Changes in Dementia Incidence, Prevalence, Severity and Mortality

Estimating future demand across the Dementia pathway

A support pack for commissioning Dementia services

NHS Dudley Clinical Commissioning Group
Key points for the CCG

There has been a sustained increase in Dementia prevalence in recent years, likely due in part to improved ascertainment.

There are significant practice variation in reported prevalence even accounting for age profiles.

There are estimated to be around 4,067 patients in the CCG with Dementia.

Currently 58.6% are on Dementia disease registers, compared to 58.0% regionally.

Projections for the CCG suggest there may be around 4,891 patients living with Dementia by 2021.

In order for the CCG to achieve the 67% diagnosis aspiration, they require 1,368 new diagnosis throughout 2015.

If not already, the CCG should consider implementing or improving the following interventions along the Dementia pathway:

- Primary prevention – CVD risk reduction
- More timely and accurate diagnosis
- Integrated care:
  - Social Care
  - MDT across 1° and 2° care
  - Training for housing and nursing home staff
- Ongoing palliative care
- Carer support
- Dementia friendly communities and hospitals
Background

There are currently estimated to be over ¾ million people in the UK living with Dementia, costing society over £26 billion per year. Returns from primary care disease registers and national prevalence estimates suggest a large diagnosis gap across the UK [1].

These numbers and costs are likely to rise materially over the coming years in line with demographic changes to the population [2].

Primary and secondary mental health services will require detailed information to support service planning.

HSCIC and NHS England have made information available on the underlying prevalence of dementia and the number of dementia cases known to primary care.

Whilst this information is useful, effective service planning will require detailed information about for example, the number of new cases of dementia, the progression of patients between mild, moderate and advanced stages and the number of dementia patients who are expected to die each year.

This support pack is intended to help understand the need for future dementia diagnosis and treatment services in their area and to identify and prioritise interventions.

[1] Dementia Prevalence Calculator, Primary Care Webtool, NHS England
There are 4 principle components to the analysis presented in this report:

1. A review of historic and current rates of formal diagnosis of Dementia from Primary Care registers

2. Estimates of the likely prevalence using the latest literature - thus deriving diagnosis rates.


Steps 1 & 2 replicate information that is already available via the HSCIC and NHS England’s Dementia Prevalence Calculator, however they are necessary steps in developing the model (step 3) that predicts the future burden of Dementia.

Whilst the modelled estimates in 3 & 4 are presented here unadjusted in the report, it should be noted that due to the margin for error, figures rounded to the nearest 50 or 100 should be used for planning assumptions.

NB. Due to slight methodological differences or variations in assumptions, the outputs of our modelling are comparable but may not match precisely with that of existing modelled estimates of dementia prevalence from other sources.
How to interpret the information

Box and Whisker plots:

These charts show the distribution of practice data in the CCG for each year of QOF. The green bars show the interquartile range (IQR, the middle 50% of practices) and the yellow circle on line shows the median (middle) value of all practices.

If the IQR is small, then the practices tend to have similar prevalence. A larger IQR suggests a greater variation in prevalence. If the median is not in the centre of the IQR then the data are skewed i.e. more practices are above/below the average.

Maximum and minimum outliers are also shown so the full extent of the data range can be seen.

SPC Funnel charts:

The funnel charts show the spread of reported prevalence data by practice in the context of the practice list size. Practices with smaller populations have a wider range of values that would be considered ‘normal’. The red lines in funnel shape represent control limits (equivalent to 3 standard deviations from the CCG mean). Practices falling outside these limits demonstrate ‘special cause variation’ and may be worthy of further investigation.

The reasons for high outliers may be that they are nursing home practices therefore have a particularly high prevalence. Similarly, those practices with very low prevalence may be University practices and thus have few patients with Dementia.

However, any outlying practice may also have good or poor processes in place to identify new Dementia patients.
1. Evaluation of changes over time and variation in reported Dementia prevalence

The following information utilises publically available QOF data at practice and CCG level.

Changes to diagnosed prevalence over time for practices and CCGs are compared to national and regional trends and assessed for significance of any differences.

