East Midlands Clinical Networks

# Modelling renal demand, 2014-2023

## Model documentation, May 2014

**2020 Delivery**

# 1 Contents

# 2 Overview of model

## 2.1 Background

- Dialysis provision across the East Midlands accounts for around £45m of costs and over 360,000 patient dialysis contacts each year and has been growing steadily.
- Across the region there take-on rates and clinical practice vary significantly
- The Renal CAG has identified **inequalities in renal dialysis capacity** and variable patient experience and choice as a key priority to be addressed.
- The **geographical location** of future services to reflect changing demand is a key factor in service planning given the frequency of attendance on an on-going basis by patients with end stage kidney failure.
- To support the development of renal service provision, this model was commissioned by the CAG to predict patient activity levels and flows up to 10 years into the future.
- The model is intended to:
    - Allow a 'current state' assessment to be made and thereby confirm the variability and inequality of the current service provision;
    - Allow the option to re-configure the network, and re-apportion patients accordingly;
    - Be owned and updated annually by the Strategic Clinical Network.
- The aim of this document is to demonstrate how to use the model, and answer most technical questions. The methodology of the model is given in a separate hand-over slide pack.

## 2.2 Inputs to the model

The following are the main inputs to the model:

- GP Practice location, list size and CKD stages 3-5 prevalence data from QOF
- Dialysis sites including type, main provider and location (post code)
- Travel time data between GP practices and dialysis sites
- ONS population estimates and projections
- Raw risk factors (i.e. probability of requiring RRT by demographic category)
- Modality take-on rates for each main renal provider (calculated from provider data)
- Transition rates between modalities for each main renal provider (calculated from Renal Registry data)

## 2.3 Outputs – for each year from 2014 to 2023:

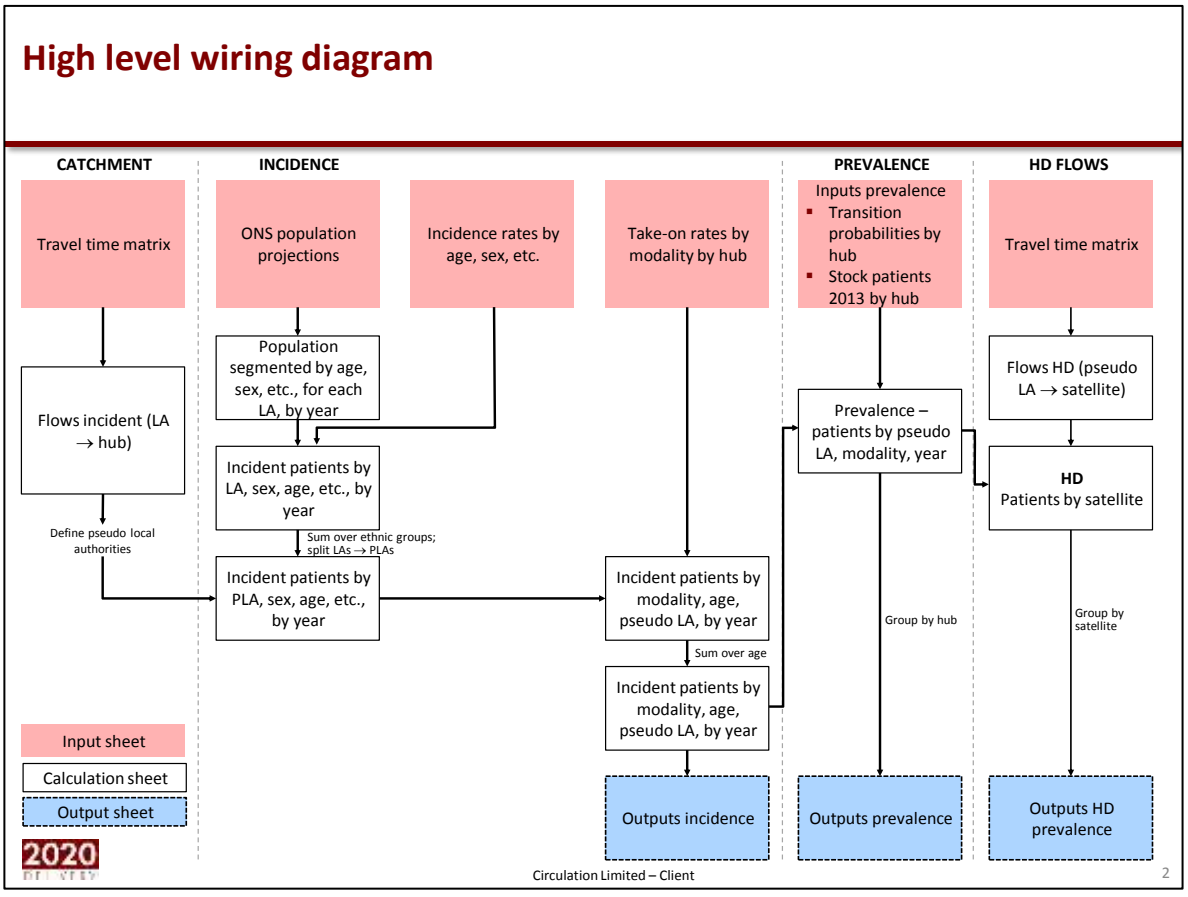
The model produces the following outputs:

- Incident and Prevalent patient numbers by main renal provider and by modality, both in raw numbers and per million population
- Incident and Prevalent patient numbers by county and by modality, both in raw numbers and per million population
- Expected numbers of haemodialysis patients at each dialysis site, including travel time profile
- Catchment populations of each dialysis site and main provider expressed as population and number of CKD 3-5 prevalent patients

## 2.4 Structure of the model

The model consists of four main sections as outlined in the wiring diagram below:

- *Catchment* – this uses travel time data to define the catchments of the main providers in terms of flows from each local authority
- *Incidence* – this combines ONS population data with incident and modality take-on rates to project the number of new patients each year by modality at local authority level for each main provider
- *Prevalence* – this combines snapshot data from providers with new patients from incidence modelling and transition probabilities between modalities to project the number of prevalent patients by modality by local authority for each main provider
- *HD flows* – this uses travel time data to allocate projected in-centre haemodialysis patients to haemodialysis sites



# 3 Model at a glance

The model contains a large number of worksheets, many of which are used for calculations and do not need to be accessed by most users of the model. The table below provides a brief description of each sheet. All the main user defined assumptions are in "Main Sheet" which is described in more detail below.

## 3.1 Main sheet

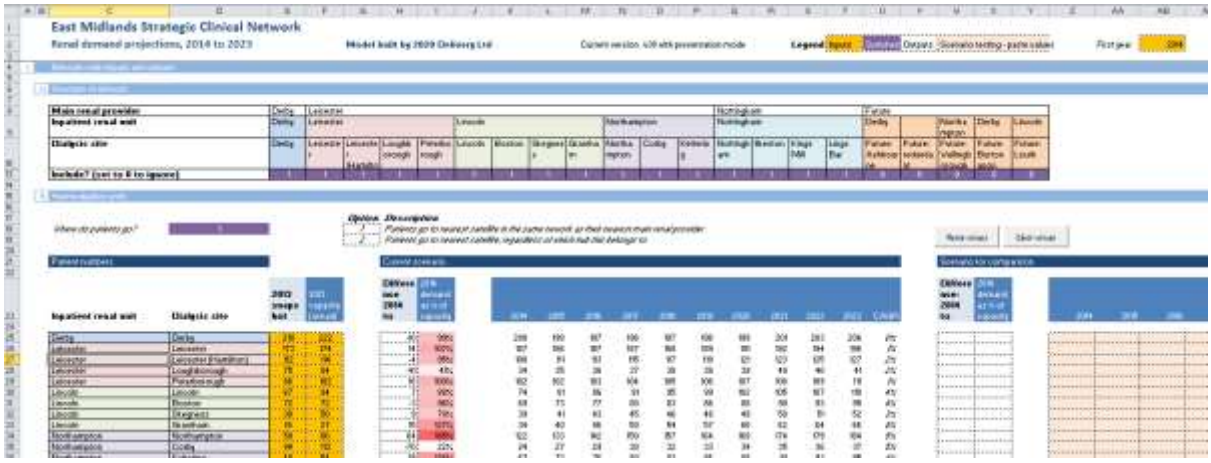
The sheet entitled 'Main' contains most of the user defined assumptions, switches and outputs of the model. This sheet can be used to:

- Change site configuration (turn individual sites 'on' and 'off')
- Input current capacity and patient numbers by dialysis site
- Switch between patients travelling to nearest site of main provider or nearest site regardless of main provider
- Compare scenarios by "pasting as values" initial scenario and then running a second scenario
- Changing assumptions for: incident rates, take on rates, transition probabilities

It provides a range of outputs for selected scenario and one comparator scenario including:

- Projected in-centre haemodialysis patients by dialysis site for each year
- Travel time and catchment profiles for selected scenario and one comparator scenario
- Network wide incident and prevalent patient numbers by modality, age band and main provider (both absolute number and per million population)

