



# Community Services allocations formula

For 2019/20 to 2023/24 revenue  
allocations

# Community Services allocations formula

For 2019/20 to 2023/24 revenue allocations

Version number: 1.0

First published: November 2019

Prepared by: NHS England – Analysis and Insight for Finance

Classification: OFFICIAL

Promoting equality and addressing health inequalities are at the heart of NHS England's values. Throughout the development of the policies and processes cited in this document, we have:

Given due regards to the need to eliminate discrimination, harassment and victimisation, to advance equality of opportunity, and to foster good relations between people who share a relevant protected characteristic (as cited under the Equality Act 2010) and those who do not share it;

Given regard to the need to reduce inequalities between patients in access to, and outcomes from, healthcare services and in securing that services are provided in an integrated way where this might reduce health inequalities.

# Contents

- 1 Introduction and summary ..... 4**
- 2 District nursing..... 5**
- 3 Datasets ..... 7**
  - 3.1 Community Services Data Set ..... 7
  - 3.2 Kent Integrated Dataset ..... 7
  - 3.3 West Midlands ..... 8
  - 3.4 Leeds ..... 8
- 4 Model Development..... 9**
  - 4.1 Analysis of Kent Integrated dataset ..... 9
  - 4.2 Analysis of West Midlands dataset ..... 10
  - 4.3 Validation using the Leeds dataset ..... 12
  - 4.4 Comparison of CCG need weights..... 14
  - 4.5 Regression Model ..... 15
  - 4.6 Additional model testing ..... 16
- 5 Model implementation..... 18**
  - 5.1 Calculation of weighted populations..... 18
  - 5.2 Community services model scope ..... 18
- 6 Appendices ..... 21**
  - Appendix 1 – Analysis of Variation (ANOVA) of district nursing contact rates across the five selected Kent CCGs (2016/17) ..... 21
  - Appendix 2 – district nursing activity model ..... 22
  - Appendix 3 – model alternatives ..... 24

## 1 Introduction and summary

This paper describes a new model that has been developed for the 2019/20 allocations round to introduce a separate community services component of the CCG core services target formula. The model was developed using data that were not available when the previous formula for CCG core services was being developed<sup>1</sup>. In previous allocation rounds the resources for community services have been distributed using the general and acute component of the formula. This was a significant and acknowledged limitation of the previous CCG formula.

For the purposes of CCG allocations, community services are CCG funded health services which take place outside of a hospital setting and are not part of the primary medical care portfolio. Community services cover a wide range of service types and different CCGs will commission different sets of services depending on the make-up of their populations and on historical factors affecting service provision in their area.

In 2017/18 community health services accounted for 9% of total CCG core service spending (£7.3bn). The most common forms of community services are district nursing or long-term condition management, intermediate care, podiatry and children's services. Other services include physiotherapy and speech and language therapy.

Community mental health services are excluded here as they are included in the mental health formula. Community services funded by local authorities, such as health visiting and school nursing, are also out of scope<sup>2</sup>.

In order to develop this model, we have focused our analysis on contact with district nursing, because:

- it represents a large part of the spend on community health services (18%);
- it is provided universally across England; and
- the age profile of service recipients is significantly different to the profile for general and acute services, rising even more steeply for recipients in their 70s and 80s. This very strongly indicates that the need for such services is different to general and acute services

We have considered new data collected by NHS Digital for its Community Services Data Set (CSDS), and data from local datasets (covering parts of Kent, the West Midlands and Leeds). Further validation of the analysis was based on data from NHS Benchmarking and NHS Programme Budgeting.

We have developed an activity based model of district nursing based on the demographic characteristics of the GP registered population (using age, sex and deprivation as drivers of activity). We will continue to analyse both national and local community service data sets in order to continue to improve our allocations formula in future rounds.

---

<sup>1</sup> <https://www.england.nhs.uk/wp-content/uploads/2016/04/3-rep-elland-all-sections.pdf>

<sup>2</sup> Responsibility for commissioning health visiting, and other children's public health services, transferred from NHS England to local authorities on 1 October 2015. Local authorities have had responsibility for school nursing since April 2013 as part of the wider transfer of service commissioning for 0 to 19 year olds.

Our analysis suggests that 50% of all community service activity (weighted by expenditure) varies in a similar way to district nursing. The community services component of the core CCG formula will therefore be used to distribute 50% of the resources for community services with the remaining 50% continuing to be distributed in-line with the general acute component of the formula.

In section 2 there is a brief description of district nursing and section 3 describes the data sets used in our analysis. Sections 4 and 5 describe the development of the community services model and how that model has been implemented.

## 2 District nursing

Community services cover a wide range of service types and different CCGs will offer different sets of services depending on the make-up of their populations and on historical factors affecting service provision in their area. The most common forms of service are district nursing or long-term condition management, intermediate care (step-down care often following an inpatient stay), podiatry and children's services. Services also include physiotherapy and speech and language therapy.

We have focused our analysis on contact with district nursing, because:

- it represents a large part of the spend on community health services (18%<sup>3</sup>);
- it is provided universally across England; and
- the age profile of service recipients is significantly different to the profile for general and acute services, rising even more steeply for recipients in their 70s and 80s. This very strongly indicates that the need for such services is different to general and acute services. This is shown in figure 1, below.

A district nursing team provides nursing care to people in their homes<sup>4</sup> in a defined geographical area or for a GP registered list<sup>5</sup>. It is a nurse-led service with a team leader who will normally have a district nursing specialist practitioner qualification. District nursing co-ordinates care with individuals through acute illness, long-term and multiple health challenges and at the end of life. They work closely with general practice, social care, community pharmacy, nursing specialisms, allied health professionals and others<sup>6</sup>. The close relationship with general practice explains the high referral rate seen from GPs, higher than from secondary care which is further reason to develop a component of the allocation formula separately from general and

---

<sup>3</sup> Department of Health (2015) quoted in The King's Fund paper "Understanding quality in district nursing services" (2016)

<sup>4</sup> 95% of district nursing contacts in the patient's home and 3% in a care/nursing home across five selected Kent CCGs (2016/17)

<sup>5</sup> The Royal College of Nursing survey suggested that a 'typical' district nursing team covers a population of slightly more than 5,000 people quoted in The King's Fund paper (2016)

