Demand and capacity models

Core model user guidance

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Contents

1. Introduction

1.1 What is the core model?

The core model is an Excel tool to help you assess the demand and capacity needs of your service.

It is a development of NHS Improvement's suite of demand and capacity tools for elective care, using similar methodology; so if you have used the earlier tools, you will be familiar with the sheets in the core tool.

This model can be used across all sectors of elective care – acute, community and mental health – provided the service being modelled has the following characteristics:

- there is a request for access to an elective care service (eg via a referral)
- the patients are booked to see a clinician – the wait to be seen is typically at least one day but may be a number of weeks
- the clinical contact is completed on the day of the appointment
- once the patient has had clinical contact, they move to the next stage of the treatment pathway or are discharged from the service.

Examples of applicable services are:

- outpatient clinics for new patients
- elective daycase surgeries
- two-week wait services (eg cancer).

If your service pathway is more complex, you may need to use the high complexity model, which is also available on our website.[1]

Examples of services that might benefit from the high complexity model include:

- improved access to psychological therapies (IAPT) services
- district nursing services
- chemotherapy services.

1.2 How to use this guide

This is a quick reference guide to using and reading the sheets in the core model. We assume that users are familiar with the basic concepts of demand and capacity management. This includes as a minimum understanding:

- the role of variation, and how to account for it when managing capacity
- what a statistical process control (SPC) chart is, and how to interpret it
- what a waiting list is, and how such lists are used in elective care.

If you need a refresher on these concepts, you can find relevant resources at www.england.nhs.uk/ourwork/demand-and-capacity/resources/.

There is also guidance in the model, which can be accessed in one of two ways:

- If you see the icon below, click it to bring up an information window. Click the icon again to hide it.

- If you see a cell with a small red triangle in the upper right corner, hover your mouse cursor over the cell to reveal an information window.

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[1] https://improvement.nhs.uk/resources/elective-care-demand-and-capacity-models
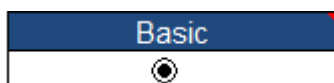
2. Before you start

You will need the following data to populate the model:

- demand data for your service, summed by week for a period of up to five years
- capacity information for your service (eg clinics, lists, appointment slots)
- patients removed from your waiting list before booking
- non-attendances (ie cancellations or did not attend [DNAs]), split by:
  – where the clinical slot could be reused (non-attendances where the slot was reused [NASR], and where the original patient was discharged/ removed from the waiting list)
  – where the clinical slot was lost (non-attendances where the slot was lost – [NASL]) – overall numbers, as well as subsequent discharges from the service/removed from the waiting list
- your waiting list size: the number of patients (booked and unbooked) waiting for treatment.

3. Workbook structure

The core model and this guide are divided into the following sections:

- initial setup
- demand data and SPC analysis:
  - for elective and same-day care
  - for planned care
- available capacity
- parameters based on activity outcomes
- summary of demand and capacity measures.

3.1 Set-up

Set-up sheet

Select the relevant options for your service from this sheet:

You can select up to 10 'modalities' of clinical intervention, eg different types of diagnostic scans or clinic types.

Your lower percentile can be set to: 65, 70, 75 or 80.

Higher percentile values are suitable for more variable services or services with a greater level of urgency.

| Provider Name: | A. N. Other Trust 3 |
| Service Name: | Service 3 |

Setup

Number of modalities required:	4
Does **planned** activity constitute a significant portion of your workload?	No
Is there a significant amount of **same day** (eg. emergency) activity?	Yes
Unit of work:	Minutes
Lower bound for percentile calculation:	65

Urgencies:

1	2WW
2	Urgent
3	Routine

		Current waiting list size (Pts)
Modality 1 Name:	Test name 1	400

You can define up to three different urgency levels for your service – these can be renamed in the outlined boxes under 'Urgencies' and customised to fit your service.

Ensure that you update your current waiting-list size regularly.

You should always count your waiting list in terms of patients when entering data in this box.

3.2 Demand and SPC analysis

Demand

You can enter demand data for all the modalities of treatment on this sheet.

If you are copying and pasting data from another sheet, please ensure you use the 'Paste Special (Values)' or 'Paste Special… (Text)' method of pasting data.

If you are unsure of how to do this, please get in touch with your informatics department for help.