**Figure 2: Screen shot of "Main Sheet"**



## 3.2 Other sheets

The model contains a total of 35 sheets, 17 of which are hidden in the standard Presentation mode.

| Sheet name | What sheet does | Inputs | Hidden in standard Presentation mode? |
|---|---|---|---|
| **Main input and output sheets** | | | |
| Index | Index sheet, including details of model creation, links to other sheets | None | Visible |
| 'Main' | Main sheet of model; contains most commonly-used features; blank tables for scenario testing | Transition rates; take-on rates; switches for scenario testing | Visible |
| HistoricIncident | Compare 2014 model outputs to historic data from Renal Registry and Richard Fluck data returns, for incident patient numbers | Renal Registry figures; Richard Fluck figures | Visible |
| HistoricPrevalent | Compare 2014 model outputs to historic data from Renal Registry and Richard Fluck data returns, for prevalent patient numbers | Renal Registry figures; Richard Fluck figures | Visible |
| OutputsIncidentCounty | Incident patient numbers, by modality, age-band, main renal provider | None | Visible |
| OutputsIncident | Incident patient numbers, by modality, age-band, main renal provider | None | Visible |
| OutputsPrevalent | Prevalent patient numbers, by modality, age-band, main renal provider | None | Visible |
| AccessHubs | Catchment of each inpatient renal unit, both for adult population and stage 3-5 CKD patients; travel time profile for each dialysis site; for travel options 1 and 2 | None | Visible |
| AccessHD | Catchment of each dialysis site, both for adult population and stage 3-5 CKD patients; travel time profile for each dialysis site; for travel options 1 and 2 | None | Visible |
| AccessByCCG | Travel time profile for each CCG, for travel time to nearest dialysis site | None | Visible |
| PopulationPLA | Catchment populations for each | None | Visible |
| TravelTimes | Complete profile of each GP practice, including practice details, nearest main renal provider, nearest inpatient renal unit, nearest dialysis site under all travel options, and travel time to each; also serves as output sheet for purposes for Google Fusion maps | None | Visible |
| GPPractices | Details of each GP practice | Details of each GP practice | Visible |
| Network | Details of each of the renal units (addresses etc) | Icons to be used for Google Fusion maps | Visible |
| Transitions | Restructures the transition matrices for subsequent calculations | None | Hidden |

| Sheet name | What sheet does | Inputs | Hidden in standard Presentation mode? |
|---|---|---|---|
| Stock | Input sheet: current patients by main renal provider and pseudo-local authority | Current patient numbers by main renal provider and pseudo-local authority | Visible |
| FlowsTravelChange | Matrix of changes in patient flows when travel option changed from 1 (status quo - patients travel to nearest dialysis site belonging to nearest hub) to 2 (patient travel to nearest) | None | Visible |
| FlowsIncident | Flows from each local authority to each inpatient renal unit; defines list of pseudo-local authorities | Switch for whether to base flows on GP lists or CKD population; lower cut-off for ignoring flows | Visible |
| FlowsPLA | Flows from each pseudo-local authority to each dialysis site | Switch for whether to base flows on GP lists or CKD population | Visible |
| TravelTimeMatrix | Matrix of travel times from each GP practice to each renal provider; used to calculate nearest dialysis sites and main renal provider | None | Visible |
| General | | None | Hidden |
| Incident | Calculation sheet | None | Hidden |
| **Engine sheets (carry out most of the calculations)** | | | |
| IncidentPatientsByPopSegment | Calculation sheet | | Hidden |
| IncidentPatients | Calculation sheet | | Hidden |
| IncidentPatientsModalityAgePLA | Calculation sheet | | Hidden |
| IncidentPatientsModalityPLA | Calculation sheet | | Hidden |
| Prevalent | Calculation sheet | | Hidden |
| HD | Calculation sheet | | Hidden |
| **Population sheets** | | | |
| PopulationTriangulation | Calculation sheet | | Hidden |
| PopulationSegmented | Calculation sheet | | Hidden |
| PopulationEthnicity | Calculation sheet | | Hidden |
| Ethnicity | Calculation sheet | | Hidden |
| Lookups | | | Hidden |
| ONSpopulations | ONS population projections to 2021, based on 2011 census | ONS population projections | Hidden |
| ONSpopulations2010 | ONS population projections to 2035, based on 2009 mid-year estimates | ONS population projections | Hidden |

## 3.3 Colour convention

The following colour convention is used for the cells in each sheet:

| |
|---|
| Input cells for scenario testing |
| Input cells |
| Switches |
| Derived quantities/text |

## 3.4 Presentation mode and developer mode

The model has two modes of use:

- **Presentation mode**: by default, upon opening the model, this mode is selected. The user may only change cells designated as input cells (yellow) or switches (purple). This mode encompasses most users of the model, including scenario testing. Only the sheets containing inputs or outputs are accessible to the user.
- **Developer mode**: by entering a password, full access is granted to the user, including access to all sheets, and the ability to change all formulae.

Changing between modes

- *To change from user to developer mode:* Press CTRL + W together; when dialogue box appears, enter password *2020delivery*
- *To change from developer to Presentation mode:* Press CTRL + P together
- *Alternatively, go to the Index sheet,, and press the relevant button in section 1b.*

In addition to the two user modes, a further level of protection has been introduced so that only input cells can be changed. To unprotect all cells, navigate to the Index sheet, and click 'Unprotect sheets'. The password is also '2020delivery'. To re-protect sheets, click 'Protect sheets', and choose a password (the user will need to choose a password every time the sheets are protected.

# 4 User guide, by level of user

This model has been constructed in such a way that most of its intended uses may be undertaken without a detailed understanding of either the mechanics of the model or the coding used to perform the calculations. In "Presentation mode" the model has been protected with a password to prevent the user inadvertently deleting formulae and thus breaking the model logic. More complex operations may be undertaken in "developer mode".

There are four different tasks that are explained below:

1. Running scenarios and adjusting user defined assumptions (Presentation mode)
2. Updating input data (Developer mode)
3. Adding new sites (Developer mode)
4. Producing maps from outputs (Developer mode)

Further assistance may be obtained by contacting 2020 Delivery directly (details given at the end of this document).

## 4.1 Running scenarios and adjusting user defined assumptions

The model provides the end user with functionality to:

Compare scenarios using existing user defined assumptions:

- Switch basis for patient flows for in centre haemodialysis patients between nearest within main provider's 'network' and nearest regardless of main provider
- Change site configuration by adding in pre-defined new sites at and / or turning off existing sites

Changing user defined assumptions:

- Incident rates by age-gender-ethnic group at network level
- Apply inflator or deflator to apply to future years incident rates
- Modality take on rates by age band and main provider
- Transition probabilities between modalities at main provider level

Update basic capacity and patient number data at dialysis site

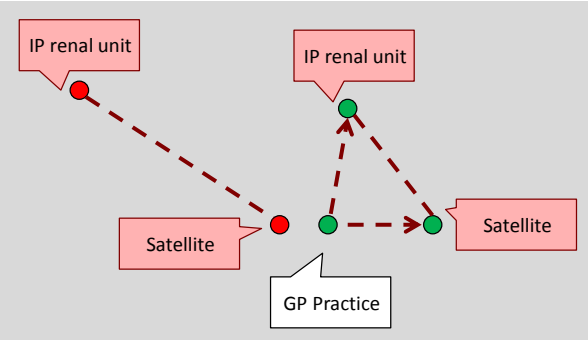
### 4.1.1 Change patients flows for in-centre haemodialysis patients

**How the model works:**

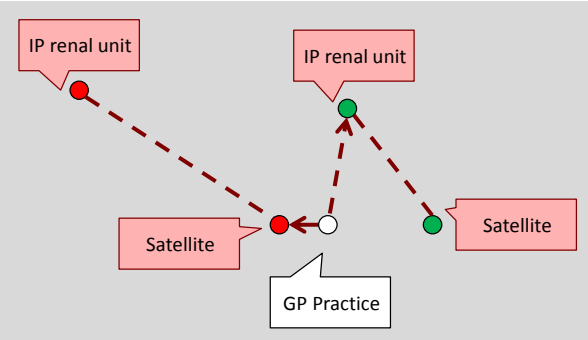
- Prevalent patients are calculated at the level of "pseudo" local authority (PLA), using the transition probabilities of the hub associated to that PLA
- Flows from each PLA to each dialysis satellite are calculated based on the travel time of the PLA's constituent GP practices to each satellite and the number of CKD registered patients at that practice – this gives a matrix of flows from each PLA to each satellite
- GP practices are used as proxy for centroid of population

- There are two options available within the model:
    1. Patients go to their nearest dialysis satellite belonging to their nearest inpatient renal unit
    2. Patients go to their nearest dialysis satellite (regardless of the parent hub)

**Option 1: patients flow to closest satellite belonging to their hub even if there is a closer dialysis site from a affiliated to a different hub**