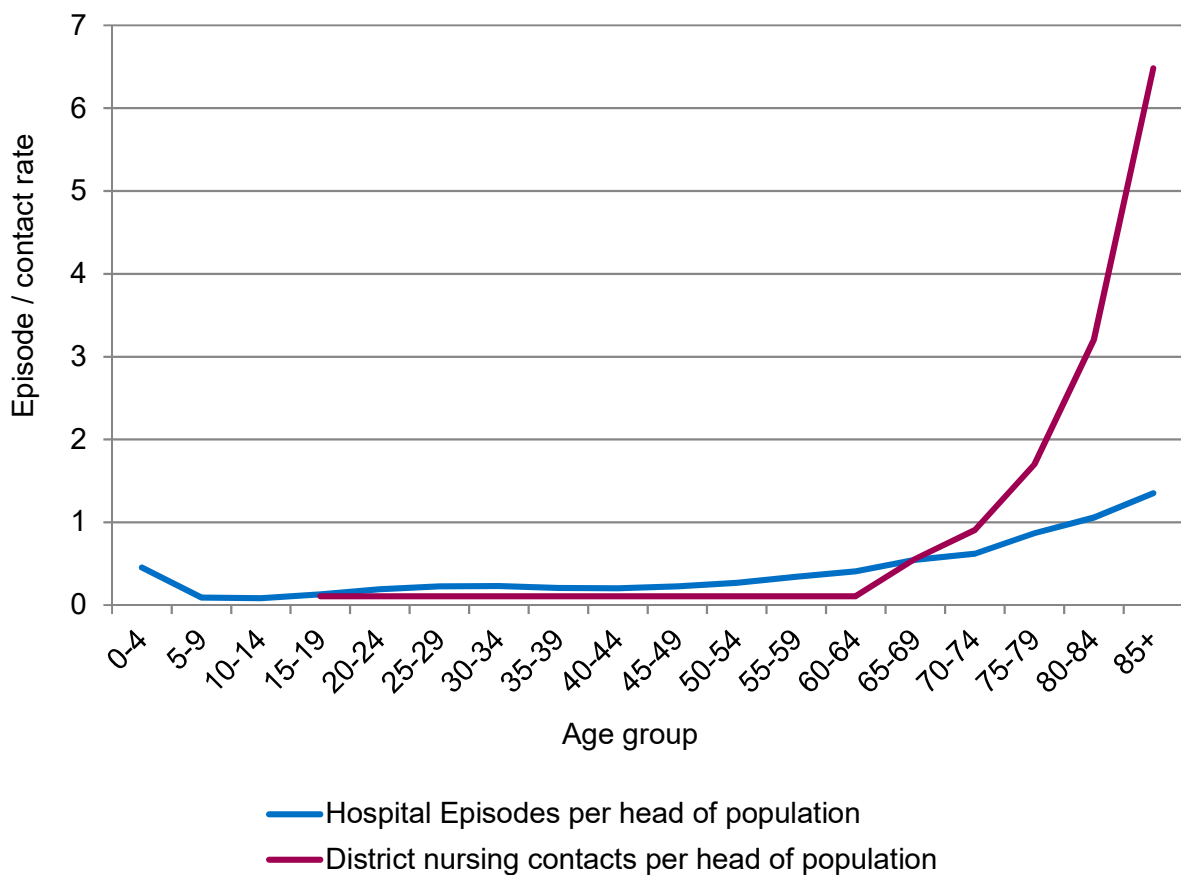
<sup>6</sup> NHS Improvement paper "Safe, sustainable and productive staffing - An improvement resource for the district nursing service" (Jan 2018)

acute services<sup>7</sup>. Table 1 shows that wound, diabetes and ulcer management are the most common treatments provided by district nursing teams.

**Table 1: Common treatments for District Nurse contact across the five selected Kent CCGs (2016/17)**

Treatment Description	Share (%)	Cumulative share (%)
Wound Management	25.8	25.8
Administration/Drawing Insulin/Diabetic Management	23.4	49.2
General Nursing	6.7	55.9
Leg Ulcer	4.2	60.1
Pressure ulcer	3.5	63.6
Catheter Management	3.5	67.1
Null	2.9	70.0
End of Life Care	2.2	72.2
Other	27.8	100.0

**Figure 1: Comparison of contact rates for General Acute and Community Services (Kent Integrated Dataset 2016/17)**



<sup>7</sup> 55% of referrals to district nursing from GP practices across five selected Kent CCGs

## 3 Datasets

This section describes the datasets we used to develop and test our district nursing model. The model is based on data from two detailed local integrated datasets, from Kent and the West Midlands. Programme budgeting shows that the two sets of CCGs covered by Kent and the West Midlands are a reasonable sample of middle-ranking CCGs for district nursing spend, so would produce a reliable starting point for the equitable distribution of district nursing funding. We also tested it against a similar dataset from Leeds. Whilst the national Community Services Data Set should in time enable a model to be developed based on national data, this dataset is still relatively new and more time is required before we can be confident in using it to generate a model.

### 3.1 Community Services Data Set

The Community Services Data Set (CSDS) is a new national data collection for community services information. It superseded the Children and Young People's Health Service (CYPHS) data set in October 2017<sup>8</sup>, which collected data for children and young people aged 0-18. The CSDS also allows adult community data to be submitted.

However, the CSDS is relatively new and immature data set, so more analysis and data quality assurance are necessary before it can be used to build a community services model for allocations. In particular, we need to improve our understanding of which providers should submit data, which community services are covered and the populations covered. Our assessment is that at least two years of reliable data will be needed before this data can be used to build a model.

Nevertheless, there are a small number of more developed local datasets available in some areas of the country which are sufficiently robust to be used to develop a model. Kent and Leeds were early implementation sites for NHS England's "National Long Term Conditions Years of Care" programme<sup>9</sup>, which supported the creation of integrated whole population datasets.

### 3.2 Kent Integrated Dataset

Kent County Council, along with Kent Public Health Observatory and NHS bodies in Kent and Medway, developed an integrated dataset linking patient-level records from services including general practices, hospitals, community health services and social care. The design and governance of the dataset is led by local authorities, health commissioners and service providers.

---

<sup>8</sup> <https://digital.nhs.uk/data-and-information/data-collections-and-data-sets/data-sets/community-services-data-set>

<sup>9</sup> The Long Term Conditions Year of Care Commissioning Programme Implementation Handbook is available at <https://www.england.nhs.uk/wp-content/uploads/2017/02/ltc-yoc-handbook.pdf>. There were three other EISs that completed the programme: West Hampshire; Southend and Barking; and Dagenham, Havering and Redbridge (BHR),

The Kent Integrated Dataset (KID) is a population-level dataset that uses pseudonymisation-at-source to link data. Although its data span eight CCGs, its community service data relates to a provider, Kent Community Health, with comprehensive coverage across five of the eight CCGs<sup>10</sup>. Community care services for the other three CCGs are provided by Medway Community Healthcare and Virgin Care and are not included within the KID<sup>11</sup>. KID contains data from April 2014 onwards, with monthly updates from data providers.

To ensure that patients could not be identified in its dataset, Kent removed names and other potentially identifiable information, for example, dates of birth were replaced by single year-of-age and postcodes replaced by Lower Super Output Areas (each area on average covers 1,500 residents).

### 3.3 West Midlands

The West Midlands dataset contains summary district nursing contact data for three service providers provided by Midlands and Lancashire CSU: Dudley Group NHS Foundation Trust (RNA), Royal Wolverhampton NHS Trust (RL4) and Walsall Healthcare NHS Trust (RBK) who supplied community services for NHS Dudley CCG (05C), NHS Walsall CCG (05Y) and NHS Wolverhampton CCG (06A) respectively. The providers were selected after a quality assurance review of data available from a wider range of community service providers across the West Midlands. This dataset was based on residential population data whereas the allocations model uses GP registered populations. Analysis showed there was very close alignment between the residential and GP registered populations for the three CCGs included in the dataset and it was therefore appropriate to use.

We were not given access to the CSU's data, instead summary activity data were provided by the CSU based on the patient age, sex and deprivation cohorts identified from our Kent analysis.

The same activity and population stratification criteria that were used for the KID activity data were applied to the West Midlands data.

### 3.4 Leeds

The Leeds dataset contains community service data from January 2013 to September 2016 for the three Leeds CCGs (prior to their merger into a single CCG in April 2018). Whilst this dataset contains data on age and sex it does not include a reliable source for determining deprivation. We have therefore not been able to use it to derive an activity model for district nursing in Leeds based on patient sex, age and deprivation. We identified two years of district nursing activity (2013/14 and 2014/15)

---

<sup>10</sup> NHS Ashford CCG (09C); NHS Canterbury and Coastal CCG (09E); NHS Dartford, Gravesham and Swanley CCG (09J); NHS Medway CCG (09W); NHS South Kent Coast CCG (10A); NHS Swale CCG (10D); NHS Thanet CCG (10E); NHS West Kent CCG (99J)

<sup>11</sup> Medway ([www.medwaycommunityhealthcare.nhs.uk/our-services/community-nursing](http://www.medwaycommunityhealthcare.nhs.uk/our-services/community-nursing)) Medway Community Healthcare provides community healthcare in Medway area. Virgin Care ([www.virgincare.co.uk/service-hub/north-kent-adults](http://www.virgincare.co.uk/service-hub/north-kent-adults)) provides Adult Community Services in Dartford, Gravesham, Swanley and Swale areas. Services include community nursing and occupational therapy. Virgin Care began providing these services in September 2016.



from the Leeds dataset, before the service was subsumed into the wider Integrated Neighbourhood Teams. The Leeds dataset did provide sufficient data to be used to validate the model developed using the KID and West Midlands datasets.