If you have selected units other than 'Patients', you have the option to complete this box.

Enter the typical slot size (in minutes or points) for the modality here.

Please enter your demand information (per week) below
Note that you can enter up to 5 years (260 rows) of data - the sheet will extend itself if more than 52 weeks of data are entered.

Week Starting: 01/04/2015

Year	Week	Date	Test name 1 Minutes: 25					Total (Patients)	Total (Minutes)	Exclude data point?
			2WW	Urgent	Routine	Emergency	Total			
2015	14	01/04/2015			156	19	175	156	4,375	
	15	08/04/2015			155	11	166	155	4,159	
	16	15/04/2015			168	13	181	168	4,523	
	17	22/04/2015			145	14	159	145	3,980	

Dates are automatically set up for you. They are based on what you enter in the 'Week starting' box.

Every time you enter a value in a row, the worksheet will generate the appropriate date values.

Statistical process control (SPC) chart

The SPC Chart sheet lets you set a baseline for SPC analysis using the demand data you entered on the 'Demand' sheet.

Seasons: You can select between one and four 'seasons' to differentiate regular periods of high/low demand.

Each season is a minimum of 10 weeks, and will be used to calculate the appropriate percentile values for your demand.

Display type:	1+ Seasons	
Baseline selection		
Season 1 begins:	02/12/2015	
Season 1 ends:	13/07/2016	33 weeks
Include 2nd Season?	Yes	
Season 2 ends:	02/11/2016	16 weeks
Include 3rd Season?		
Season 3 ends:		
Include 4th Season?		
Season 4 begins:		
Baseline period:		
49 weeks		
Remaining wks use season:	1	
Show SPC values:	Yes	
Show percentile values:	No	
Show emergencies:	No	
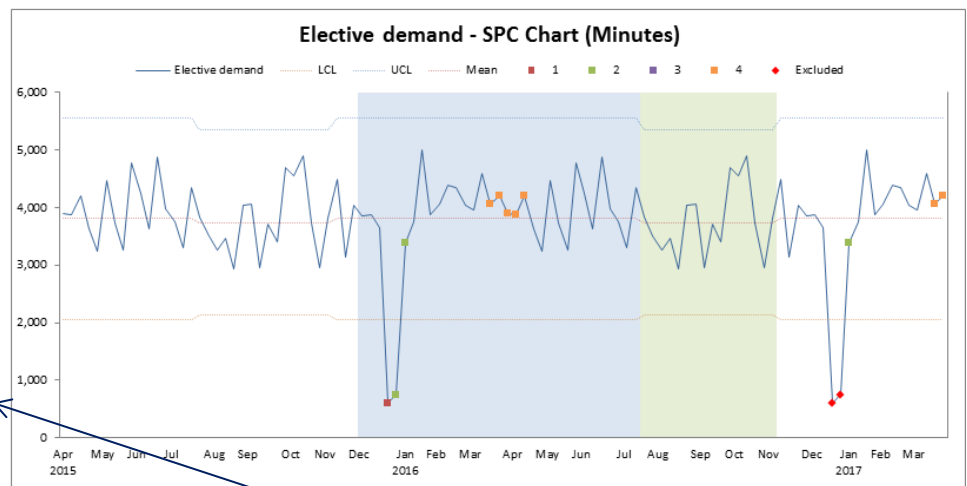
Special Cause Variation markers

1. A data point is more than 3 sigma (Σ) from the mean
2. 2 out of 3 points are more than 2 sigma (Σ) from the mean, with all 3 on the same side of the mean
3. 6 consecutively rising or falling points
4. a run of 9 or more points on the same side of the mean

Elective demand - SPC Chart (Minutes)

Elective demand — LCL — UCL — Mean ■ 1 ■ 2 ■ 3 ■ 4 ◆ Excluded

If your baseline is less than 52 weeks and you have defined several seasons, you can link the remaining weeks to one of your defined seasons.

The control panel lets you toggle the following metrics on the chart:

- SPC values
- percentile values
- same day/emergencies (if chosen in set-up).

Planned

The Planned sheet is where you can enter scheduled or planned demand, as per the definitions provided in the appendix.

The interface and functionalities are similar to those for the Demand sheet:

Please enter your planned demand information (per week) below
Note that you can enter up to 52 weeks of data only here

Enter data by:　　Overall

Week starting:　　01/04/2018

You can enter planned demand data in aggregate, or by modality.