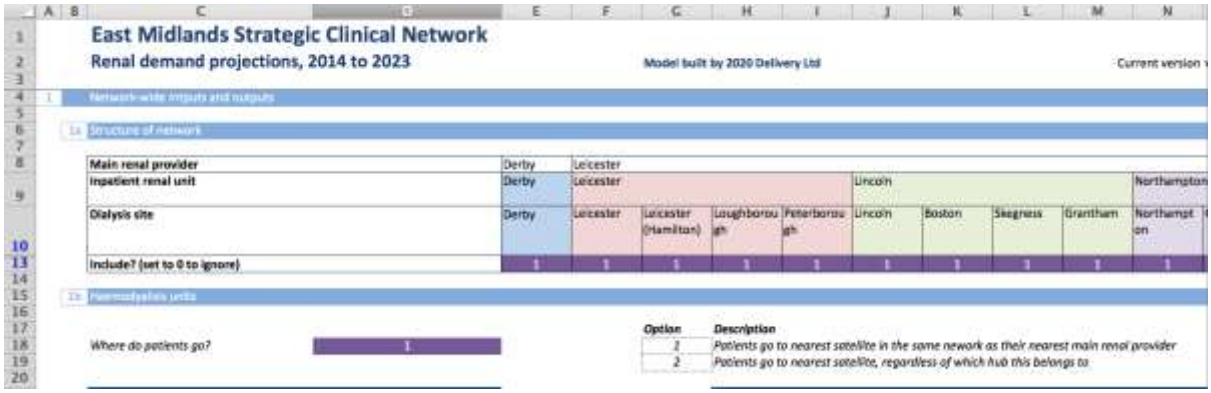



**Option 2: GP Practice remains 'linked' to nearest Renal IP for new patients and assumptions but HD patients flow to satellite nearest home**



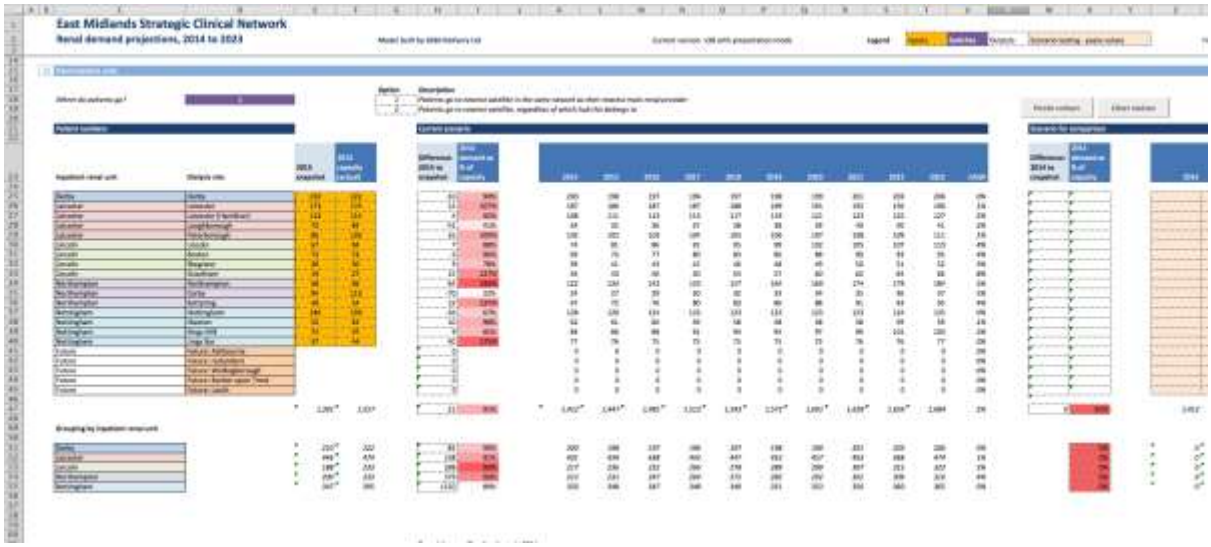

**How to apply the switch:**

- In order to switch between options 1 and 2:

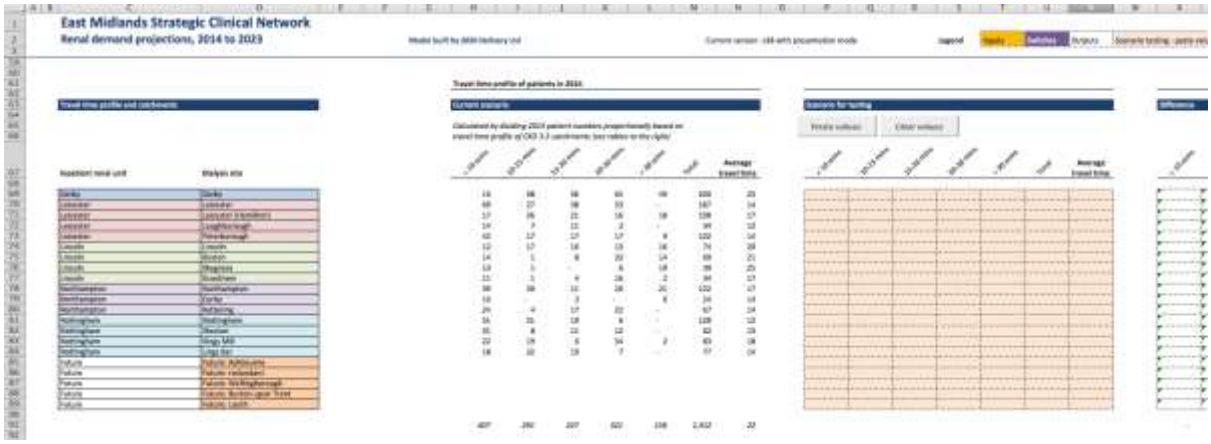


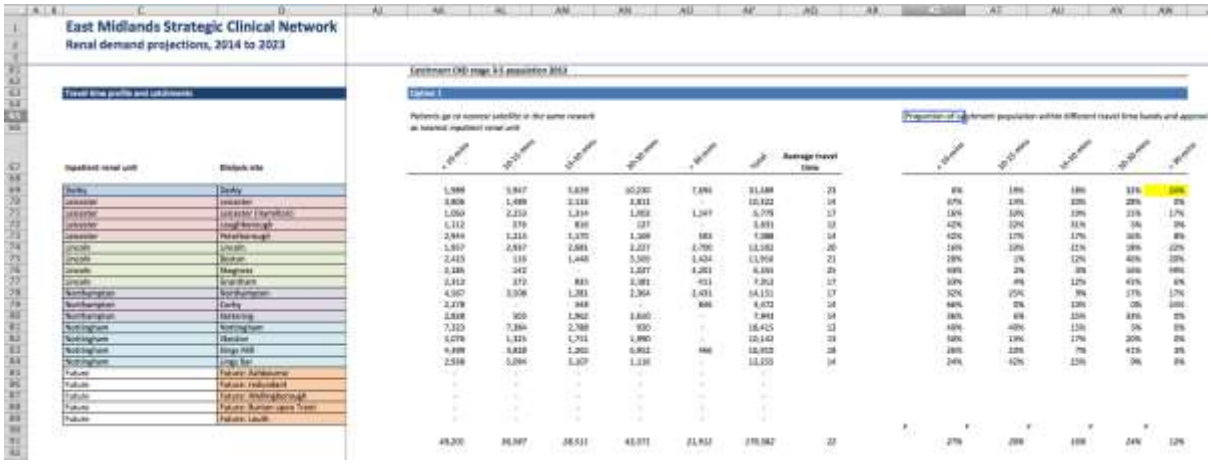

    - Go to the 'Main' sheet
    - Go to cell D18, and enter either 1 or 2
        - 1 – Patients go to nearest satellite in the same network as their nearest main renal provider (represents status quo)
        - 2 – Patients go to nearest satellite, regardless of which hub this belongs to

The output can be shown in a variety of ways. Below is the summary of projected patient numbers by dialysis site. This can be 'captured' and used for comparing with different scenarios by clicking in the "Paste values" button in cell W20 (and cleared by clicking on the "Clear values" button next to it). The paste values button then copies the current scenario and pastes it into the salmon coloured cells. A new scenario can then be run (e.g., switching cell D18 from 1 to 2) and the change in numbers is displayed.




This can also be used to compare travel times and catchment populations (see below):



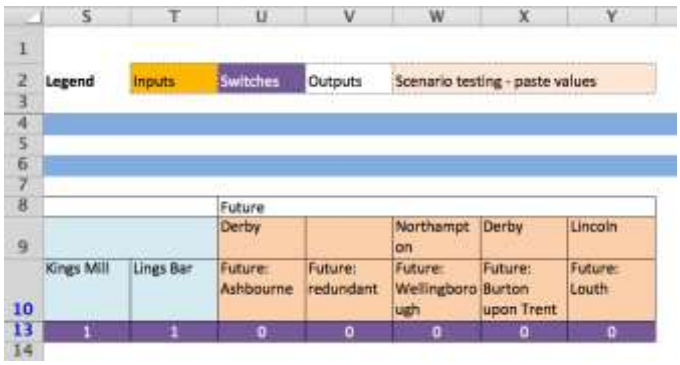

### 4.1.2 Dialysis site scenario testing with pre-loaded sites

One of the purposes of the model is to test various network configuration scenarios, such as closing an existing dialysis site and opening new ones.

