Update of the formula for general and acute hospital services for 2022/23 allocations

1. Overview

1.1 Introduction

The Advisory Committee for Resource Allocation (ACRA) plays a key part in the setting of resource allocations to local health systems: currently Clinical Commissioning Groups (CCGs), in the past Primary Care Trusts (PCTs) and in the future, subject to the passage of legislation, Integrated Care Boards (ICBs).

ACRA is an independent, expert, technical committee made up of academics, GPs, NHS managers and public health experts.[1]. ACRA's role is to develop and make evidence based recommendations on the approach taken to estimating the relative need for healthcare resources for different populations, based on the characteristics of those people and the evidence for how their characteristics are associated with future need for healthcare.

These relative needs are designed to support the allocation of resources in a way that supports equal opportunity of access for equal need and contribute to the reduction of health inequalities that are amenable to healthcare. These aims are confirmed when ACRA is commissioned in each allocation round by NHS England.

Following the 2019/20 allocations round, ACRA were commissioned to recommend any updates to the need estimates that might be required for 2022/23 onwards.

As part of the development programme for resource allocations the general and acute (G&A model) was one aspect of the allocations formula that was prioritised for development.

The G&A component is part of the ICB core allocations model and covers both inpatient and outpatient general and acute services, A&E and critical care. It does not cover maternity, mental health, prescribing, or specialised services as these are covered by separate models. The G&A model implemented for the 2016/17 allocations round was a refresh of the Nuffield person-based model (used in 2014/15 and 2015/16 allocations) and followed the same approach to modelling. This same model was used in the 2019/20 allocation round.

There were several drivers for updating the general and acute model for 2022/23 allocations:

1. The scale of spend driven by this component of the model
2. The last update was for the 2016/17 allocations round and modelled cost weighted need for 2013/14
3. Since the G&A model was last updated (for 2016/17 allocations) access to data has improved significantly. NHS England and Improvement analysts now have access to patient level data from SUS+ that is anonymised is such a way that it

[1] ACRA terms of reference; NHS England » Advisory Committee on Resource Allocation (ACRA) terms of reference

is still possible to link this to other datasets. This provides the opportunity to update the general and acute based on more up to date and more detailed data. There have also been changes in currency design used to price services with the introduction of HRG4+

This document sets out the development of the updated G&A model and describes updates and changes in this model that have been presented to ACRA during the development process. It also sets out the final model to be used to estimate need for G&A services in the 2022/23 allocations formula.

ACRA makes its recommendations based on the best available evidence. ACRA is supported in this through the work of its Technical Advisory Group (TAG). ACRA and TAG undertake detailed scrutiny of the development work undertaken for allocations and their decisions regarding what formulae constitute the best assessment of relative need are informed by a set of criteria. These are set out in ACRA's terms of reference and are provided in Annex A.

ACRA's view is that this updated model provides an improved estimate of relative need for general and acute services compared to the current model.

1.2 Background to allocations

The allocation of funding to CCGs (and to ICBs from 2022/23), with which they commission services for their local population is one of the key duties of NHS England.[2] The principle at the heart of the approach to setting allocations is ensuring equal opportunity of access for equal need.

The approach to allocations is also informed by NHS England's duty to have regard to the need to reduce inequalities between patients with respect to their ability to access services and with respect to the outcomes they achieve.[3]

These two aims are reflected in the allocations target formula, which produces a target allocation or 'fair share' for each area, based on a complex assessment of factors such as demography, morbidity, deprivation, and the unavoidable cost of providing services in different areas.

1.2.1 The transition to Integrated Care Boards

ACRA's recommended approach uses either: individual level data or lower layer super output area (LSOA) population characteristics. Using granular data means that different geographies can be constructed relatively straightforwardly, and the recommended approach is therefore suitable for ICBs.

For convenience of comparison with previous methodologies, this document refers throughout to CCGs.

[2] Section 223G NHS Act 2006, as amended by the Health and Social Care Act 2012.

[3] Section 13G Health and Social Care Act 2012.

1.2.2 Target allocations methodology

The formulae for target allocations estimate the relative need and relative unavoidable costs between CCGs for healthcare services. There are separate formulae for CCGs' core responsibilities, specialised services and primary medical care. For each of these, the relative need is calculated for each GP practice, which is then aggregated to the CCG level. It does not seek to calculate an absolute level of need for each area, but to assess relative need (and relative unavoidable costs).