The nature and extent of current variation in practice and CCG-level prevalence is evaluated using statistical process control methods to identify potential outliers.

Projections are provided for future disease register sizes to 2021 on the basis of 67% (2015) and 80% (2021) ascertainment rates.

For pre-CCG information, data is processed at practice level and aggregated to current CCG configurations. Where historic practices do not exist in current CCG configurations, they are allocated on a PCT-to-CCG best fit basis. Although small in number, this may affect some CCG outputs more than others.
1. Evaluation of changes over time and variation in reported Dementia prevalence

Trends in diagnosed prevalence, 06/07 to 14/15*

Reported prevalence trajectory (QOF) in CCG, Region and England (relative growth 06/07 to 14/15 in brackets):

- **NHS Dudley (108.8%)**
- West Midlands (86.4%)
- England (84.5%)

* Prevalence figures for 2014/15 are based on the Dementia-specific QOF returns as at March 2015 published by the HSCIC. Final QOF prevalence figures for 14/15, when published, may differ slightly.
1. Evaluation of changes over time and variation in reported Dementia prevalence

Variation in current reported prevalence [1]

Box and whisker plot - distribution of reported prevalence in GP practices, 2006/07 to 2014/15

NHS Dudley
1. Evaluation of changes over time and variation in reported Dementia prevalence

Variation in current reported prevalence [1]

Box and whisker plot - distribution of reported prevalence in GP practices, 2006/07 to 2014/15

NHS Dudley
1. Evaluation of changes over time and variation in reported Dementia prevalence

Variation in current reported prevalence [2]

Variation in reported dementia prevalence in 65+ population by practice, 2014/15
1. Evaluation of changes over time and variation in reported Dementia prevalence

Variation in current reported prevalence [3]

Practices with the highest number of cases relative to 65+ list size 2014/15:

<table>
<thead>
<tr>
<th>Code</th>
<th>Practice Name</th>
<th>Patients 65+</th>
<th>with Dementia</th>
</tr>
</thead>
<tbody>
<tr>
<td>M87018</td>
<td>SUMMERHILL SURGERY</td>
<td>1,904</td>
<td>630</td>
</tr>
<tr>
<td>M87601</td>
<td>KEELINGE HOUSE SURGERY</td>
<td>864</td>
<td>42</td>
</tr>
<tr>
<td>M87617</td>
<td>NETHERTON SURGERY</td>
<td>235</td>
<td>13</td>
</tr>
<tr>
<td>M87634</td>
<td>ST. THOMAS'S MEDICAL CENTER</td>
<td>47</td>
<td>3</td>
</tr>
<tr>
<td>M87024</td>
<td>WYCHBURY MEDICAL GROUP</td>
<td>4,399</td>
<td>178</td>
</tr>
</tbody>
</table>

The reasons for high outliers may be that the practice has a high volume of nursing home patients therefore has an artificially high prevalence. These practices may also have good early diagnosis processes in place.

Practices with the lowest number of cases relative to 65+ list size 2014/15:

<table>
<thead>
<tr>
<th>Code</th>
<th>Practice Name</th>
<th>Patients 65+</th>
<th>with Dementia</th>
</tr>
</thead>
<tbody>
<tr>
<td>M87023</td>
<td>WORDSLEY GREEN HEALTH CE</td>
<td>2,136</td>
<td>38</td>
</tr>
<tr>
<td>M87037</td>
<td>THE NORTHWAY SURGERY</td>
<td>1,376</td>
<td>25</td>
</tr>
<tr>
<td>M87021</td>
<td>COSELEY MEDICAL CENTRE</td>
<td>1,404</td>
<td>27</td>
</tr>
<tr>
<td>M87002</td>
<td>NORTON MEDICAL PRACTICE</td>
<td>1,513</td>
<td>31</td>
</tr>
<tr>
<td>M87605</td>
<td>CENTRAL CLINIC</td>
<td>580</td>
<td>6</td>
</tr>
</tbody>
</table>

Practices with very low prevalence may be University practices and thus have few patients with Dementia. Alternatively they may have poor processes in place to assess and refer potential Dementia patients.
1. Evaluation of changes over time and variation in reported Dementia prevalence