The Leeds dataset was pseudonymised at source, and potentially identifiable information was removed.

## 4 Model Development

This section describes the modelling undertaken to develop the community services component of the allocations formula.

### 4.1 Analysis of Kent Integrated dataset

We have based our analysis on district nursing activity in 2016/17 and 2017/18 across five Kent CCGs<sup>12</sup> because of concerns with data quality for earlier years. We have used the mid-year count of GP registered patients for each CCG for each year (October 2016 and October 2017 respectively) as the GP registered population which we have divided within each CCG into cohorts based on gender, age-bands and deprivation deciles based on the 2015 Index of Multiple Deprivation (IMD). Table 2 shows the age bands used, the youngest age band includes patients aged 15-17 because these were included in the raw data within quinary age bands 15-19. In Table 2 IMD decile 10 relates to the most deprived decile.

Table 2 shows that sample sizes for patients in the two older age bands are very small for the most deprived decile, with only 300 men aged 85 and above. We saw no value in extending the age groups to age 85 to 89, age 90 to 94 and age 95 and above as it would introduce more sample variation into the estimated contact rates. Analysis showed that there was no significant difference between regression model coefficients for quinary age bands within the first age band 15 to 64 and therefore they were considered as a single group.

An analysis of variance (appendix 1) shows that age is the key factor ( $F > 1.3$  million) influencing contact levels: there is exponential growth in district nursing contacts with age for patients aged 65 years and above. The table also shows that within each age band there is a general deprivation slope ( $F > 34,000$ ) which means that controlling for age, patients in more deprived areas receive more contacts than those in less deprived areas. The same pattern can be seen in table 3 which shows the cohort level district nursing contact rates, using Kent 2016/17 data.

---

<sup>12</sup> The five CCGs are NHS Ashford CCG (09C), NHS Canterbury & Coastal CCG (09E), NHS South Kent CCG (10A), NHS Thanet CCG (10E) and NHS West Kent CCG (99J).

**Table 2: GP registered population size for cohorts used for district nursing activity model - KID 2016/17 - gender, age-band and IMD decile**

Sex	Age Band	IMD decile (10 = most deprived)									
		1	2	3	4	5	6	7	8	9	10
F	15-64	41,949	32,337	41,900	50,129	51,896	35,186	32,211	24,330	28,365	15,857
F	65-69	4,207	3,709	5,075	5,855	5,449	4,433	3,168	2,145	2,227	1,178
F	70-74	3,554	3,249	4,212	4,885	4,547	3,700	2,627	1,914	1,808	896
F	75-59	2,745	2,183	3,054	3,410	3,313	2,684	1,853	1,473	1,286	691
F	80-84	2,256	1,911	2,296	2,599	2,510	2,052	1,414	1,198	1,067	532
F	85+	2,548	2,359	2,737	3,077	3,024	2,327	1,672	1,454	1,291	719
M	15-64	40,009	31,862	38,617	51,355	51,128	34,388	31,942	22,752	27,750	15,312
M	65-69	3,866	3,414	4,809	5,402	5,057	4,141	2,997	2,094	2,099	1,201
M	70-74	3,332	2,851	3,954	4,529	4,280	3,502	2,440	1,650	1,598	893
M	75-59	2,359	1,887	2,721	3,093	2,910	2,355	1,621	1,191	1,142	605
M	80-84	1,844	1,420	1,905	2,111	2,001	1,585	1,074	793	730	407
M	85+	1,538	1,198	1,525	1,746	1,668	1,297	866	728	602	300

**Table 3: District nursing contact rates by sex, age and deprivation 2016/17 (Kent data)**

Sex	Age Band	IMD decile (10 = most deprived)									
		1	2	3	4	5	6	7	8	9	10
F	15-64	0.05	0.09	0.07	0.11	0.10	0.10	0.14	0.18	0.14	0.17
F	65-69	0.27	0.34	0.35	0.66	0.71	0.39	0.77	0.97	0.80	1.14
F	70-74	0.62	0.79	0.39	0.98	0.92	1.03	1.09	1.22	2.26	1.15
F	75-59	1.44	1.73	1.61	1.66	2.02	2.05	2.34	2.01	2.23	2.71
F	80-84	2.17	3.39	3.23	3.22	3.55	3.88	6.55	4.53	5.17	4.54
F	85+	5.83	7.13	8.54	6.86	6.59	7.40	9.50	11.05	8.89	7.52
M	15-64	0.05	0.08	0.08	0.08	0.08	0.13	0.14	0.20	0.21	0.14
M	65-69	0.30	0.87	0.49	0.53	0.45	0.57	0.82	0.89	1.27	1.41
M	70-74	0.40	0.61	0.81	0.71	0.80	0.97	1.09	0.76	1.68	3.40
M	75-59	1.70	1.26	1.64	1.60	1.52	1.14	2.11	1.78	2.54	5.17
M	80-84	2.11	3.09	2.54	3.20	2.82	2.14	3.95	4.82	5.01	3.11
M	85+	5.09	6.48	6.90	6.76	6.17	4.96	6.00	8.65	11.12	12.74

## 4.2 Analysis of West Midlands dataset

NHS Midlands and Lancashire CSU undertook regression analysis of patient level district nursing activity covering three separate CCGs over three years (2015/16, 2016/17 and 2017/18). Analysis of activity rates over time suggested that there were some data coverage issues which meant that only certain time periods were used in each area. Furthermore, contact rates were calculated for 10 months activity in each financial year (excluding February and March because there was no data for March 2018 and unusually low levels of activity for February 2018 which affects two of the five sets of activity data). This ensured consistency across the three years, but relied on the assumption that activity patterns do not change over the year. The analysis used the same sex-age-deprivation cohorts as Kent using ONS mid-year resident

population rather than GP registered population<sup>13</sup>. The West Midlands data, in common with the Kent data, cover the full deprivation range, but a comparison of table 4 with table 2 shows that the West Midlands population is more heavily weighted towards more deprived areas. The same pattern of contact rate by sex, age and deprivation can be seen in the West Midlands data (table 5) as the Kent data (table 3).

---

<sup>13</sup> NHS Midlands & Lancashire CSU provided an analysis of the resident population for the three CCGs which showed that they spanned the full range of IMD deciles.