Modality-specific information is drawn from what you entered on the Demand sheet.

Year	Week	Date	Overall (Manual entry) Minutes: 24	Total (Patients)	Total (Minutes)	Exclude data point?
2018	14	01/04/2018		232	232	5,469	
	15	08/04/2018		218	218	5,139	
	16	15/04/2018		202	202	4,762	
	17	22/04/2018		210	210	4,950	
	18	29/04/2018		229	229	5,398	
	19	06/05/2018		238	238	5,610	
	20	13/05/2018		240	240	5,657	

Planned SPC

The options for the Planned SPC sheet are the same as those for the main SPC Chart sheet:
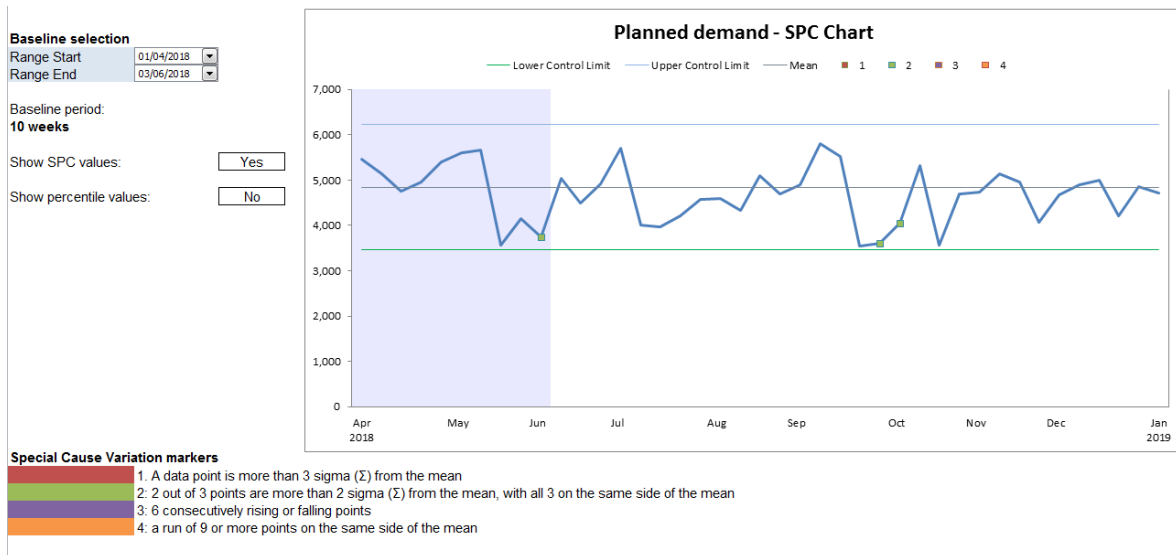
The main difference is that your sample period cannot be divided into different seasons.

3.3 Available capacity

You have two options when entering your available capacity in the model:

Use the basic capacity calculator only

Switch to 'Planning' to enable the capacity planning calculator.

Capacity

Start date	01/04/2017
End date	31/03/2018

Basic	Planning
◉	○

Capacity calculator

Core capacity

					67,320	1,295
Clinic Name	Clinic Description 1	Clinic Description 2	Weeks Per Year	Minutes Per Clinic	Total (Minutes)	Average Per Week (52 Weeks)
CLNC1	Clinic 1	Tuesday Clinic	42	240	10,080	194
CLNC2	Clinic 2	Thursday Clini	36	240	8,640	166
CLNC3	Clinic 3	Friday Clinic	42	60	2,520	48
CLNC4	Clinic 4	Nurse Clinic	52	120	6,240	120
CLNC5	Clinic 5	Registrar Mon	42	180	7,560	145
CLNC6	Clinic 6	Registrar Tue	36	300	10,800	208
CLNC7	Clinic 7	Nurse Clinic	50	180	9,000	173
CLNC8	Clinc 8	Registrar Thur	52	180	9,360	180
CLNC9	Clinic 9	Registrar Fri	52	60	3,120	60

Ad-Hoc capacity

				Totals	4,800	92
Clinic Name	Clinic Description 1	Clinic Description 2	Weeks Per Year	Minutes Per Clinic	Total (Minutes)	Average Per Week (52 Weeks)
AHCL1	Ad-Hoc Clinic 1	Tuesday Clinic	15	240	3,600	69
AHCL2	Ad-Hoc Clinic 2	Nurse AH	10	120	1,200	23

Enter your core clinical sessions here. You will need to enter:

- frequency of clinical session (adjusted for leave, bank holidays, any other commitments)
- slots per session, using the units you selected in 'Set-up'.