A number of potential future sites have been pre-loaded into the model, and have been chosen as they represent likely possibilities for development of the network (or theoretical 'in fill' sites where access is poor). The post codes used to generate travel time data are based on current NHS sites.

- **Close an existing dialysis site -** In order to close a dialysis site that already exists,
  - Go to the 'Main' sheet
  - Find the site in the table from row 8 onwards (see image below)
  - Set the corresponding switch in row 13 to '0'.


- **Open new dialysis sites in pre-determined locations**
  - Pre-loaded locations
    - Burton: Peel Croft Surgery, Lichfield Street, Burton upon Trent, Burton-on-Trent, Staffordshire DE14 3RH
    - Wellingborough: Isebrook Hospital, Irthlingborough Road, Wellingborough NN8 1LP
    - Louth: County Hospital Louth, High Holme Rd, Louth, Lincolnshire LN11 0EU
    - Ashbourne: St Oswald's Hospital, Clifton Road, Ashbourne, Derbyshire DE6 1DR
  - In order to see what happens if a dialysis site was opened in one of these locations:
    - Go to the 'Main' sheet
    - Find the site in the table from row 8 onwards (see image below)
    - Set the corresponding switch in row 13 to '1'.

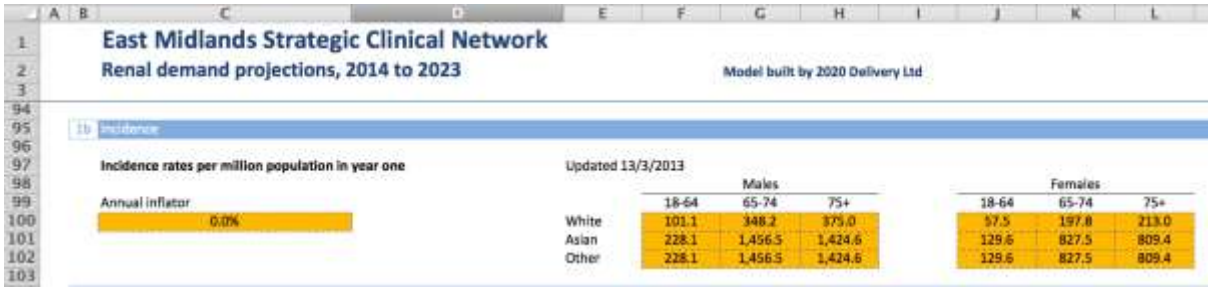



It is also possible to add new dialysis sites in any other location, but this requires additional travel time data to be generated and requires the user to be in 'development mode'. Instructions are given in subsequent sections of this document.

### 4.1.3 Changing user defined assumptions

The model is loaded with user defined assumptions which have been derived from a variety of sources. Each is easily changed where a user wishes to test different rates or where new information leads to an updating of the assumptions. Assumptions can be changed by typing over the existing assumptions in the relevant yellow cells. The following assumptions can be updated in the "Main sheet"

- **Incident rate risk factors:** These are defined for three broad age bands, for males and females and for three patient groups based on ethnic origin. This is shown in the screen shot below. In addition, there is an 'annual inflator' (which can also be negative or deflator) which can be used to model an increasing or decreasing incident rate.



East Midlands Strategic Clinical Network

Renal demand projections, 2014 to 2023

Model built by 2020 Delivery Ltd

1b Incidence

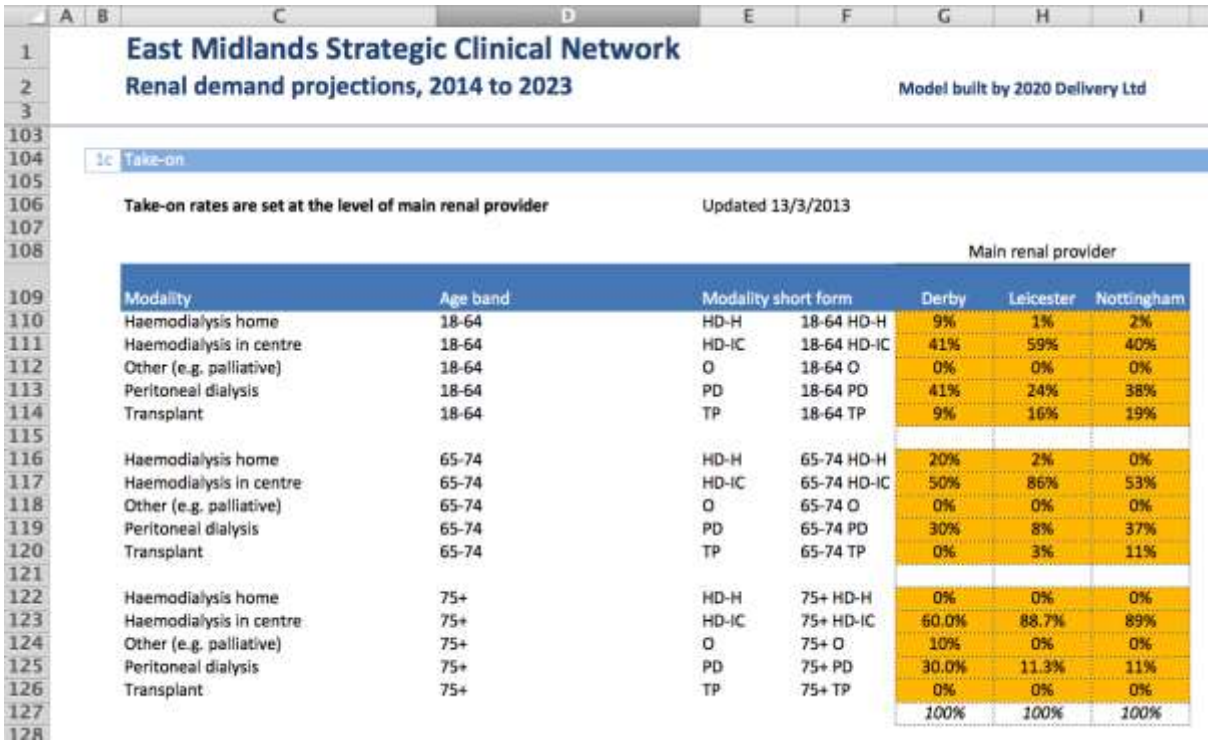
Incidence rates per million population in year one

Updated 13/3/2013

Annual inflator: 0.0%

| | Males | | | Females | | |
|---|---|---|---|---|---|---|
| | 18-64 | 65-74 | 75+ | 18-64 | 65-74 | 75+ |
| White | 101.1 | 348.2 | 375.0 | 57.5 | 197.8 | 213.0 |
| Asian | 228.1 | 1,456.5 | 1,424.6 | 129.6 | 827.5 | 809.4 |
| Other | 228.1 | 1,456.5 | 1,424.6 | 129.6 | 827.5 | 809.4 |

- **Modality take on rates:** These are defined for each of the three broad age bands, for each modality for each main provider. This is shown in the screen shot below. Each main provider by age band block must add to 100%.