**Table 4: Resident population size for cohorts used for district nursing activity model – West Midlands 2016/17 - gender, age-band and IMD decile**

Sex	Age Band	IMD decile (10 = most deprived)									
		1	2	3	4	5	6	7	8	9	10
F	15-64	15,347	14,913	18,875	15,379	12,776	26,871	21,803	29,067	61,393	51,057
F	65-69	1,843	1,914	2,209	1,673	1,294	2,537	1,897	2,289	3,961	3,115
F	70-74	1,801	1,687	2,076	1,610	1,205	2,275	1,683	2,055	3,109	2,498
F	75-79	1,537	1,271	1,588	1,275	871	1,919	1,353	1,747	2,823	2,152
F	80-84	1,141	876	1,289	1,116	710	1,405	1,138	1,429	2,294	1,651
F	85+	1,064	837	1,249	1,162	769	1,587	1,125	1,452	2,309	1,846
M	15-64	15,332	14,520	18,753	15,602	12,762	26,158	21,770	28,773	61,719	50,436
M	65-69	1,752	1,705	2,030	1,622	1,236	2,436	1,918	2,295	3,814	3,041
M	70-74	1,573	1,557	1,866	1,372	1,015	2,044	1,490	1,856	3,005	2,273
M	75-79	1,300	1,159	1,327	1,157	798	1,513	1,210	1,382	2,375	1,777
M	80-84	909	709	979	794	569	1,062	818	1,088	1,532	1,171
M	85+	659	532	672	700	399	812	610	771	1,238	875

**Table 5: District nursing contact rates by sex, age and deprivation (West Midlands data)**

Sex	Age Band	IMD decile (10 = most deprived)									
		1	2	3	4	5	6	7	8	9	10
F	15-64	0.09	0.10	0.10	0.09	0.16	0.13	0.16	0.12	0.15	0.18
F	65-69	0.19	0.29	0.20	0.36	0.39	0.67	0.37	0.48	1.00	0.73
F	70-74	0.61	0.94	0.72	0.47	0.72	1.20	0.91	1.45	1.45	2.07
F	75-79	1.34	1.28	1.70	1.53	2.40	1.29	2.09	2.00	2.89	3.51
F	80-84	1.72	2.65	2.71	3.60	3.60	3.07	4.26	4.46	4.37	6.01
F	85+	5.07	7.35	7.19	7.38	6.28	9.33	8.78	7.26	8.90	10.95
M	15-64	0.04	0.10	0.11	0.12	0.09	0.10	0.15	0.15	0.16	0.20
M	65-69	0.28	0.59	0.37	0.48	0.66	0.92	0.30	0.75	1.27	1.19
M	70-74	0.41	0.67	0.59	0.78	0.83	0.94	0.95	1.65	1.86	2.31
M	75-79	1.05	1.07	2.03	1.97	1.75	2.04	2.37	1.86	2.70	3.48
M	80-84	1.52	3.17	1.94	3.60	5.49	2.38	4.51	2.82	4.97	6.42
M	85+	3.70	6.26	6.82	4.72	5.65	5.98	8.29	6.44	7.10	10.36

### 4.3 Validation using the Leeds dataset

We used the Leeds dataset to compare contact rates based on patient sex and age only with the results from applying the Kent and West Midlands activity models, to validate those two models.

Table 6 shows district nursing contact rates by sex and age band in each year, alongside the mid-year registered population. We have compared these with the rates and population sizes we would expect in 2016/17 based on the Kent and West Midlands activity models. We applied the cohort contact rates from each model to the known registered population (for the sex-age-deprivation decile cohorts used in the two models) for Leeds to derive contact rates for 2016/17.

**Table6: Comparison of Leeds district nursing contact rates with Kent and West Midlands models**

Year	2013/14	2013/14	2013/14	2014/15	2014/15	2016/17	2016/17	2016/17
Sex	Age Band	Registered Population	Contact Rate	Registered Population	Contact Rate	Registered Population	Kent model Contact Rate	West Mids model Contact Rate
F	15-64	280,641	0.10	283,762	0.11	289,690	0.12	0.16
F	65-69	19,170	0.58	19,728	0.49	20,047	0.64	0.54
F	70-74	14,320	0.92	14,652	1.19	15,700	0.97	1.25
F	75-79	13,075	1.75	13,093	1.81	12,600	1.97	2.44
F	80-84	10,180	3.47	10,150	4.08	10,307	3.85	4.43
F	85+	10,627	11.32	10,868	11.56	11,022	7.75	9.53
M	15-64	292,097	0.11	294,677	0.12	300,399	0.13	0.16
M	65-69	18,120	0.67	18,627	0.62	19,084	0.77	0.82
M	70-74	12,829	0.93	13,268	1.09	14,358	1.18	1.30
M	75-79	10,764	1.80	10,759	1.67	10,374	2.19	2.45
M	80-84	7,123	3.47	7,329	4.56	7,767	3.11	4.40
M	85+	5,524	8.68	5,682	8.65	5,900	7.64	7.82

The Leeds contact rates for 2013/14 and 2014/15 are very similar. However, they differ from the contact rates derived from the Kent and West Midlands models. This is especially evident for most elderly women aged 85 and above, where the Kent model predicts around two-thirds of the activity levels reported by Leeds in 2014/15, and the West Midlands model prediction is 18% lower than Leeds for 2014/15.

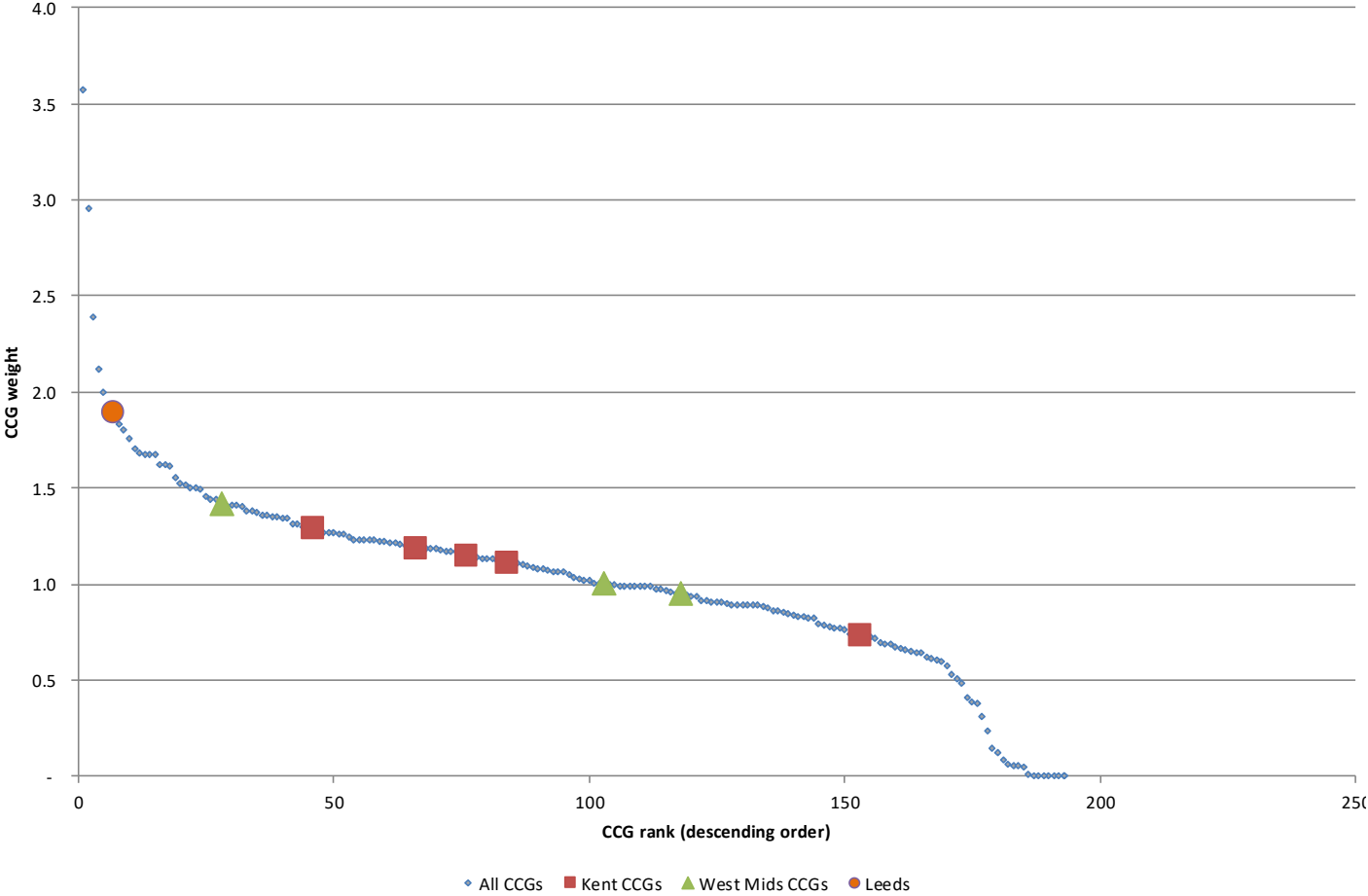
Analysis to investigate the potential causes of these differences concluded that they can most likely be explained by differences in commissioning decisions and the use of community services between Leeds and the other areas. This analysis showed that Leeds spends considerably more per head on district nursing than the Kent and West Midlands CCGs and the England average, which would explain the higher contract rates.