Please ensure your statements of capacity are operationally verified before committing to these figures.

Ad-hoc (plus cost) clinical sessions can be listed here.

If you use this option the model will assume your capacity is evenly distributed across the year.

Use the capacity planning calculator

Once you have enabled the capacity planning calculator, then you will have two extra sheets:

- Critical resources

    You can enter key resources required to run your clinical sessions here.

Critical resources
Start date   01/04/2017
End date   31/03/2018

Please enter up to 5 periods when your critical resources are unavailable

Clinical resource	Period 1 Start	Period 1 End	Period 2 Start	Period 2 End	Period 3 Start	Period 3 End	Period 4 Start	Period 4 End	Period 5 Start	Period 5 End
Consultant: Mr Smith	01/04/2017	08/04/2017	06/05/2017	13/05/2017	16/09/2017	07/10/2017	03/02/2018	03/02/2018	03/03/2018	
Consultant: Ms Taylor	23/12/2017	06/01/2018								
CT Scanner 1	05/08/2017	23/09/2017								
CT Scanner 2										
CT Scanner 3										

Enter dates that your key resources will be **unavailable** in these boxes.

- Capacity set-up

    You can link your clinical sessions to your key resources.

Show:
Core

Core capacity

| Clinic Name	Key resource 1	Key resource 2	Key resource 3	Frequency from calculator	Adjusted for critical resources	Stated capacity	Adjusted (minimum) capacity
CLNC1	1. Consultant: Mr Smith			42	43	10,080	10,080
CLNC2	1. Consultant: Mr Smith	2. Consultant: Ms Taylor		36	40	8,640	8,640
CLNC3	2. Consultant: Ms Taylor	3. CT Scanner 1		42	41	2,520	2,460
CLNC4	3. CT Scanner 1			52	44	6,240	5,280
CLNC5	2. Consultant: Ms Taylor			42	49	7,560	7,560
CLNC6				36	52	10,800	10,800
CLNC7				50	52	9,000	9,000
CLNC8				52	52	9,360	9,360
CLNC9				52	52	3,120	3,120

All the sessions listed in 'Capacity' will be shown here.

You can select key resources – for a session to run, **all** the key resources must be available.

Capacity summary

This sheet will show a time-based breakdown of ad-hoc and core capacity, using the session data entered in the Capacity sheet, and any extra options selected by the user.