East Midlands Strategic Clinical Network

Renal demand projections, 2014 to 2023

Model built by 2020 Delivery Ltd

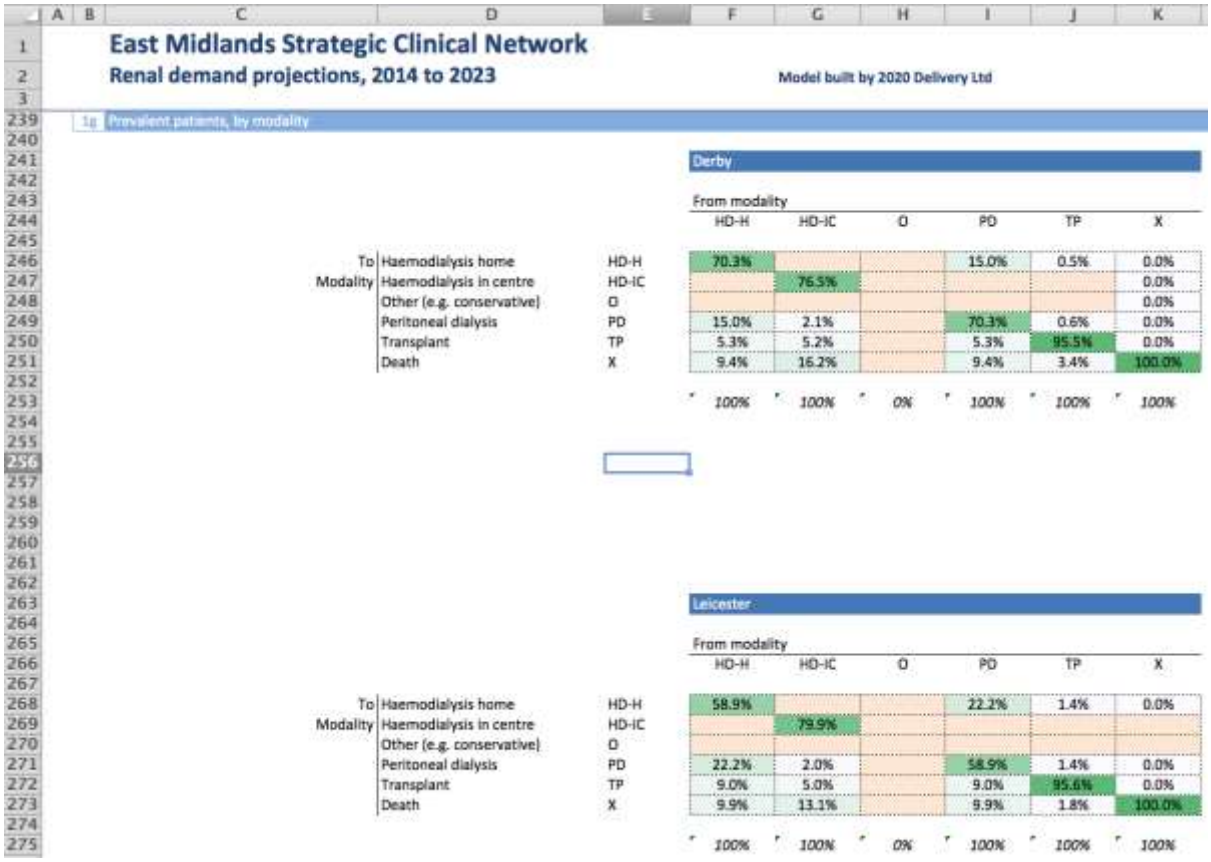
1c Take-on

Take-on rates are set at the level of main renal provider

Updated 13/3/2013

| | | | | Main renal provider | | |
|---|---|---|---|---|---|---|
| Modality | Age band | Modality short form | | Derby | Leicester | Nottingham |
| Haemodialysis home | 18-64 | HD-H | 18-64 HD-H | 9% | 1% | 2% |
| Haemodialysis in centre | 18-64 | HD-IC | 18-64 HD-IC | 41% | 59% | 40% |
| Other (e.g. palliative) | 18-64 | O | 18-64 O | 0% | 0% | 0% |
| Peritoneal dialysis | 18-64 | PD | 18-64 PD | 41% | 24% | 38% |
| Transplant | 18-64 | TP | 18-64 TP | 9% | 16% | 19% |
| | | | | | | |
| Haemodialysis home | 65-74 | HD-H | 65-74 HD-H | 20% | 2% | 0% |
| Haemodialysis in centre | 65-74 | HD-IC | 65-74 HD-IC | 50% | 86% | 53% |
| Other (e.g. palliative) | 65-74 | O | 65-74 O | 0% | 0% | 0% |
| Peritoneal dialysis | 65-74 | PD | 65-74 PD | 30% | 8% | 37% |
| Transplant | 65-74 | TP | 65-74 TP | 0% | 3% | 11% |
| | | | | | | |
| Haemodialysis home | 75+ | HD-H | 75+ HD-H | 0% | 0% | 0% |
| Haemodialysis in centre | 75+ | HD-IC | 75+ HD-IC | 60.0% | 88.7% | 89% |
| Other (e.g. palliative) | 75+ | O | 75+ O | 10% | 0% | 0% |
| Peritoneal dialysis | 75+ | PD | 75+ PD | 30.0% | 11.3% | 11% |
| Transplant | 75+ | TP | 75+ TP | 0% | 0% | 0% |
| | | | | *100%* | *100%* | *100%* |

- **Transition probabilities:** These are set out in matrices with the 'from' (current) modality shown across the page and the 'to' (future) modality shown down the page. Each 'from' column must add to 100% so that all prevalent patients transition to a future modality (including no change which are represented along the diagonal of the matrix). The transition probabilities are defined at main provider level (as shown in screen shot below). The probabilities for Nottingham can be found from cell V241 to the right of the Derby probabilities.



**East Midlands Strategic Clinical Network**

**Renal demand projections, 2014 to 2023**

Model built by 2020 Delivery Ltd

1g Prevalent patients, by modality

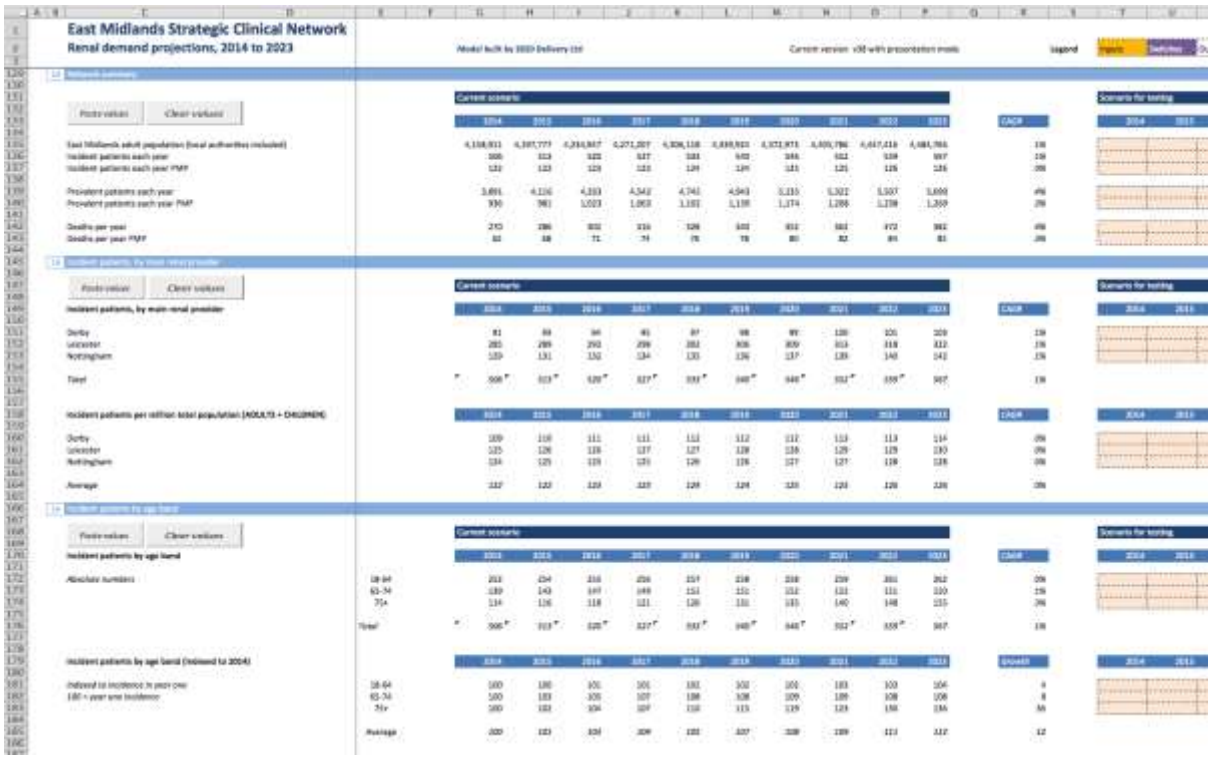
**Derby**

| | | | From modality | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | HD-H | HD-IC | O | PD | TP | X |
| To Modality | Haemodialysis home | HD-H | 70.3% | | | 15.0% | 0.5% | 0.0% |
| | Haemodialysis in centre | HD-IC | | 76.5% | | | | 0.0% |
| | Other (e.g. conservative) | O | | | | | | 0.0% |
| | Peritoneal dialysis | PD | 15.0% | 2.1% | | 70.3% | 0.6% | 0.0% |
| | Transplant | TP | 5.3% | 5.2% | | 5.3% | 95.5% | 0.0% |
| | Death | X | 9.4% | 16.2% | | 9.4% | 3.4% | 100.0% |
| | | | 100% | 100% | 0% | 100% | 100% | 100% |