We looked at programme budgeting spend for 2016/17 for district nursing and converted each CCG's share of total district nursing spend into a weighted patient value, which was divided by the registered population to derive a CCG weighting on district nursing spend (the England average is 1.0). These weights have been plotted in figure 2 against CCG ranking (in descending order by CCG weight). The five Kent CCGs, three West Midlands CCGs and (single) Leeds CCG have been highlighted in the figure.

The weighted average CCG weighting for the five Kent CCGs was 1.00, for the three West Midlands CCGs it was 1.14 and for Leeds 1.89. Leeds had the seventh highest spend per head across England. The Kent and West Midlands CCGs spend on district nursing per head is close to the England average, which provides some

assurance that extrapolating national patterns of utilisation from those two local datasets is reasonable.<sup>14</sup>.

**Figure 2: CCG weighting versus programme budgeting district nursing spend 2016/17**



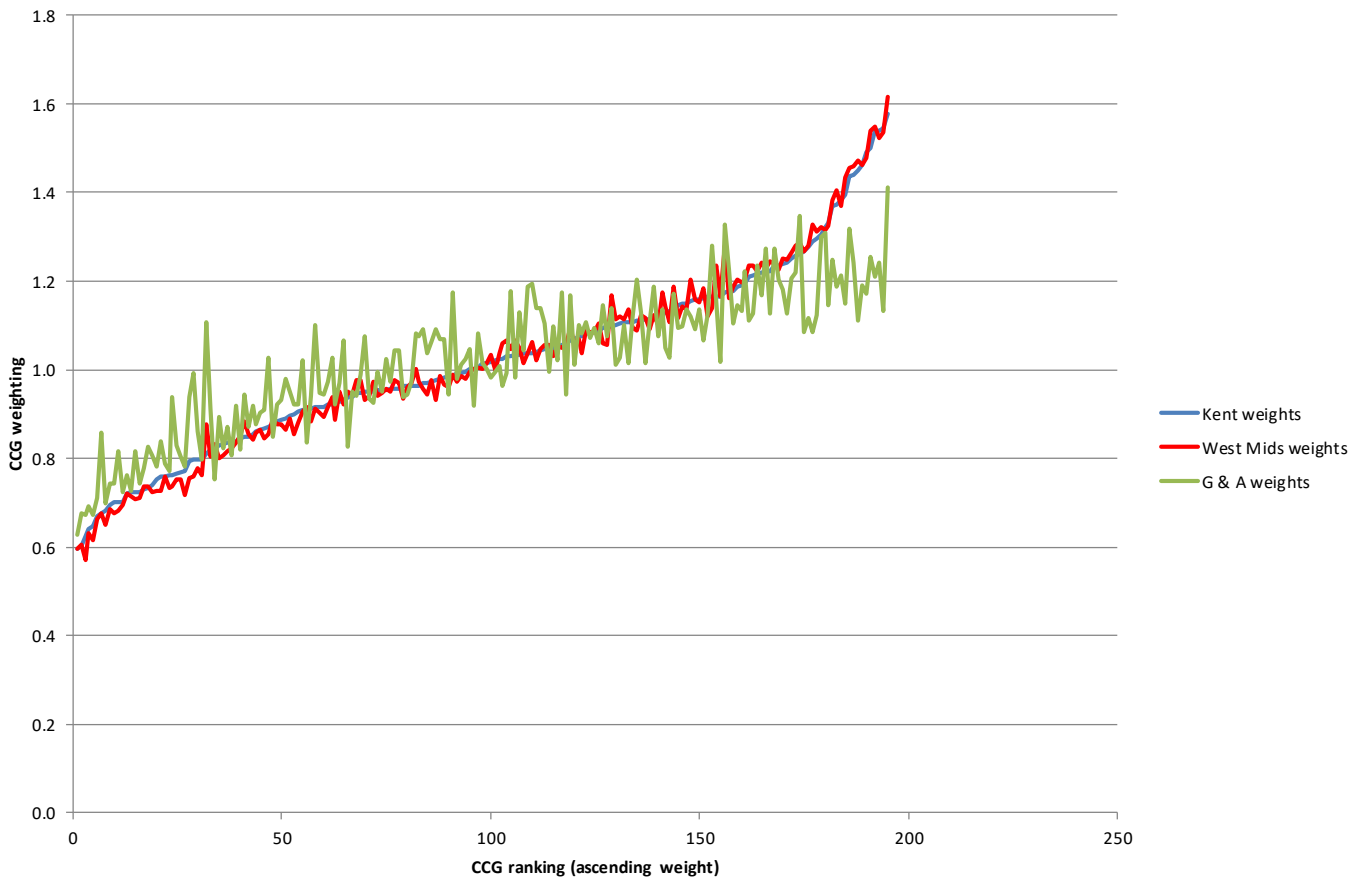
**4.4 Comparison of CCG need weights**

The Kent and West Midlands contact rates were applied to 195 CCGs using October 2017 GP registered patient data to derive separate needs weights for CCG level district nursing. These were compared with general and acute needs weights. CCGs were ordered in figure 3 by their Kent-data district nursing needs weights (blue line), together with their West Midlands-data district nursing needs weight (red line) and general and acute needs weight (green line).

The figure shows that the two sets of district nursing need weights are very similar, with distinctly higher need weights for district nursing as opposed to general and acute services for around 10 per cent of CCGs. We would expect a significant impact to these CCGs on the target allocation for CCG core services for those CCGs if we included a district nursing component.

<sup>14</sup> We found poor quality data on spend for around 25 of the current 195 CCGs, which if incorporated would shift all the CCG weights down but would not alter their relative ordering

**Figure 3: Comparison of CCG weights derived from Kent and West Midlands district nursing contact activity with general and acute weights (2018/19) across 195 CCGs**