If you are using the basic calculator, the model assumes an even spread of capacity across the year.
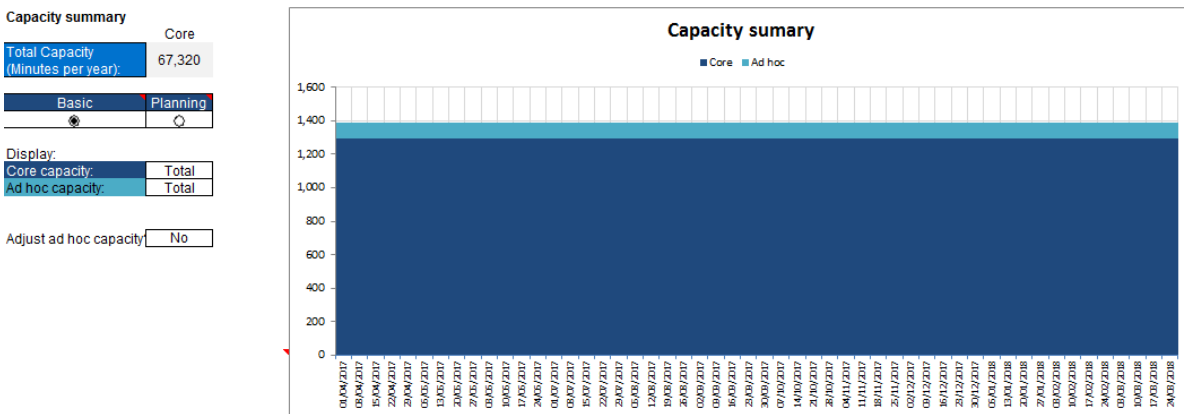
Selecting the 'Planning' option will instruct the model to allocate capacity depending on the availability of key resources for clinical sessions; this will generate a more detailed map of your capacity.
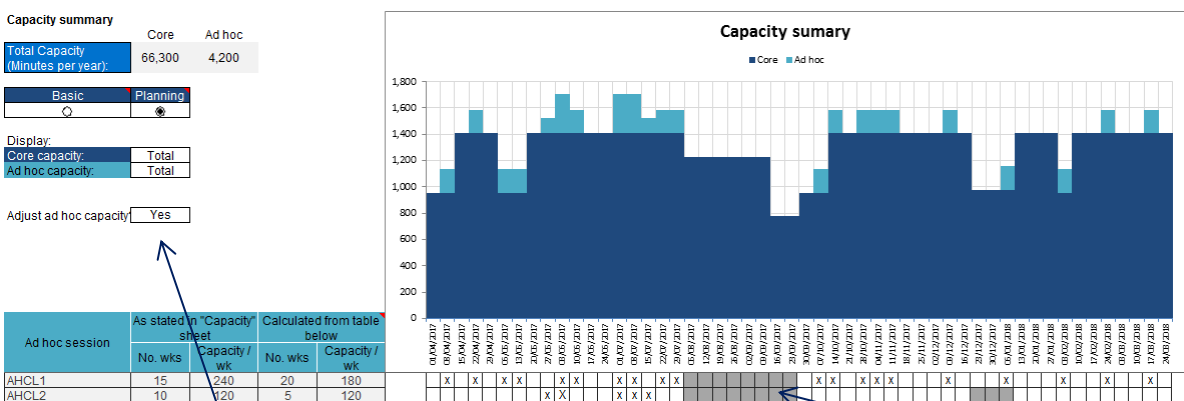
If you enable 'Adjust ad-hoc capacity', you can select the specific weeks for which your ad-hoc capacity will run.

If you have linked ad-hoc sessions to a key resource, weeks in which your key resource is unavailable will automatically be blocked..

3.4 Parameters based on activity outcomes

This sheet is used to establish the behaviour of service once a request for service has been received.

The following parameters are based on a specific set of activity outcomes:

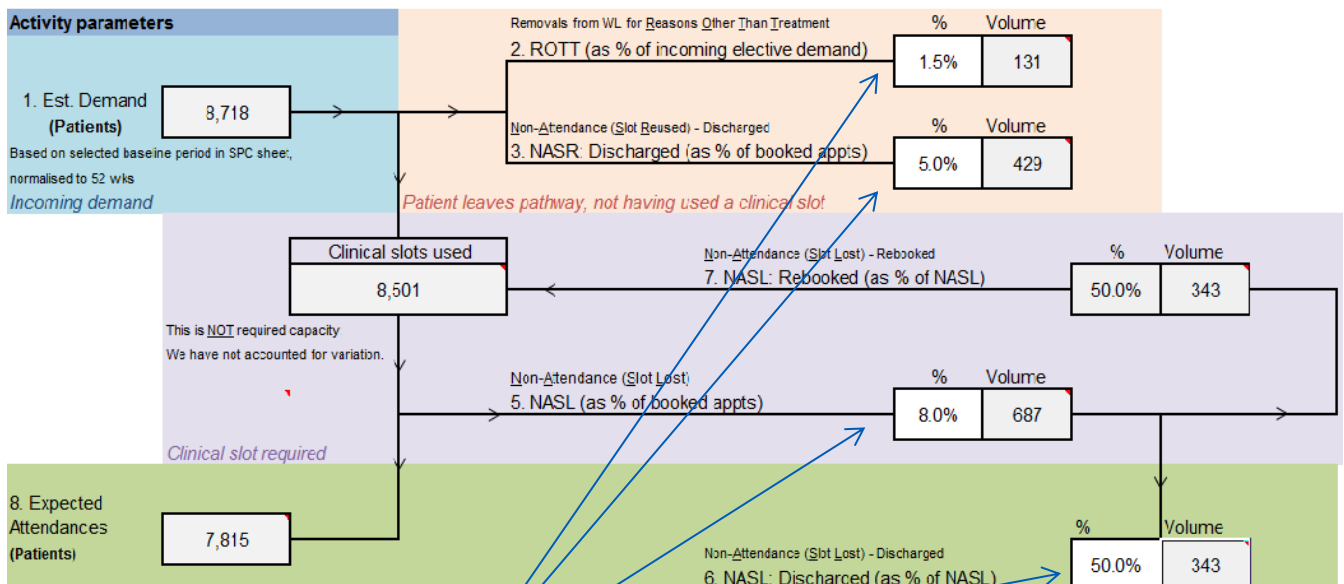| Metric	Example
Patients removed from the waiting list for reasons other than treatment (ROTT)	An inappropriate referral who is returned to primary care, and no appointment is booked for them.
Non-attendances where the slot was reused, and the original patient was discharged (NASR discharge)	A patient who cancels their appointment two weeks ahead of time because they no longer want treatment for their condition.
Non-attendance where the slot was lost (NASL)	A patient who cancels 48 hours ahead of time, and your service cannot reliably rebook another patient into this slot.
Non-attendance where the slot was lost, and the original patient was discharged (NASL discharge)	A patient who is unable to attend their appointment at short notice due to another illness, and is subsequently discharged to another service for further treatment as a result.