Geographical variation in reported prevalence

2006/07

2013/14

Legend

- CCG boundary
- Prevalence by Practice:
  - No Data
  - Lower Quartile
  - Lower-middle Quartile
  - Upper-middle Quartile
  - Upper Quartile

NB. Size of practice ‘squares’ is in relation to the median list size across the 2 periods. As such, any changes in size reflects an increase/decrease in list size to 2013/14.
2. Estimating the total number of Dementia patients

This analysis utilises the latest prevalence estimates [3,4] to model the likely true prevalence of Dementia. As these estimates combine pre-65 and 65+ age-specific prevalence from different sources, they may differ slightly from those published in the Dementia Prevalence Calculator.

Rates have been applied to Clinical Commissioning Groups using the most up-to-date age and gender resident population counts from ONS adjusted for registration to resident ratios [5].

A break-down of dementia diagnosis by severity/stage and by Dementia sub-type for the CCGs is presented.

For the purposes of this report, the definition of Dementia stages has been taken from Dementia UK report, 2007 [6].

The modelled prevalence for 2014 is compared to the year-to-date reported prevalence in 2014/15 to derive a ‘diagnosis rate’. The variation in this measure is assessed across the region at CCG level and by using statistical process control charts [7] to determine significant variance from the national average.

2. Estimating the total number of Dementia patients

This analysis utilises the latest prevalence estimates [3,4] to model the likely true prevalence of Dementia. As these estimates combine pre-65 and 65+ age-specific prevalence from different sources, they may differ slightly from those published in the Dementia Prevalence Calculator.

Rates have been applied to Clinical Commissioning Groups using the most up-to-date age and gender resident population counts from ONS adjusted for registration to resident ratios [5].

A break-down of dementia diagnosis by severity/stage and by Dementia sub-type for the CCGs is presented.

For the purposes of this report, the definition of Dementia stages has been taken from Dementia UK report, 2007 [6].

The modelled prevalence for 2014 is compared to the year-to-date reported prevalence in 2014/15 to derive a ‘diagnosis rate’. The variation in this measure is assessed across the region at CCG level and by using statistical process control charts [7] to determine significant variance from the national average.

2. Estimating the total number of Dementia patients

Overall burden of disease [1]

The current total estimated number of patients in the CCG with Dementia is **4,067**

This is projected to rise to **4,891** - a net increase of **824** by the year 2021.

<table>
<thead>
<tr>
<th>Dementia sub-type, 2014</th>
<th>Estimate</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alzheimer's disease</td>
<td>2,521</td>
<td>62%</td>
</tr>
<tr>
<td>Vascular dementia</td>
<td>691</td>
<td>17%</td>
</tr>
<tr>
<td>Mixed dementia</td>
<td>407</td>
<td>10%</td>
</tr>
<tr>
<td>Dementia with Lewy bodies</td>
<td>163</td>
<td>4%</td>
</tr>
<tr>
<td>Frontotemporal dementia</td>
<td>81</td>
<td>2%</td>
</tr>
<tr>
<td>Parkinson's dementia</td>
<td>81</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>122</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4,067</strong></td>
<td></td>
</tr>
</tbody>
</table>

In the latest available QOF data (2014/15 to Mar 31st) for disease registers **2,385** patients are being managed by GPs in the CCG for Dementia – a diagnosis rate of **58.6%** compared to **58.0%** across the region as a whole.

<table>
<thead>
<tr>
<th>Year</th>
<th>Mild</th>
<th>Moderate</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>2,325</td>
<td>1,297</td>
<td>445</td>
</tr>
<tr>
<td>2021</td>
<td>2,768</td>
<td>1,565</td>
<td>558</td>
</tr>
<tr>
<td>Change</td>
<td>443</td>
<td>268</td>
<td>113</td>
</tr>
<tr>
<td>% change</td>
<td>19.1</td>
<td>20.6</td>
<td>25.5</td>
</tr>
</tbody>
</table>
2. Estimating the total number of Dementia patients