**Leicester**

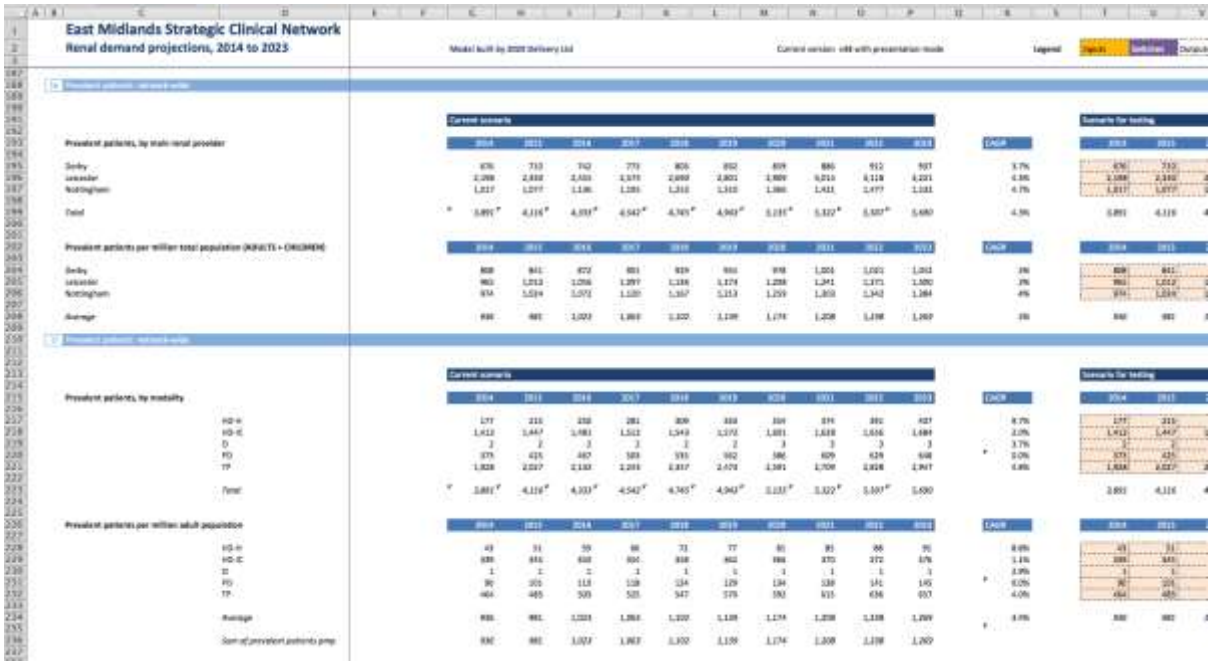
| | | | From modality | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | HD-H | HD-IC | O | PD | TP | X |
| To Modality | Haemodialysis home | HD-H | 58.9% | | | 22.2% | 1.4% | 0.0% |
| | Haemodialysis in centre | HD-IC | | 79.9% | | | | |
| | Other (e.g. conservative) | O | | | | | | |
| | Peritoneal dialysis | PD | 22.2% | 2.0% | | 58.9% | 1.4% | 0.0% |
| | Transplant | TP | 9.0% | 5.0% | | 9.0% | 95.6% | 0.0% |
| | Death | X | 9.9% | 13.1% | | 9.9% | 1.8% | 100.0% |
| | | | 100% | 100% | 0% | 100% | 100% | 100% |

The impact of changing these user defined assumptions can be observed in the main sheet which also allows two scenarios to be compared using the same 'paste values' approach outlined above. The screenshots below show how the incident patient and prevalent patient changes over time are displayed on "Main sheet".



**East Midlands Strategic Clinical Network**

**Renal demand projections, 2014 to 2023**




### 4.1.4 Updating basic dialysis site information

Users can update basic capacity and patient numbers at each current dialysis site to allow comparison with modelled numbers. This is done by typing over the current values in the yellow cells shown in the screen shot below (Main Sheet cells E25 to F40).


## 4.2 Updating input data (Developer mode)

A number of data sources have been used to populate the model, many of which can be updated annually to allow the model to project demand based on latest available data. In addition to updating user defined assumptions outlined above, further updates can be made to:

- Update prevalent patient ‘snapshot’
- Update historic data

It may also be necessary to update GP practice details and refresh ONS population data but these changes are more complex and beyond the scope of this document.

### 4.2.1 Update prevalent patient 'snapshot'

The model uses provider 'snapshot' data to define the prevalent patients in Year 0. This is input to sheet "Stock" as shown below. Some adjustments of provider data may be necessary where there are patient flows to main provider which are not included within the expected set of Local Authority-Main provider "pseudo-local authorities" (PLAs). For example, there may be Derby transplant patients included within Nottingham snapshot and for local authorities with a low level of split flows (e.g., Amber Valley) where any patients recorded at the 'minority' main provider should be added to the 'expected' main provider.

ToC **Stock** Current version v38 with ; ######

1 Inputs

1a Stock patients

Year "zero" (year before first year of model) 2013

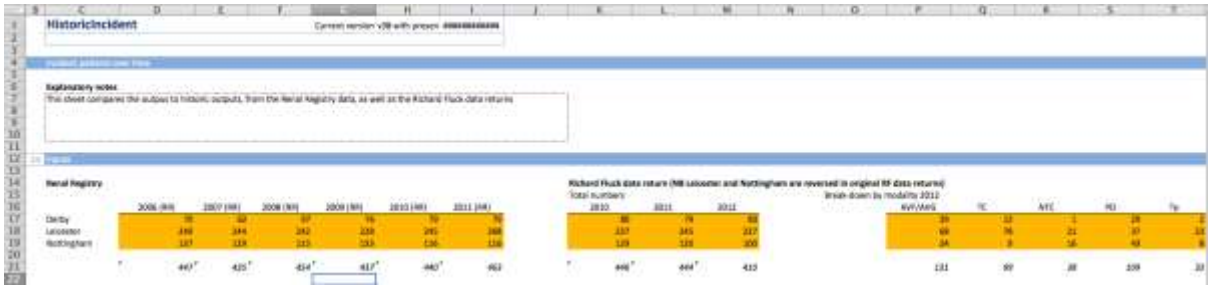
**Stock patients by local authority, hub and modality**

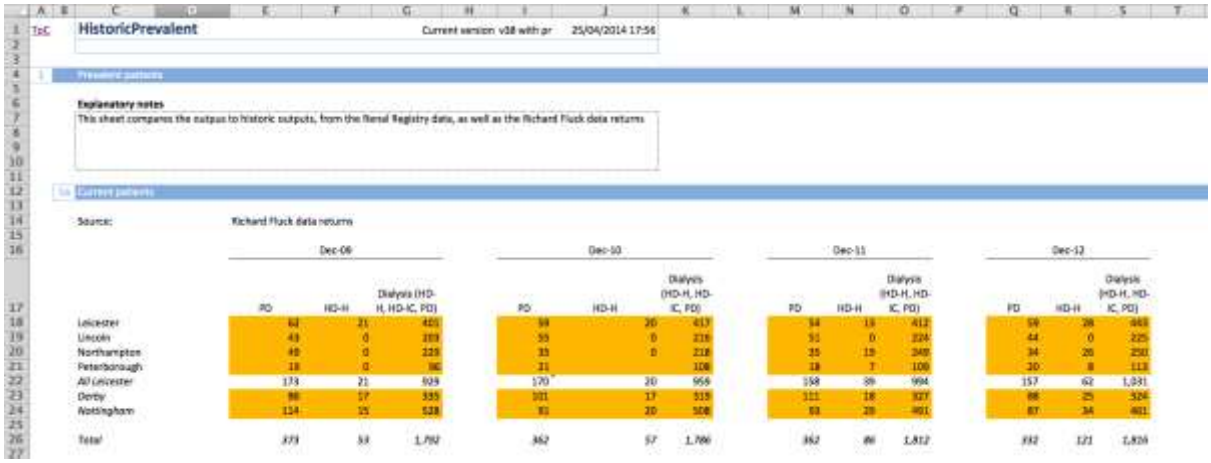
Death ('X') will always be zero, but is included because of the way the formulae work
Shaded rows relate to local authorities that do not flow to a single hub
This table is for patients in the year before the projections begin - year one is to be set
Updated 13/3/2013

