputs.

The first graph shows the required and available capacity balance. The various options on the left will change the view of the graph, from individual days to a whole week view, as well as change between the different streams. The graph will show the required capacity in blue, and the available capacity in orange.

The table below the graph shows the same information in a slightly different format, comparing expected required capacity and available capacity as figures for the entire week. Where available capacity exceeds required, the figure in the difference row will be highlighted green, where available capacity does not meet required capacity it will be highlighted in red.

Below these outputs is an expected queue size calculation. Based on the balance of available and required capacity, it is possible to estimate the queue size in the department at a given day and hour in the next week. You can configure an expected starting queue size, which is the size of the queue that is being brought over from the previous week. Similar to the forecasting app, if the department is not a 24 hour service, where the queue would be cleared at the end of the day, the time can be entered in to the ‘clear queue at’ column.

You can then press the run queue builder button to run the model for calculating the expected queue size, and the graph will display the expected queue size in the department over the next seven days.

Thank you for watching this video walkthrough of the Demand and Capacity Team’s Emergency Department model. If you have any questions about the model, please contact the team.