Overall burden of disease [2]

Estimated number of people with Dementia by age and gender, 2014 and 2021

<table>
<thead>
<tr>
<th>Age-group</th>
<th>2014 Male</th>
<th>2014 Female</th>
<th>2021 Male</th>
<th>2021 Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-54</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>55-59</td>
<td>16</td>
<td>9</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td>60-64</td>
<td>79</td>
<td>81</td>
<td>82</td>
<td>83</td>
</tr>
<tr>
<td>65-69</td>
<td>109</td>
<td>166</td>
<td>98</td>
<td>154</td>
</tr>
<tr>
<td>70-74</td>
<td>220</td>
<td>197</td>
<td>249</td>
<td>220</td>
</tr>
<tr>
<td>75-79</td>
<td>298</td>
<td>413</td>
<td>354</td>
<td>470</td>
</tr>
<tr>
<td>80-84</td>
<td>396</td>
<td>479</td>
<td>494</td>
<td>533</td>
</tr>
<tr>
<td>85+</td>
<td>369</td>
<td>1,221</td>
<td>561</td>
<td>1,549</td>
</tr>
<tr>
<td>Aged 50+</td>
<td>1,494</td>
<td>2,573</td>
<td>1,864</td>
<td>3,027</td>
</tr>
</tbody>
</table>

The numbers of early-onset dementia cases in the CCG population are relatively small compared to the overall burden and unlikely to increase dramatically over the next few years.
2. Estimating the total number of Dementia patients

Variation in prevalence and diagnosis rates

Reported prevalence

Diagnosis rate

The CCG currently has well above average reported prevalence and current diagnosis rates compared to the region as a whole.

This may suggest overall the systems in place for the identification of disease are GOOD compared to the West Midlands, although improvements can always be made in diagnosis across disease stages, for all age groups and in some GP practices.
3. Predicting the future number of Dementia patients across the pathway.

Analysis at this level utilises the latest evidence of disease progression and mortality in dementia at a population level [10]. We have assumed a static age-specific incidence rate over time in the absence of quality evidence to the contrary.

The model parameters have been applied to the latest CCG-specific population projections [11]. These projections are based on resident populations within CCG geographical boundaries.

As such, prior to modelling we have adjusted the total resident population by historic CCG registered-to-resident population ratios and applied the resident-based age and gender population distribution to obtain estimates for CCG-registered populations.

A Markov chain model approach is used to allocate numbers of patients to different states of disease over time, forecasting these likely states up to 2021. These are compared to aspirational diagnosis rates to 2015 and 2021 of 67% and 80% respectively to identify opportunities for the identification of new cases of dementia.


3. Predicting the future number of Dementia patients across the pathway.

Overall burden of disease [1]

Estimated number of prevalent cases of Dementia by stage and gender, 2012 to 2021

NHS Dudley

Mild

Moderate

Advanced

All stages
3. Predicting the future number of Dementia patients across the pathway.

Prevalence by disease stage

Estimated and projected dementia prevalence by stage, 2014 and 2021

<table>
<thead>
<tr>
<th>Year</th>
<th>Advanced</th>
<th>Moderate</th>
<th>Mild</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>431</td>
<td>1,264</td>
<td>2,269</td>
<td>19.1</td>
</tr>
<tr>
<td>2021</td>
<td>558</td>
<td>1,565</td>
<td>2,768</td>
<td>25.5</td>
</tr>
</tbody>
</table>

% change
Aspiration and opportunity for diagnosis

Opportunity for case-finding - the gap between estimated and diagnosed patients:

NHS Dudley

‘Diagnosis gap 1’ refers to the difference between diagnosed numbers at the current rate (Jan ’15) and the aspirational rate for the CCG.