| Local authority code | Local authority name | Inpatient renal unit ('hub') | Pseudo local authority name | HD-H | HD-IC | O | PD | TP | X |
|---|---|---|---|---|---|---|---|---|---|
| E06000013 | North Lincolnshire | Lincoln | E06000013 Lincoln | 0 | 1 | 0 | 0 | 1 | 0 |
| E06000015 | Derby | Derby | E06000015 Derby | 10 | 100 | 4 | 37 | 122 | 0 |
| E06000016 | Leicester | Leicester | E06000016 Leicester | 8 | 211 | 0 | 20 | 231 | 0 |
| E06000017 | Rutland | Leicester | E06000017 Leicester | 2 | 2 | 0 | 4 | 10 | 0 |
| E06000018 | Nottingham | Nottingham | E06000018 Nottingham | 7 | 118 | 0 | 28 | 135 | 0 |
| E06000031 | Peterborough | Leicester | E06000031 Leicester | 4 | 90 | 0 | 15 | 82 | 0 |
| E07000032 | Amber Valley | Derby | E07000032 Derby | 8 | 24 | 3 | 9 | 57 | 0 |
| E07000033 | Bolsover | Nottingham | E07000033 Nottingham | 1 | 12 | 0 | 1 | 9 | 0 |
| E07000034 | Chesterfield | Nottingham | E07000034 Nottingham | 1 | 0 | 0 | 0 | 4 | 0 |
| E07000035 | Derbyshire Dales | Derby | E07000035 Derby | 3 | 9 | 0 | 3 | 19 | 0 |
| E07000036 | Erewash | Nottingham | E07000036 Nottingham | 2 | 40 | 0 | 10 | 44 | 0 |
| E07000038 | North East Derbyshire | Derby | E07000038 Derby | 0 | 0 | 0 | 0 | 1 | 0 |
| E07000039 | South Derbyshire | Derby | E07000039 Derby | 5 | 13 | 0 | 4 | 37 | 0 |
| E07000129 | Blaby | Leicester | E07000129 Leicester | 1 | 28 | 0 | 4 | 40 | 0 |
| E07000130 | Charnwood | Leicester | E07000130 Leicester | 5 | 41 | 0 | 3 | 74 | 0 |
| E07000131 | Harborough | Leicester | E07000131 Leicester | 4 | 12 | 0 | 5 | 38 | 0 |
| E07000132 | Hinckley and Bosworth | Leicester | E07000132 Leicester | 2 | 16 | 0 | 4 | 43 | 0 |
| E07000133 | Melton | Leicester | E07000133 Leicester | 2 | 9 | 0 | 0 | 22 | 0 |
| E07000134 | North West Leicestershire | Derby | E07000134 Derby | 2 | 29 | 0 | 6 | 51 | 0 |
| E07000135 | Oadby and Wigston | Leicester | E07000135 Leicester | 1 | 19 | 0 | 3 | 25 | 0 |
| E07000136 | Boston | Leicester | E07000136 Leicester | 0 | 17 | 0 | 4 | 32 | 0 |
| E07000137 | East Lindsey | Lincoln | E07000137 Lincoln | 6 | 50 | 0 | 14 | 37 | 0 |
| E07000138 | Lincoln | Lincoln | E07000138 Lincoln | 2 | 19 | 0 | 4 | 40 | 0 |
| E07000139 | North Kesteven | Lincoln | E07000139 Lincoln | 4 | 35 | 0 | 7 | 27 | 0 |
| E07000140 | South Holland | Leicester | E07000140 Leicester | 0 | 31 | 0 | 4 | 18 | 0 |
| E07000141 | South Kesteven | Leicester | E07000141 Leicester | 5 | 28 | 0 | 10 | 52 | 0 |
| E07000142 | West Lindsey | Lincoln | E07000142 Lincoln | 0 | 22 | 0 | 8 | 19 | 0 |
| E07000150 | Corby | Leicester | E07000150 Leicester | 2 | 20 | 0 | 2 | 22 | 0 |
| E07000151 | Daventry | Northampton | E07000151 Northampton | 5 | 10 | 0 | 2 | 15 | 0 |
| E07000152 | East Northamptonshire | Northampton | E07000152 Northampton | 7 | 26 | 0 | 4 | 25 | 0 |
| E07000152 | East Northamptonshire | Leicester | E07000152 Leicester | 0 | 0 | 0 | 0 | 0 | 0 |
| E07000153 | Kettering | Northampton | E07000153 Northampton | 5 | 25 | 0 | 4 | 54 | 0 |
| E07000154 | Northampton | Northampton | E07000154 Northampton | 5 | 70 | 0 | 17 | 73 | 0 |
| E07000155 | South Northamptonshire | Northampton | E07000155 Northampton | 2 | 8 | 0 | 0 | 16 | 0 |
| E07000156 | Wellingborough | Northampton | E07000156 Northampton | 3 | 24 | 0 | 8 | 23 | 0 |
| E07000170 | Ashfield | Nottingham | E07000170 Nottingham | 0 | 36 | 0 | 8 | 54 | 0 |
| E07000172 | Broxtowe | Nottingham | E07000172 Nottingham | 3 | 37 | 1 | 9 | 54 | 0 |
| E07000173 | Gedling | Nottingham | E07000173 Nottingham | 3 | 24 | 0 | 8 | 30 | 0 |
| E07000174 | Mansfield | Nottingham | E07000174 Nottingham | 0 | 28 | 0 | 5 | 48 | 0 |
| E07000175 | Newark and Sherwood | Nottingham | E07000175 Nottingham | 7 | 26 | 0 | 13 | 59 | 0 |
| E07000175 | Newark and Sherwood | Lincoln | E07000175 Lincoln | 1 | 2 | 0 | 1 | 2 | 0 |
| E07000176 | Rushcliffe | Nottingham | E07000176 Nottingham | 3 | 33 | 0 | 2 | 54 | 0 |
| E07000193 | East Staffordshire | Derby | E07000193 Derby | 4 | 28 | 1 | 10 | 34 | 0 |
| E07000194 | Lichfield | Derby | E07000194 Derby | 1 | 1 | 0 | 6 | 6 | 0 |
| X00000001 | Redundant LA 1 | Derby | X00000001 Derby | 0 | 0 | 0 | 0 | 0 | 0 |
| X00000001 | Redundant LA 1 | Leicester | X00000001 Leicester | 0 | 0 | 0 | 0 | 0 | 0 |
| X00000002 | Redundant LA 2 | Leicester | X00000002 Leicester | 0 | 0 | 0 | 0 | 0 | 0 |
| X00000002 | Redundant LA 2 | Lincoln | X00000002 Lincoln | 0 | 0 | 0 | 0 | 0 | 0 |
| X00000003 | Redundant LA 3 | Leicester | X00000003 Leicester | 0 | 0 | 0 | 0 | 0 | 0 |
| X00000003 | Redundant LA 3 | Northampton | X00000003 Northampton | 0 | 0 | 0 | 0 | 0 | 0 |
| X00000004 | Redundant LA 4 | Leicester | X00000004 Leicester | 0 | 0 | 0 | 0 | 0 | 0 |
| X00000004 | Redundant LA 4 | Nottingham | X00000004 Nottingham | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | *136* | *1,374* | *9* | *306* | *1,839* | *0* | *3,664* |

### 4.2.2 Update other historic data

To help triangulate the outputs of the model with known 'actuals', the model also includes historic data for incident patients by modality and main provider and also for prevalent patients since 2007. This can be updated when the starting year is changed by overwriting existing data and adding latest year to sheet "HistoricIncident" and "HistoricPrevalent"



## 4.3 Adding new sites (Developer mode)

### 4.3.1 Add new dialysis sites and get travel time data

**How to add new sites**

The model allows for one further site to be added (more may be added, but this would require replacing one of the existing pre-loaded scenarios). Enter developer mode

1. Hit CTRL + F to bring up the "find and replace" dialogue box. Click the 'replace' tab at the top. Replace "Future: redundant" with "Future: site name". It is essential to write "Future: site name" and not just "Site name",as the site name may be similar to an existing county, site, or hub, which may cause problems. Choose "Workbook" from the "Within" drop-down menu. Click "Replace All".


2. Go to the 'Network' sheet, and enter the details of the new site in cells U8 to U15 (coloured as 'input' cells). All details are required, including which IP renal unit the new site would belong to, and the postcode. If the full address is not available or known, the postcode will suffice (see figure below)

3. Go to the TravelTimeMatrix sheet, and in column AT (coloured as 'input' cells), enter the

same details.

4. The model includes a macro to obtain travel time data from Bing Maps. To use this, the user will need to register for a key (a string of letters and numbers) which must be inserted into the macro code. For instructions on how to do this, please see below. Once this has been done, travel time data may be obtained for the new site by navigating to cell AT19 and typing =GetTimeInMins(AT$13, $D19), and then dragging this formula down to cell AT959 (or the last row with a postcode in column D).
5. Activate the new site by navigating to cell V13 on the 'Main' sheet; predicted patient numbers should appear in the table below.

**How to add the Bing maps API key**

1. The model includes a macro to obtain travel time data from Bing Maps, but does not include a key, which the user must obtain directly from Microsoft at https://www.microsoft.com/maps/choose-your-bing-maps-API.aspx.

2. Once the key has been obtained, this needs to be added to the Macro. To do this, enable the Developer ribbon (see Excel Help for instructions on how to do this), and click the "visual basic" icon. This will open the VBA editor.


3. On the left-hand side of the window, there will be a series of objects, relating to each of the sheets in the model. Below these there will be a series of 'modules'. Double click


MdBing.

4. Within this module, there are two macros, one, GetDistance, for obtaining the distance between two points (not used in the model), and another, GetTimeInMins, for obtaining the travel time (driving) between two postcodes. Within this there is a variable called apikey. Insert the Bing Maps API key between the speechmarks. Do not change any other

lines in the code.

```
Function GetTimeInMins(sPCode As String, ePcode As String) As Double

    'Define variable types
    Dim t As String
    Dim re As XMLHTTP

    'Set variable t to be Bing maps key
    apikey = " "
    t = "http://dev.virtualearth.net/REST/V1/Routes/Driving?o=xml&wp.0=" & sPCode & "&wp.1=" & ePcode & "&avoid=minimizeTolls&du=mi&key=" & apikey

    Set re = New XMLHTTP
    re.Open "get", t, False
    re.send

    Do
        DoEvents
    Loop Until re.readyState = 4

    With re
        s = Split(.responseText, "<TravelDuration>")
    End With

    GetTimeInMins = Val(s(1)) / 60

End Function
```

5. Exit the Visual Basic Editor. There is no requirement to save the code.

### 4.3.2 Add new dialysis sites outside of the East Midlands, or change existing out of area dialysis sites

**Turning 'on' and 'off' existing out-of-area providers**

The switches for toggling out-of-area providers on and off are not on the 'main' sheet, as is the case for the East Midlands providers. To turn these on and off:

1. Enter developer mode
2. Navigate to cell AX16 on the 'TravelTimeMatrix' sheet, and change the relevant cell to '0' or '1' to turn the desired site off or on, respectively.