#### 4.5 Regression Model

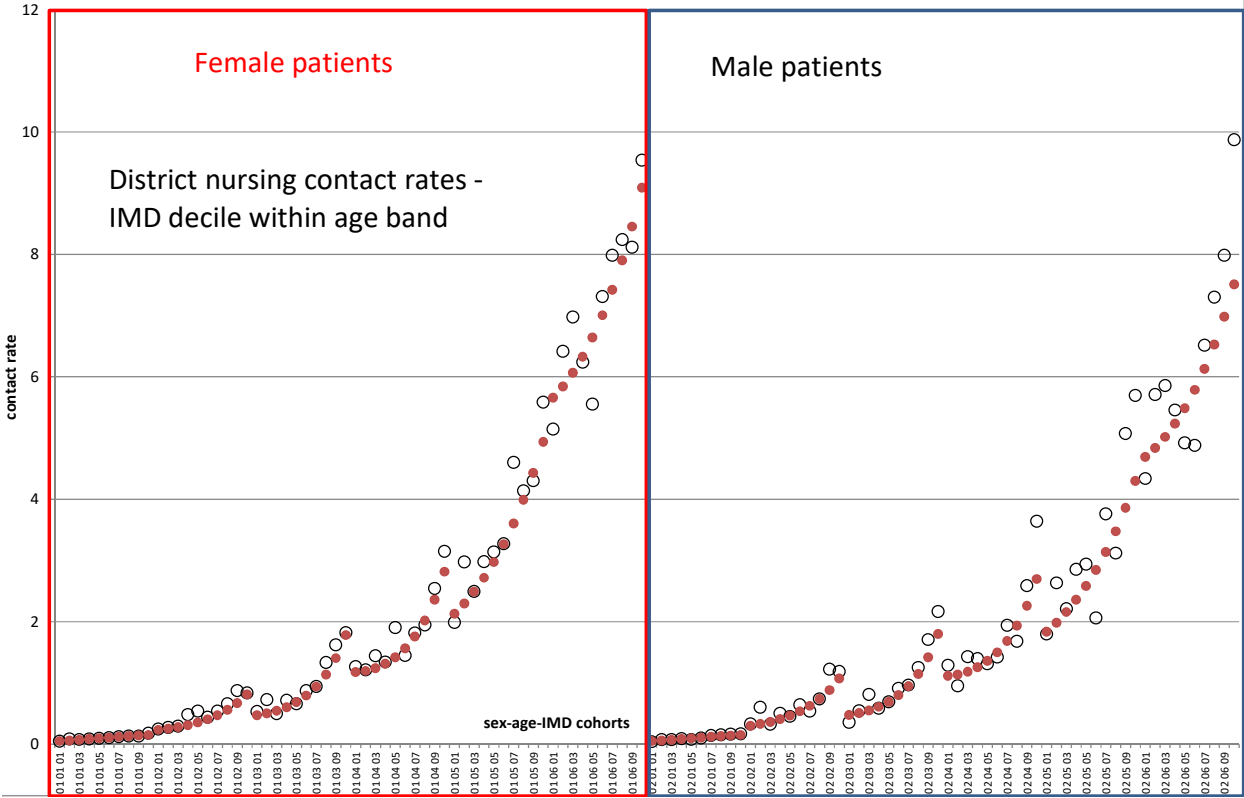
As noted above, sample sizes were small for very elderly people in the most deprived decile. In order to compensate for the effects on contact rate of small sample sizes for some deprivation deciles we therefore used a multiplicative regression model.

Initially we applied a single term for IMD decile (ranging from 1 to 10 with 10 the most deprived). This model applied a 10 percentage point increase to contact rates for each increase in IMD decile. However, this approach was rejected because it was felt that the effects of deprivation were not the same in each age band.

Instead a second regression model was used with a different IMD structure for each age-sex grouping. As background to the rationale for this change, figure 4 compares the actual (unfilled circles) and model (red dots) contact rates for female and male patients, by IMD decile within age band. The ratio of contact rates between the most deprived and least deprived decile within each age band is much greater for the younger age bands. For example, for females in their early 80s, the difference in contact rates by IMD ranges from 2 to 4.5, whereas for those in their late 60s, those in the most deprived decile have a contact rate of 2 compared to 0.3 for the least deprived, a 7-fold difference. In other words, IMD has more of an impact at younger age groups than at older age groups, which is what we would have expected if deprivation results in poorer health outcomes being seen at earlier ages.

This model appears to be a very good fit for patients below age 80. Variation by IMD decile within age band for patients aged 80 and over is less easily explained by the model. This may be the result of smaller sample sizes and the effects of particular conditions suffered by patients, for example diabetes. The model clearly demonstrates the importance of age on utilisation. Our view is that the new model is an improvement over the previous model while incorporating the requirement that IMD effects are smoothed. The multiplicative activity regression model based on gender, age-band and deprivation is shown in appendix 2.

**Figure 4 – actual cohort contact rates versus model rates – full Kent and West Midlands data**



**4.6 Additional model testing**

**4.6.1 Workload model**

Alternative measures of district nursing resources were investigated for use in the model. We would ideally want to produce a cost-weighted formula in which we model the cost of receiving district nursing services. Costs of appointments will vary because appointments contain different treatments and may be provided by a different skills mix (particularly between district nurses and healthcare assistants) which vary the appointment duration and cost. However, we do not currently have the data required to build a cost weighted model, the data available allowed us to create an activity based (contact frequency) based model. Data on the skills mix used to deliver district nursing were not available. We were able to compare average contact time for different treatment types using the Kent data, but advice from NHS England community services policy experts and contacts in community providers was that it



was very difficult to apply averages to treatment duration, given differences between patients, and the fact that appointments for the same treatment could vary considerably depending on the patient's circumstances and general health. Those stakeholders did support the conclusions from the data analysis that activity levels grew exponentially with age and were higher for patients in more deprived areas. The additional analysis to extend the activity model is described in more detail in appendix 3.

The above observations lead us to conclude that attempting to estimate a workload model would add little value to and involve greater uncertainty than an activity model. We therefore developed an activity model based on a combination of the Kent and West Midlands data.

#### **4.6.2 Travel time**

95% of district nursing contacts take place in the patient's home and NHS Benchmarking figures<sup>15</sup> on community services suggest that 11% of clinician time is spent travelling. We therefore considered how travel time could be reflected in our model. In particular we considered applying the travel time calculations used in the health visiting model used for public health allocations. However, generating a simple adaptation of the health visitor model would assume that the distribution of the two target populations (the very young and the very old) are very similar. Further work is required to investigate district nursing travel time.

#### **4.6.3 Long term conditions**

Diabetes and hypertension were seen to be associated with higher levels of need. However, these conditions are highly correlated and both are correlated with age. When QOF prevalence data were included in the regression models they produced counter-intuitive coefficients. When the model included diabetes prevalence only it shows that contact rates are higher for those with diabetes, which appears sensible given that we know there are a large proportion of diabetes related treatments. When the model includes diagnoses for both diabetes and hypertension, the model suggests fewer contacts for patients with hypertension, which seems counter-intuitive.

#### **4.6.4 Supply measures**

We recognise that supply induced demand is present in NHS services, so we routinely include supply variables in our models. As utilisation driven by available capacity is not a reflection of need, while the supply variables are included in the models, they are sterilised and set to the national average when calculating weighted populations. This means areas are not penalised in the formula for lower utilisation due to relatively lower capacity.

---

<sup>15</sup> NHS Benchmarking Network Community Services Report December 2016 – NHS Benchmarking

For the community services model, supply measures including the relative supply of acute, primary and social care were considered to account for the impact of local commissioning choices.

## 5 Model implementation

This section describes how the community services model described in section 4 has been applied in the calculation of target allocations.

### 5.1 Calculation of weighted populations

We have applied the model to the Kent and West Midlands data separately and derived (by age-sex-deprivation) a single table (table 7) of cohort contact rates based on equal weighting for the two datasets.

Contact rates by age and sex are calculated for GP practices and CCGs based on applying the contact rates from the model to the registered populations by age, sex and deprivation decile. These contact rates are then applied to the registered populations for those cohorts to produce a weighted population.