‘Diagnosis gap 2’ is the difference between 100% ascertainment of estimated cases and the aspirational rate for the CCG.
### Diagnosis requirements for the CCG

<table>
<thead>
<tr>
<th>Year</th>
<th>No. on Register (current rate)</th>
<th>Aspirational no. on register</th>
<th>Deaths from register prior year</th>
<th>New diagnosis requirement</th>
<th>New diagnosis required pppy^*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013~</td>
<td>1,914</td>
<td>1,914</td>
<td>455</td>
<td>652</td>
<td>14</td>
</tr>
<tr>
<td>2014~</td>
<td>2,385</td>
<td>2,385</td>
<td>450</td>
<td>921</td>
<td>19</td>
</tr>
<tr>
<td>2015</td>
<td>2,445</td>
<td>2,793</td>
<td>459</td>
<td>867</td>
<td>18</td>
</tr>
<tr>
<td>2016</td>
<td>2,506</td>
<td>2,955</td>
<td>476</td>
<td>638</td>
<td>13</td>
</tr>
<tr>
<td>2017</td>
<td>2,574</td>
<td>3,131</td>
<td>485</td>
<td>660</td>
<td>14</td>
</tr>
<tr>
<td>2018</td>
<td>2,648</td>
<td>3,319</td>
<td>499</td>
<td>687</td>
<td>14</td>
</tr>
<tr>
<td>2019</td>
<td>2,723</td>
<td>3,513</td>
<td>517</td>
<td>711</td>
<td>15</td>
</tr>
<tr>
<td>2020</td>
<td>2,797</td>
<td>3,711</td>
<td>531</td>
<td>729</td>
<td>15</td>
</tr>
<tr>
<td>2021</td>
<td>2,868</td>
<td>3,912</td>
<td>554</td>
<td>755</td>
<td>16</td>
</tr>
</tbody>
</table>

^ pppy = per practice per year
* assuming diagnosis gap met in prior year
~ actual numbers on register as per QOF

The ‘opportunity’ for diagnosis presented here is based on numbers of aspirational cases at year end (point prevalence). The sum of the change from the previous years’ point prevalence (at aspirational rate) plus deaths during the prior year equate to the ‘opportunity’.

As such, the number of newly identified patients required in any given period to even maintain the diagnosis rate exceeds that of the simple gap between the current and previous diagnosis aspirations.

The figures for each year depend on the previous year’s diagnosis aspiration being met. Should they not, the volumes will accumulate and the gap become more challenging to close.
3. Predicting the future number of Dementia patients across the pathway.

Estimated patient flows for the CCG

The numbers of incident cases are rising steadily due to demographic changes, however the rate remains constant.

The number of deaths are estimated to rise at a slightly slower rate, hence the incremental growth in prevalence each year.

Across the CCG between 390 and 480 patients will progress from mild to moderate disease each year, and a further 130 to 160 from moderate to advanced stage disease.

The scale and nature of services for patients and their carers along each element of this pathway will vary by CCG. Where numbers are fairly small, neighbouring CCGs may wish to co-commission some services.
4. Estimates of Dementia in care and nursing homes.

Methods and summary
The exact number of persons living in care homes is not known. There has been no national data collection for GP populations since September 2011, for which an overall ‘Nursing Home’ population was counted [8].

The Census tells us how many people within a specified residential area live in care homes by type (Local Authority / Other with nursing / Other without nursing).

By applying these proportions to the latest CCG registered populations we can estimate the likely numbers in homes by type and thus derive further estimates of the numbers in the CCG with Dementia.

The prevalence estimates used here are the setting-based consensus estimates taken from the 2014 Dementia UK update report [9].

2021 estimates are based on the changes to the combined population prevalence of moderate and severe disease predicted by our model to that time. Overall numbers in nursing homes are assumed to remain constant.

<table>
<thead>
<tr>
<th>CCG Patients in residential care (all)</th>
<th>All*</th>
<th>2014</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>With dementia*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCG Patients in residential care (all)</td>
<td>2,025</td>
<td>1,280</td>
<td>1,518</td>
</tr>
<tr>
<td>Patients in Local Authority care homes</td>
<td>99</td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>Patients in other care homes w/o nursing</td>
<td>1,214</td>
<td>703</td>
<td>840</td>
</tr>
<tr>
<td>Patients in other care homes with nursing</td>
<td>712</td>
<td>520</td>
<td>621</td>
</tr>
</tbody>
</table>

* Summed figures may differ to overall figures due to rounding

NB. These are broad estimates only, intended for high-level planning use. Specific and up-to-date local data collections would be required at GP or care home level when considering the design and scale of care home services and/or interventions.