**Adding new out-of-area dialysis sites**

To add new providers, follow the same procedure as for adding East Midlands dialysis sites, with the exceptions that in the 'Network' sheet, a new column will need to be added between columns X and Y, and in the TravelTimeMatrix sheet, a new column will need to be added between columns AW and AX.

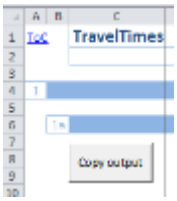
## 4.4 Producing maps from outputs (Developer mode)

### 4.4.1 Google Fusion maps

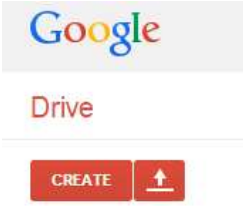
One of the strengths of the model is to be able to predict demand on a geographical basis. Outputs may be visualised through Google Fusion Tables, which allows for the user to generate maps demonstrating catchments.

In order to generate maps, the user will need an account on Google Drive. This may be obtained free at http://drive.google.com/.

1. Enter developer mode within the model
2. Go to the TravelTimes sheet and click 'Copy output':




3. Open a new workbook, and paste values into this document. Save this file.
4. Log in to Google Drive.
5. Click *Create* >> *Fusion Table (experimental)*




6. Click *Choose File* >> navigate to the file >> click *Next*
7. Ensure the field "full address" is marked as a location
8. Add map by clicking + >> *Add map*
9. Click *Map1* >> *Change Map*
10. From the *Location* drop-down menu on the left-hand side, choose "Practice full address"
11. Click *Change Feature Styles*
12. Click *Column* >> select icon type – this allows the user to change what is being plotted; the options available are as follows:
    a. Map icon (coloured by NEAREST INPATIENT RENAL UNIT)
    b. Map icon (coloured by travel time to NEAREST INPATIENT RENAL UNIT)
    c. Map icon (coloured by nearest SAME PROVIDER dialysis site)
    d. Map icon coloured by travel time to nearest SAME-PROVIDER dialysis site - travel option 1)
    e. Map icon (coloured by NEAREST dialysis site)
    f. Map icon (coloured by travel time to NEAREST dialysis site - travel option 2)
    g. Map icon (coloured by NEXT NEAREST dialysis site)
    h. Map icon (coloured by travel time to NEXT NEAREST dialysis unit)
13. In order to generate images of the maps, the user may take a snapshot of the map by using the Windows snipping tool, and pasting the resulting image into a document.

## 4.5 Other options in developer mode

### 4.5.1 Change population on which to base flows

The flows for both incident (local authority to inpatient renal unit) and haemodialysis patients (local authority to dialysis site), can be based on either the GP list sizes, or the stage 3-5 CKD population for each catchment. The default option is to bas e flows on the CKD stage 3-5 registered list 2013, as this will reflect demand more accurately (using CKD prevalence as a proxy for renal patient numbers).

#### *4.5.1.1 For incident patients*

Incident patients flow to their nearest inpatient renal unit for take-on, and therefore have the take-on probabilities of this unit applied to them.

- Go to the sheet **FlowsIncident**
- Change cell D15 (should look like the cell below) to either 1 or 2
    - 1 – default - this bases the flows on the CKD 3-5 registered list 2013
    - 2 – this bases the flows on the registered GP list size 2013


#### *4.5.1.2 For haemodialysis patients*

The flows from each pseudo-local authority to each dialysis site can be based on either the GP list sizes, or the stage 3-5 CKD population for each catchment. The default option is to base flows on the CKD stage 3-5 registered list 2013. In order to change this:

- Go to the sheet **FlowsPLA**
- Change cell D12 to either 1 or 2
    - 1 – default - this bases the flows on the CKD 3-5 registered list 2013
    - 2 – this bases the flows on the registered GP list size 2013


### 4.5.2 Change which sheets are hidden in Presentation Mode

In presentation mode, only the main input and output sheets are visible; however, in developer modes, all sheets are visible.

1. Enter developer mode
2. Navigate to the sheet **Sheet_Hiding**
3. Find the relevant sheet in column C, and change the corresponding cell in column D to the desired value: ‘TRUE’ for hidden in presentation model, ‘FALSE’ for always visible.

The user should remember to add new sheet names to this table, otherwise they will appear in both presentation and developer mode.

# 5 Additional information

## 5.1 Limitations

### 5.1.1 Main renal providers cannot be changed without updating the list of pseudo-local authorities

The pseudo-local authorities are defined by the main renal provider catchments, and therefore moving the main renal providers is not possible without updating the list of pseudo-local authorities. The details of the main renal providers can be changed in the same way as one would change the details of any dialysis site, but if the location were changed, the flow matrix would be incorrect. In order to change the structure of the network, a new list of pseudo-local authorities would need to be generated, based on the correct new flows, and this list would need to be updated in every calculation sheet. The instructions for this are beyond the scope of this user guide, and require further support from 2020 Delivery.

### 5.1.2 Pseudo-local authority population over-state at peripheries of region

Local authorities are split into pseudo-local authorities, based on which main renal provider patients are expected to flow to based on travel times. However, at the periphery of the region, some PLAs flow entirely within the region, whereas in reality, there may be some flow out of area. This causes there to be a slight over-estimation of the population in these areas.

### 5.1.3 Take-on rates and transition probabilities cannot be changed at level of inpatient renal unit (i.e., Northampton, Lincoln)

The take-on rates, and transition cannot be changed at the level of inpatient renal unit, only at the level of main renal provider. This is because there is too much variation between the theoretical patient flows and the actual flows within the Leicester sub-network, which would require too many manual over-rides in order for the patient numbers to accurately reflect the actuals. In addition, the transition probabilities were only supplied by Renal Registry at Main Provider level.

## 5.2 Data sources used

| Inputs | Source | Issues with inputs |
|---|---|---|
| GP practices | 2013 QOF database (list sizes used for flows)<br>- List size<br>- CKD list size<br>- Geographical details | None |
| Travel Times | Bing Maps (GP practice post code to satellite / renal inpatient units) | Two local authorities have 'unexpected' flows but generally catchments are within 5% or better |
| Population | ONS population estimates used for incidence<br>• ONS 2011 projections (for 2014 to 2021 figures)<br>• ONS 2010 projections (for 2021-22, 2022-23 growth rates) | None |
| Incidence | *Towards a Best Practice Tariff* slide pack – Department of Health; Renal Registry report (2011) | Overall numbers are above average of last 7 years by more than 2 standard deviations – potential scaling down of incident rates required |
| Take-on rates | • Estimated from 2013 Snapshot data provided | • Small numbers, particularly for certain age-modality groups |
| Transition probabilities | Renal Registry regional extract (Catherine Byrne) | No data on HD-H (haemodialysis at home):<br>• Probabilities from HD-H to other modalities are same as those from PD<br>• Probabilities *to* this modality also based on PD<br>• No information on 'other' modality – palliative care |
| Stock patients | • 31st Oct 2013 Snap-shot data from providers | 'Unexpected flows' and small number of out of area flows |
| In centre HD flows | Modelled prevalent patients allocated to satellite sites based on travel time derived patient flows | Potential locations for future dialysis sites built into model |

## 5.3 Glossary

| Term | Description |
|---|---|
| PLA | Pseudo-local authorities |
| HD-H | Haemodialysis at home |
| HD-IC | Haemodialysis in centre |
| PD | Peritoneal dialysis |
| TP | Transplant |
| X | Death |
| O | 'Other' modality – covers palliative care and gaps in provision |
| Main renal provider | Top-level provider: Derby, Leicester, Nottingham |
| Inpatient renal unit, or hub | Leicester, Lincoln, Northampton; used for take-on calculations |
| Dialysis site, or satellite | All other dialysis sites; each belongs to a hub |
| LA | Local authority |
| PLA | Pseudo-local authority (some local authorities' flows are split between different hubs) |

## 5.4 Further support

### 5.4.1 Changes to the model that require additional support

There are a small number of changes that may be made to the model that are complex, and beyond the scope of this user guide. These fall into two categories: refreshing the population data and changing the structure of the model.

- Refreshing the population data
    - Refresh ONS population data
    - Refresh GP practice details (such as list size, CKD registered population)
- Changing structure of model
    - Add or remove GP practices
    - Add new local authorities
    - Update list of pseudo-local authorities
    - Add new main renal providers ('hubs')
    - Add new inpatient renal units

## 5.5 Contact details

If these instructions do not answer your query, or you need to make the changes outlined in section 5.4.1, the team at 2020 Delivery will be able to assist.

- Quick queries may be answer via or email and phone calls to:
    - David Seymour: davidseymour@2020delivery.com (07768 463220)
    - Christopher Hadley christopherhadley@2020delivery.com (07595 062630)

If further assistance is required, a screen-sharing session or workshop may be organised; please contact David or Christopher in order to set this up.