Entering the data

You can select your method of data entry for your activity outcomes here:

- by percentage value (%)
- by volume (patient or other units) – note that the denominator for demand is based on the baseline period selected in the SPC Chart sheet.

Enter values by:	%
Baseline period (wks)	52
Units	Patients

On aggregate, 1 patient = 23.6 Minutes

Activity parameters

Removals from WL for Reasons Other Than Treatment
2. ROTT (as % of incoming elective demand)

| % | Volume |
| 1.5% | 131 |

1. Est. Demand **(Patients)** — 8,718
Based on selected baseline period in SPC sheet, normalised to 52 wks
Incoming demand

Non-Attendance (Slot Reused) - Discharged
3. NASR: Discharged (as % of booked appts)

| % | Volume |
| 5.0% | 429 |

Patient leaves pathway, not having used a clinical slot

Clinical slots used — 8,501

Non-Attendance (Slot Lost) - Rebooked
7. NASL: Rebooked (as % of NASL)

| % | Volume |
| 50.0% | 343 |

This is NOT required capacity
We have not accounted for variation.

Non-Attendance (Slot Lost)
5. NASL (as % of booked appts)

| % | Volume |
| 8.0% | 687 |

Clinical slot required

8. Expected Attendances **(Patients)** — 7,815

Non-Attendance (Slot Lost) - Discharged
6. NASL: Discharged (as % of NASL)

| % | Volume |
| 50.0% | 343 |

These boxes will become available for data entry, depending on the choices made for data entry.

Each box relates to your figures for ROTT, NASR (discharge), NASL and NASL (discharge).

Parameters calculator

If you have set up the model for a service with multiple modalities and the primary unit of work is not in patients, the option to use the parameters calculator may appear.

Patient to units activity calculator

Your selected baseline period is:

52

[add info here]

Modality	ROTT	NASR - DC	NASL	NASL - DC
Test name 1	21	31	243	14
Test name 2	31	43		
Another modality	24			
Modality 4				
Modality 5	34	13		
Modality 6				
Modality 7				
Modality 8				
Modality 9				
Modality 10				

	Patients	Minutes
Estimated demand (aggregate):	8,718	205,505
Estimated attendances (aggregate):		

	ROTT	NASR - DC	NASL	NASL - DC
Summed and translated to Minutes	893	1,218	6,075	350
Estimated % values	0.4%	0.6%	3.0%	5.8%

The parameters calculator uses the activity outcomes as the main Parameters sheet, and values are entered on a **per patient** basis by modality.

These are automatically adjusted to the units (minutes/points) selected in the Set-up sheet, and the overall percentage values are then calculated using these figures.

Pathway

This sheet is where you can enter the timeframe in which your patients should be seen.

You can select the appropriate time to be seen for each level of urgency here.

Note that you can change the units from weeks to days if required.