[8] Health and Social Care Information Centre, Indicator Portal, Data item number P01109
List of appendices


2. Dementia pathway intervention points

3. Other resources and links

4. Markov model explained

5. Additional modelling assumptions
Appendix 1a: Markov Chain Model outputs: Baseline year (2014)

Dementia patient stocks and flows, 2014: NHS Dudley

NHS Dudley

Dementia patient stocks and flows, 2014:
Appendix 1b: Markov Chain Model outputs: Final year (2021)

Dementia patient stocks and flows, 2021: NHS Dudley

- **Undiagnosed**
  - MILD: 1,362
  - MODERATE: 303
  - ADVANCED: 17
  - Deaths: 145

- **Diagnosed**
  - MILD: 1,280
  - MODERATE: 192
  - ADVANCED: 183
  - Deaths: 78
Appendix 2: Intervention points and management of disease

Dementia patient stocks and flows, 2014: NHS Dudley

Primary Prevention:
- Promote wellbeing
- ‘Dementia Friendly’

Timely Accurate Diagnosis:
- Primary Care assessment & referral
- Self help information

Ongoing Care:
- IAPT
- Genetic counselling
- Dental / Hearing / Sight checks

Memory Assessment:
- Multi-disciplinary
- Expert diagnosis

Integrated Care:
- Dementia friendly housing
- Integrated CMHT
- Reablement / Intermediate Care
- Quality residential / nursing care

Palliative Care:
- End-of-life
- Bereavement

Advanced Care:
- Home treatment / Crisis intervention
- Appropriate Home & Respite care
Appendix 3: Other resources and useful links

Information and Intelligence:

1. Dementia Prevalence calculator -
https://www.primarycare.nhs.uk/default.aspx

Information and interactive reports of practice and higher-level reported and estimated prevalence snapshots (updated monthly).

2. Mental Health, Dementia and Neurology Intelligence Network -
http://fingertips.phe.org.uk/profile-group/mental-health

Series of profiles and reports on common or severe mental health, dementia and neurology conditions.

3. Health and Social Care Information Centre -
http://www.hscic.gov.uk/dementia

Range of information and reports on timely diagnosis, QOF, prescribing audits and the MHMDS in relation to Dementia.

Commissioning support:

4. West Midlands SCN -

Information on current projects and commissioning resources available from the SCN.

5. National Institute for Health and Care Excellence -
http://www.nice.org.uk/search?q=Dementia

All the latest UK guidance, quality standards and evidence on Dementia from NICE.

6. ‘Dementia Partnerships’ hub -
http://dementiapartnerships.com/resource/dementia-commissioning-pack/

Wide range of Dementia commissioning tools and templates grouped by stages and settings.
Appendix 4. Markov model explained

A Markov chain is a process with a finite number of states and dependent events. The likelihood of a patient moving from one state (e.g. Mild dementia, undiagnosed) to another (e.g. diagnosed) is generally pre-determined by available evidence or expert consensus. The ‘flows’ of patients through states are applied to the ‘stocks’ from previous periods (in this case a period = 1 year) in order to estimate the ‘stocks’ in future periods.