**Table 7: District nursing contact rates by sex, age and deprivation derived from regression model**

Sex	Age Band	IMD decile (10 = most deprived)									
		1	2	3	4	5	6	7	8	9	10
F	15-64	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.13	0.14	0.15
F	65-69	0.23	0.25	0.28	0.31	0.35	0.40	0.47	0.56	0.67	0.81
F	70-74	0.47	0.50	0.54	0.60	0.68	0.79	0.94	1.14	1.41	1.78
F	75-59	1.18	1.19	1.24	1.31	1.42	1.56	1.76	2.02	2.36	2.82
F	80-84	2.13	2.30	2.49	2.72	2.97	3.27	3.60	3.99	4.43	4.94
F	85+	5.66	5.84	6.07	6.33	6.64	7.00	7.42	7.90	8.45	9.09
M	15-64	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.13	0.14	0.15
M	65-69	0.30	0.33	0.36	0.41	0.46	0.54	0.63	0.74	0.88	1.07
M	70-74	0.48	0.51	0.55	0.61	0.69	0.80	0.95	1.14	1.42	1.80
M	75-59	1.12	1.14	1.18	1.25	1.36	1.50	1.69	1.93	2.26	2.70
M	80-84	1.83	1.98	2.16	2.36	2.58	2.84	3.14	3.48	3.86	4.30
M	85+	4.69	4.84	5.02	5.23	5.49	5.79	6.13	6.53	6.98	7.51

### 5.2 Community services model scope

The Kent data were used to identify community services with similar need profiles to district nursing, in this case proxied by age-utilisation rates. This was done using principal component analysis of the number of contacts by age band, from which we extracted four clusters as shown in figure 5. District nursing is part of the orange group 4 (bottom left hand corner) in figure 5. This group is dominated in terms of activity by district nursing and intermediate care<sup>16</sup>. Contact with patients in both cases is within the patient's home, not at a community hospital.

<sup>16</sup> The other community services most closely aligned to district nursing, of which there were 599 thousand contacts in our sample, are: intermediate care (192 thousand contacts), rapid response (19 thousand), West Kent urgent care (3.5 thousand) (the last two items are locally named variants of intermediate care), a falls service (1.5 thousand), postural stability (1 thousand), community medicines (0.8 thousand) and phlebotomy(0.5 thousand).

**Figure 5: Kent community services – Principal Component Analysis groupings of age-band utilisation**



These two services represent two thirds of all Kent’s CCG-funded community service activity. This is consistent with the results NHS Benchmarking reported nationally for 2016/17, see table 8 which shows that district nursing makes up two thirds of activity and 50% of cost. This would indicate that the district nursing model should be applied to 50% of the spend on community services.

**Table 8: NHS Benchmarking statistics per 100,000 population 2016/17**

Service	Contacts	Pay costs £'000s
District Nursing + similar services <sup>17</sup>	84,966	2,788
Total across all services excl. wheelchair	155,690	7,090
Non-CCG funded services	-25,763	-1,515
Net Total	129,927	5,574
District Nursing + similar services share %	65%	50%

<sup>17</sup> Covers community matrons, end of life care nursing, and community integrated care teams (CICT).

We also simplified the principal components analysis used to identify the other components of community service most similar to district nursing in their age profiles, so that we could check the results against the Leeds dataset and the CSDS. We compared each service’s activity (unique contacts) for patients aged 15-64 and 85 and over. The close proximity of the district nursing and intermediate care points in all three circumstances affirmed the validity of extending the formula to include both of these services.

To summarise, age utilisation and cost shares are set out in the tables below for the most common (in terms of shares of activity) forms of adult community services identified in the datasets, to inform the decision on the scope of the community services formula within target allocations. We concluded that it was reasonable to apply the district nursing model within CCG core target allocations to half of the total spend on community services, while the other half should continue to be proxied using the general and acute formula.

**Table 9: provision of key adult community services to different age groups, and overall shares of activity and costs**

Service	Proportion of activity provided to those aged over 85			Proportion provided to those aged 15-64		
	Kent	Leeds	CSDS	Kent	Leeds	CSDS
District nursing	40%	38%	37%	13%	17%	18%
Intermediate care	38%	54%	40%	12%	3%	11%
MSK	3%	1%	5%	60%	77%	70%
Podiatry	17%	21%	16%	25%	24%	35%

**Table 10: Overall activity and cost shares for community services split by age profiles**

Activity shares	Kent	Leeds	CSDS	NHS Benchmarking
Services dominated by older adults (predominantly district nursing and intermediate care)	66%	60%	55%	65%
All other services	34%	40%	45%	35%
Cost shares				
Services dominated by older adults (predominantly district nursing and intermediate care)	50%			50%
All other services	50%			50%

## 6 Appendices

### Appendix 1 – Analysis of Variation (ANOVA) of district nursing contact rates across the five selected Kent CCGs (2016/17)

**Table A1: analysis of variation (ANOVA) table of district nursing contact rates 2016/17 (Kent)<sup>18</sup>**

	Number of obs	=	939,179		R-squared	0.9029
	Root MSE	=	0.491462		Adj R-squared	0.9029
Source	Partial SS		df	MS	F	Prob>F
Model	2,108,379		119	17,717	73,354	0.00000
Sex	1,374		1	1,374	5,691	0.00000
AgeBand2	1,615,994		5	323,199	1,338,103	0.00000
Sex#AgeBand2	4,793		5	959	3,969	0.00000
IMD	74,924		9	8,325	34,467	0.00000
Sex#IMD	15,479		9	1,720	7,121	0.00000
AgeBand2#IMD	83,843		45	1,863	7,714	0.00000
Sex#AgeBand2#IMD	31,488		45	700	2,897	0.00000
Residual	226,816		939,059	0.24153492		
Total	2,335,195		939178	2.4864242		

<sup>18</sup> **Stata command** - anova ContactRate Sex##AgeBand2##IMD [fw=RegPop]

## Appendix 2 – district nursing activity model

### A multiplicative regression model for district nursing activity based on sex, age and deprivation cohorts

The natural log of contact rates was modelled because we used a multiplicative model to smooth out deprivation effects.

The model takes the form:

$$\ln(\text{contact rate}) = \text{constant} + c1 + (c2 \cdot \text{IMD} + c3 \cdot \text{IMD-squared})$$

with separate estimates of c1 for each age-sex group and separate estimates of c2 and c3 for each age group.

The model explained 90% of variation in log of contact rates, equal to 87.5% of variation in contact rates.

**Table A2(1) summary statistics regression model – Kent data**

Source	SS	df	MS	Number of obs	=	1,970,080
				F(23, 1970056)	>	99999
<b>Model</b>	3108903	23	135169.7	Prob > F	=	0
<b>Residual</b>	346393	1,970,056	0.175829	R-squared	=	0.8998
				<b>Adj R-squared</b>	=	<b>0.8997</b>
<b>Total</b>	3455296	1,970,079	1.753887	Root MSE	=	0.41932

**Table A2(2) summary statistics regression model – West Midlands data**

Source	SS	df	MS	Number of obs	=	1,136,443
				F(23, 1136419)	>	99999
Model	1547969	23	67302.99	Prob > F	=	0
Residual	205609.6	1,136,419	0.180928	R-squared	=	0.8827
				<b>Adj R-squared</b>	=	<b>0.8827</b>
Total	1753578	1,136,442	1.543043	Root MSE	=	0.42536