Enter here the typical interval for non-attendances (slot lost) to be seen after their initial non-attendance.
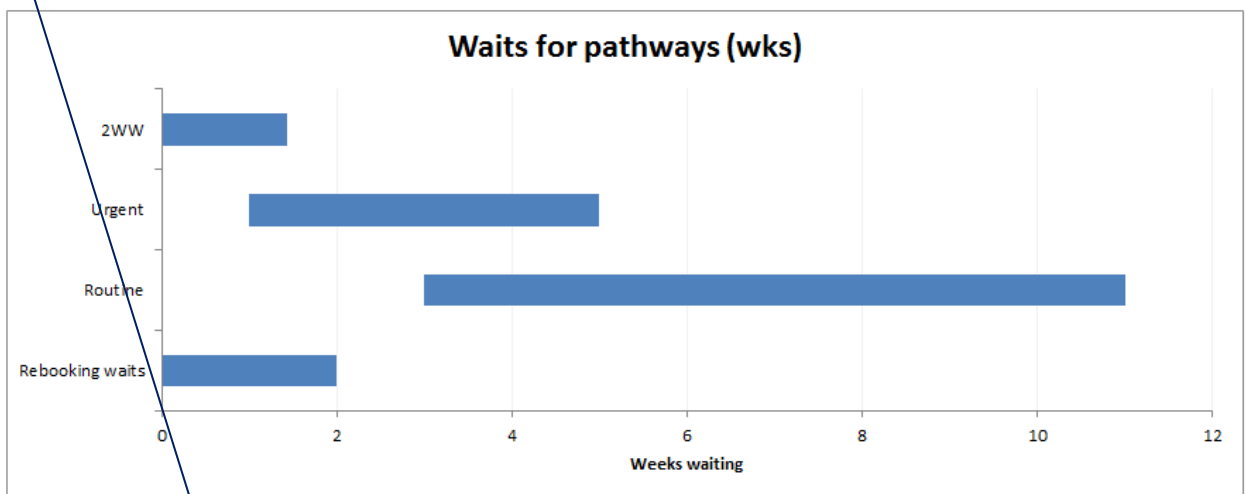
Pathway parameters

Urgency	Start	Seen by		Units
2WW	0	10		Days
Urgent	1	4		Weeks
Routine	3	8		Weeks

Rebookings are typically seen within: 2 Weeks

Waits for pathways (wks)

The proportion of patients seen in each of these levels of urgency is based on the demand data entered in the Demand sheet.

3.5. Summary

This sheet displays summary values for:

- the balance of required capacity against available capacity
- the total current waiting list size against the calculated maximum sustainable waiting list size

Required versus available capacity

This is shown as a 'bar and dash' chart:
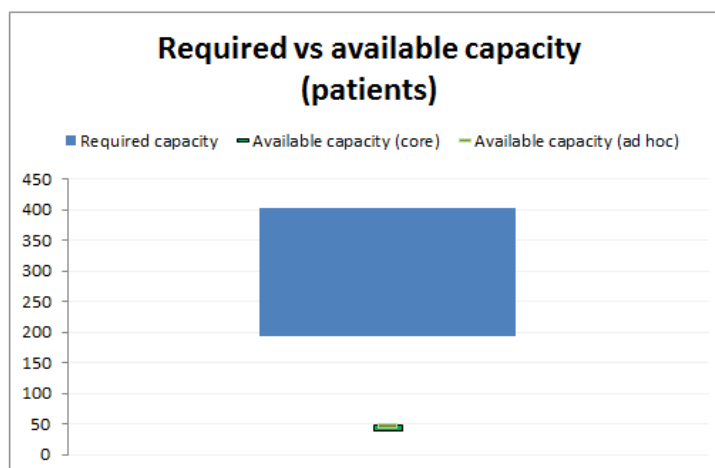
The blue bar represents the range of required capacity, and the green dash represents the available capacity (core and ad hoc).