Specific formulae for our model:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Ref</th>
<th>Derivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalent Cases – Mild, Moderate, Advanced</td>
<td>P1,2,3</td>
<td>Population projection x Age and gender specific dementia prevalence rates</td>
</tr>
<tr>
<td>Prevalent Cases - Total</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Incident Cases</td>
<td>I</td>
<td>Population projection x Age and gender specific dementia incidence rates</td>
</tr>
<tr>
<td>Death of Prevalent Cases - Mild</td>
<td>D1</td>
<td>Prevalent cases x Age and gender and CCG specific mortality rate</td>
</tr>
<tr>
<td>Death of Prevalent Cases - Moderate</td>
<td>D2</td>
<td></td>
</tr>
<tr>
<td>Death of Prevalent Cases - Advanced</td>
<td>D3</td>
<td></td>
</tr>
<tr>
<td>Death of Prevalent Cases - Total</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Prevalent Cases - Mild &gt; Moderate</td>
<td>T1</td>
<td>T1(t+1) = P3(t+1)-P3(t)+D3(t+1)</td>
</tr>
<tr>
<td>Prevalent Cases - Moderate &gt; Advanced</td>
<td>T2</td>
<td>T2(t+1) = P2(t+1)- P2(t)+D2(t+1)+T1(t+1)</td>
</tr>
<tr>
<td>Diagnosed Cases - Mild</td>
<td>R1</td>
<td>R1(t+1) = R(t+1) - R2(t+1) - R3(t+1)</td>
</tr>
<tr>
<td>Diagnosed Cases - Moderate</td>
<td>R2</td>
<td>R2(1) = 0.7 R2(t+1) = (R2(t)/(P32(t) +0.03) x P2(t+1)</td>
</tr>
<tr>
<td>Diagnosed Cases - Advanced</td>
<td>R3</td>
<td>R3(1) = 0.95 R3(t+1) = (R3(t)/(P3(t) +0.0053) x P3(t+1)</td>
</tr>
<tr>
<td>Diagnosed Cases - Total</td>
<td>R</td>
<td>R(t+1) = (R(t)/P(t) +0.03)*P(t+1)</td>
</tr>
<tr>
<td>Diagnosed Cases - Mild &gt; Moderate</td>
<td>S1</td>
<td>S1(t+1) = P1(t+1)xR1(t+1) / T1(t+1)</td>
</tr>
<tr>
<td>Diagnosed Cases - Moderate &gt; Advanced</td>
<td>S2</td>
<td>S2(t+1) = P2(t+1)xR2(t+1) / T2(t+1)</td>
</tr>
<tr>
<td>Death of Diagnosed Cases - Mild</td>
<td>E1</td>
<td>E1(t+1) = E(t+1) - E2(t+1) - E3(t+1)</td>
</tr>
<tr>
<td>Death of Diagnosed Cases - Moderate</td>
<td>E2</td>
<td>E2(t+1) = D2(t+1) x 0.8</td>
</tr>
<tr>
<td>Death of Diagnosed Cases - Advanced</td>
<td>E3</td>
<td>E3(t+1) = D3(t+1) x 0.95</td>
</tr>
<tr>
<td>Death of Diagnosed Cases - Total</td>
<td>E</td>
<td>E(t+1) = D(t+1) x 0.8</td>
</tr>
<tr>
<td>New Diagnoses – Mild, Moderate, Advanced</td>
<td>N1,2,3</td>
<td>N(t+1) = (N(t+1)-N2(t+1)-N3(t+1)</td>
</tr>
<tr>
<td>New Diagnoses - Total</td>
<td>N</td>
<td>N(t+1) = E(t+1)+R(t+1)-R(t)</td>
</tr>
</tbody>
</table>
Appendix 5: Additional assumptions used in the modelling

The aspirational diagnosis for 2015 is set at 67% in line with the National Dementia Challenge. Where current CCG diagnosis exceeds that, the current rate is used for maintenance purposes.

The aspirational diagnosis for 2021 is set arbitrarily at 80%.

Currently it is assumed that 70% of those with moderate disease and 95% of those with advanced disease are on disease registers. Both are assumed to be at 100% ascertainment by 2021.

That 20% of dementia patients die before formal diagnosis. This remains unchanged to 2021.

That the rates of all cause mortality by CCG follow the same distribution as Dementia specific mortality rates by CCG.

That the distribution of the over 85 projected population for England & Wales is the same for each CCG.

That the number of practices per CCG will remain the same up to 2021.

That the sub-types of Dementia follow the same distribution for each CCG.

The adjustment to nursing home dementia patients for changes in population prevalence of moderate/severe cases to 2021 only apply to non Local Authority care homes.
Andrew Hood

T: 0121 612 2800
E: andrewhood@nhs.net
A: Kingston House | 438 -450 High Street |
  West Bromwich | B70 9LD
M: 07720 343930