**Table A2(3) - Parameter estimates for the multiplicative regression model (Kent and West Midlands estimates)**

InCRate	Kent estimates		West Midlands estimates	
	estimate	t	estimate.	t
<b>AgeBand2#Sex</b>				
15-64#Female	0.000		0.000	
15-64#Male	0.020	29.67	-0.018	-20.28
65-69#Female	2.252	502.63	1.113	162.51
65-69#Male	2.368	525.70	1.557	226.08
70-74#Female	2.610	559.63	2.293	323.16
70-74#Male	2.603	555.00	2.314	324.62
75-79#Female	3.743	680.50	3.076	393.70
75-79#Male	3.619	649.92	3.096	394.75
80-84#Female	4.324	698.53	3.515	387.37
80-84#Male	4.113	654.48	3.437	374.32
85+#Female	5.232	860.49	4.672	482.74
85+#Male	5.084	801.28	4.444	447.94
<b>AgeBand2#c.IMD</b>				
15-64	0.269	502.28	0.171	212.44
65-69	0.004	2.48	0.136	52.83
70-74	0.055	29.14	0.003	1.07
75-79	-0.056	-24.74	0.028	9.31
80-84	0.025	9.57	0.122	34.74
85+	-0.011	-4.30	0.057	15.36
<b>AgeBand2#c.IMDSq</b>				
15-64	-0.012	-248.59	-0.005	-74.52
65-69	0.011	65.53	0.002	7.96
70-74	0.007	40.98	0.014	59.10
75-79	0.013	58.18	0.007	28.68
80-84	0.005	18.62	-0.001	-3.30
85+	0.005	19.84	0.000	1.17
<b>_cons</b>	<b>-3.508</b>	<b>2694.22</b>	<b>-2.981</b>	<b>6.97</b>

## Appendix 3 – model alternatives

As described in the main paper, we looked at appointment duration for different kinds of treatment as part of considering whether to seek to build a workload model or an activity model. This appendix sets out the work we conducted.

Table A3(1) shows summary information on appointment duration for three of the more commonly reported treatments. An appointment for treatment of an ulcer takes almost twice as long as one to administer or draw insulin/diabetes management. Wound management lies at the mid-point between these. The table includes statistics extracted from the 2016/17 data, and separate summary information provided by Kent Community Health NHS Foundation Trust for 2017/18. We compared these estimates with a study by Oliver & Buckingham published in 1997, which was the most recent study undertaken of district nursing treatment duration we were able to identify<sup>19</sup>. The article affirms the relative ordering of treatment duration<sup>20</sup>.

**Table A3(1): Appointment duration for different district nursing treatments (Kent 2016/17 data)**

Treatment Category	Number of Contacts	Appointment Time (mins.)						
		2016/17 data					2018/17 data	
		mean	std dev	median	LQ	UQ	mean	
Insulin	140,166	15.9	2.5	15	14	17	16.7	
Ulcer	46,302	29.4	3.1	29	27	32	30.0	
Wound	154,835	26.0	2.3	26	25	27	26.1	
Other	257,909	25.2	3.4	25	23	27	24.7	
Total	599,212	23.6	5.2	25	21	27	23.6	

We used the Kent reported appointment duration data to derive average contact times within each age/sex cohort. The results, contact times (minutes per person per year), are shown in table A3(2), alongside contact rates (per person per year). Because the scales are different, data bars have been included to rescale to a common scale. The data bars show the very high agreement between the two sets of measures.

The differences between the two sets of measures can be seen more clearly in table A3(3). This shows relative appointment duration across cohorts. Appointments are shorter for older patients and for those in more deprived areas. We interpret this as a function of the difference in the treatment profiles for the cohorts, with diabetes being more common amongst those groups.

<sup>19</sup> Analysis of district nurse workload in the community; Oliver L, Buckingham K; British Journal of Community Health Nursing (BJCHB), 1997, Vol. 2 No. 3, pp. 127-134

<sup>20</sup> Diabetes mellitus (ICD 9) 21 mins, wound management (ICD 894) 25 mins and treatment of ulcers (ICD 707) 28 mins



**Table A3(2): Contact rates and contact times for sex-age-deprivation cohorts 2016/17 (Kent data)**

contact rate		IMD decile (10 = most deprived)									
Gender	Age Band	1	2	3	4	5	6	7	8	9	10
F	18-64	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2
		1.4	2.6	1.9	3.2	2.5	2.6	3.3	4.3	3.9	3.9
	65-69	0.3	0.3	0.4	0.7	0.7	0.4	0.8	1.0	0.8	1.1
		7.7	8.5	10.4	16.0	18.9	9.9	20.3	23.1	19.3	24.7
	70-74	0.6	0.8	0.4	1.0	0.9	1.0	1.1	1.2	2.3	1.2
		16.3	20.7	9.6	25.5	21.7	30.3	23.4	28.5	50.8	27.0
	75-79	1.4	1.7	1.6	1.7	2.0	2.0	2.3	2.0	2.2	2.7
37.3		46.5	42.4	40.4	41.6	47.7	49.7	47.2	50.9	63.2	
80-84	2.2	3.4	3.2	3.2	3.6	3.9	6.5	4.5	5.2	4.5	
	56.0	80.8	80.2	70.1	79.6	81.6	128.6	96.5	99.4	84.1	
85+	5.8	7.1	8.5	6.9	6.6	7.4	9.5	11.0	8.9	7.5	
	143.8	167.3	182.0	158.1	153.5	164.1	202.7	217.3	186.4	153.3	
M	18-64	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1
		1.7	2.1	2.1	2.2	2.1	3.4	3.0	4.2	4.8	3.3
	65-69	0.3	0.9	0.5	0.5	0.5	0.6	0.8	0.9	1.3	1.4
		9.6	24.8	13.5	14.5	14.3	13.1	19.5	22.8	27.6	31.6
	70-74	0.4	0.6	0.8	0.7	0.8	1.0	1.1	0.8	1.7	3.4
		12.4	16.2	20.2	18.9	22.1	23.0	26.1	22.0	38.6	60.8
	75-79	1.7	1.3	1.6	1.6	1.5	1.1	2.1	1.8	2.5	5.2
45.7		34.5	34.3	42.3	38.8	28.6	53.7	40.6	58.2	94.2	
80-84	2.1	3.1	2.5	3.2	2.8	2.1	4.0	4.8	5.0	3.1	
	54.4	75.0	60.8	70.5	73.6	49.6	84.7	96.4	103.7	65.8	
85+	5.1	6.5	6.9	6.8	6.2	5.0	6.0	8.7	11.1	12.7	
	124.2	169.1	161.5	160.6	161.1	122.6	142.6	181.7	218.4	273.3	

**Table A3(3): relative appointment duration 2016/17 (Kent data)**

Relative appointment duration		IMD decile (10 = most deprived)									
Sex	Age Band	1	2	3	4	5	6	7	8	9	10
F	18-64	0.20	0.21	0.18	0.23	0.13	0.11	0.00	0.02	0.14	-0.01
	65-69	0.21	0.08	0.26	0.03	0.13	0.06	0.12	0.01	0.02	-0.08
	70-74	0.13	0.12	0.04	0.10	0.00	0.25	-0.09	-0.01	-0.04	-0.01
	75-79	0.10	0.14	0.11	0.03	-0.13	-0.01	-0.10	-0.01	-0.03	-0.03
	80-84	0.09	0.01	0.05	-0.08	-0.05	-0.11	-0.17	-0.10	-0.18	-0.21
	85+	0.05	0.00	-0.10	-0.02	-0.01	-0.06	-0.09	-0.17	-0.11	-0.14
M	18-64	0.35	0.08	0.15	0.11	0.09	0.11	-0.11	-0.10	-0.04	-0.02
	65-69	0.37	0.20	0.17	0.17	0.34	-0.02	0.00	0.09	-0.07	-0.05
	70-74	0.32	0.13	0.05	0.12	0.17	0.01	0.01	0.23	-0.03	-0.24
	75-79	0.14	0.16	-0.11	0.12	0.08	0.06	0.08	-0.03	-0.03	-0.23
	80-84	0.10	0.03	0.02	-0.07	0.11	-0.01	-0.09	-0.15	-0.12	-0.10
	85+	0.03	0.11	-0.01	0.01	0.11	0.05	0.01	-0.11	-0.17	-0.09