The chart can be changed to show either an aggregate position for the year, or a time-based view which incorporates any seasonal information that you may have entered in either the demand or capacity parts of the model.
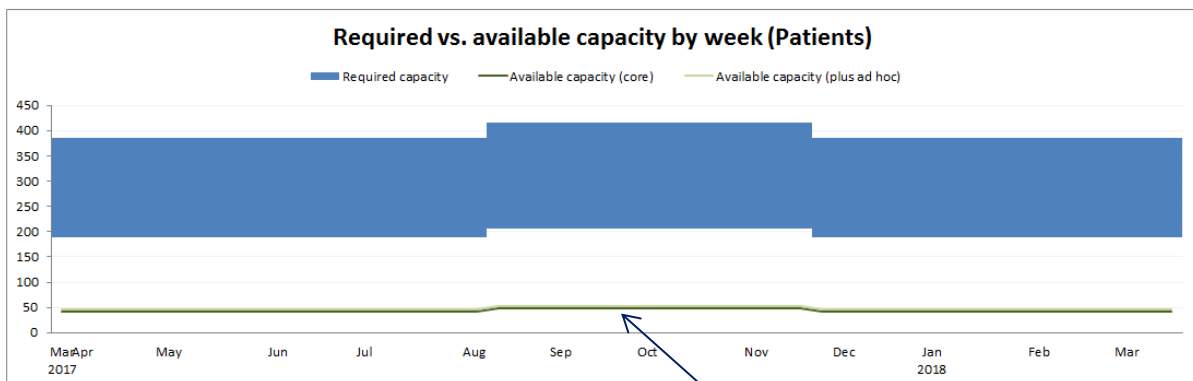
The model will automatically adjust carve-out for same-day and planned cases.

You can show this 'unavailable' capacity on the chart using this switch.

If you have enabled more complex capacity planning, this will be reflected in 'Available capacity' lines.

Current waiting list versus estimated sustainable waiting list

This chart is read in a very similar way to the required versus available capacity chart.

Current waiting list vs Estimated sustainable waiting list (Patients)

Current	1,550
Sustainable	1,190 - 2,505
Clearance	0
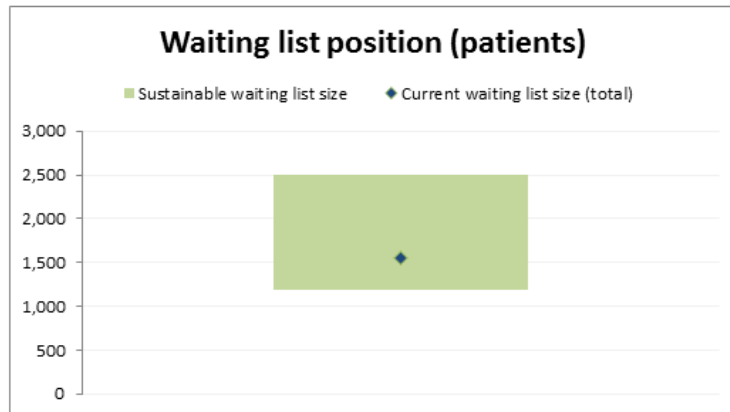
If your current waiting list is greater than the estimated sustainable waiting list size, this may result in patients waiting too long for clinical intervention.

Appendix: Glossary of key terms

Activity

Clinical contact that has taken place. As activity simply reflects what the service is capable of delivering, it is not the same as demand.

Activity can be biased by changes in capacity or by additional ad-hoc capacity such as waiting list initiatives, so we discourage using historical activity as a basis for planning your service.

Capacity

Available capacity is the resource you can deploy to provide a service for your patients. This needs to be operationally verified and compared against the required capacity.

Required capacity is what your service needs to provide so that your waiting list does not increase over time. Required capacity is a combination of your demand (adjusted for variation), and the removals and additions to your waiting list resulting from non-attendances and discharges.

Demand

Requests for service – this can be in the form of a referral, a decision to admit (DTA) or an appointment in an earlier part of your service as part of the continuation of a treatment pathway.

Non-attendances

There are two types:

- non-attendances, where the slot was reused (NASR)
- non-attendances, where the slot was lost (NASL).

Any patients who were discharged from the service subsequent to their non-attendance are described as NASR (discharge) or NASL (discharge).

Waiting list

The waiting list is the number of patients who have requested an appointment in your service, with or without a booking, and are waiting for that appointment to take place.

The estimated sustainable waiting list size is the size your service should aim for to treat patients in a timely manner, while ensuring a steady flow of patients to your clinics.

Patients removed from the waiting list for reasons other than treatment (ROTT)

This represents the patients who are included in your demand but end up not needing an appointment slot.

Examples of ROTT are inappropriate referrals or patients who are transferred to another service due to an urgent medical condition.