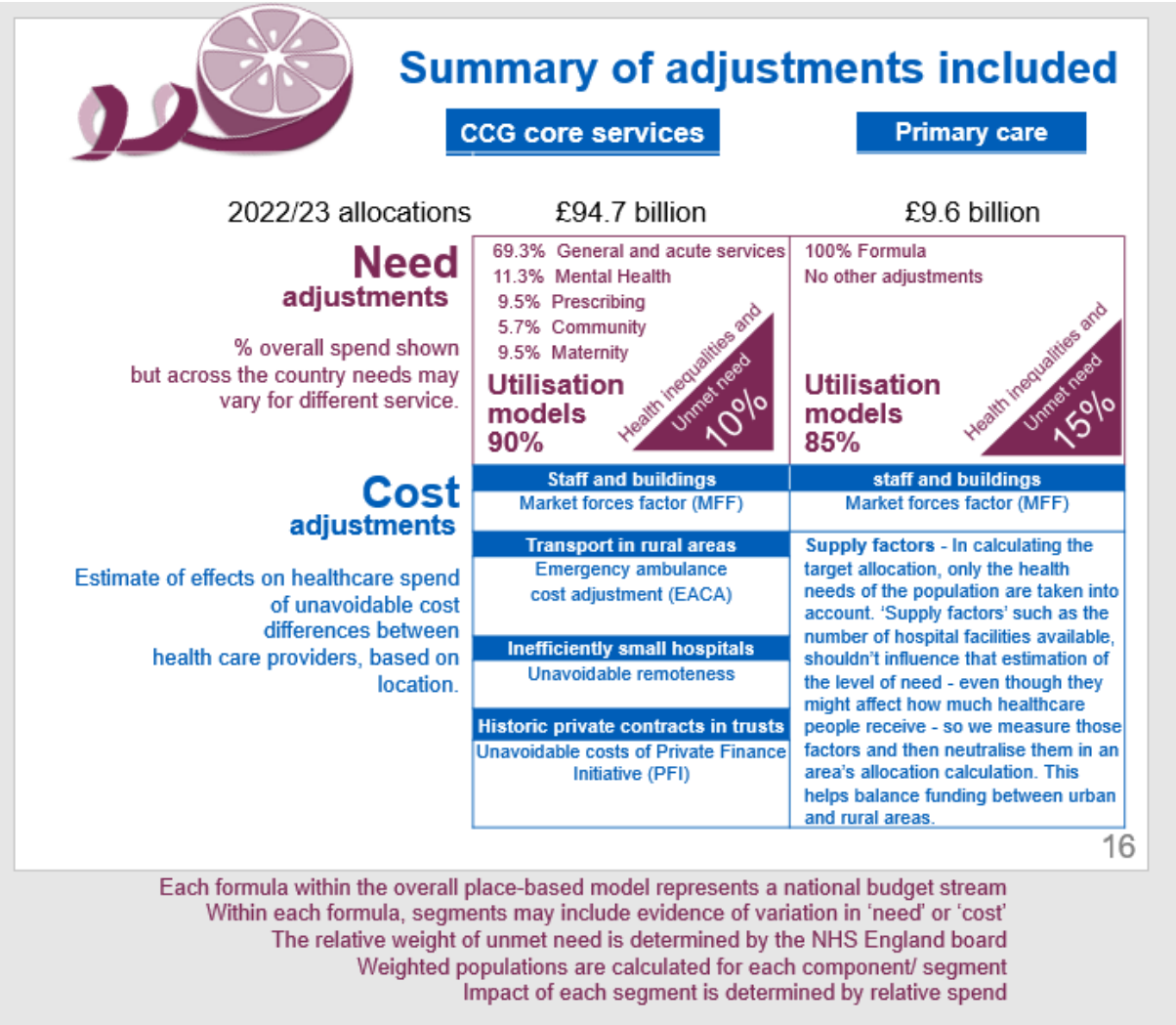
The relative need for each practice is based on:

- the age and sex distribution of the population (all else being equal, areas with older populations typically have a higher need per head) and additional need over and above that due to age (all else being equal, areas with poorer health have a higher need per head);
- unmet need and health inequalities;
- the unavoidably higher costs of delivering health care due to location alone, known as the Market Forces Factor (this reflects that unit staff, land and building input costs are higher in some parts of the country, for example London, than in others); and
- the higher costs of providing emergency ambulance services in sparsely populated areas, and the higher costs of unavoidably small hospitals with 24-hour accident and emergency services in remote areas.

As the need for different types of health services varies across the country, there are separate formulae for each of CCG core responsibilities, specialised services and primary medical care. Within each of these, there are separate components and adjustments – for example the distribution of need for CCG core responsibilities is different for general and acute, mental health, community and maternity services.

The different components and adjustments for unavoidable costs are summarised in Figure 1.

Figure 1: Summary of CCG formula and adjustments



Each component of the allocation formula is based on statistical modelling that examines the association between the utilisation of health services on the one hand, and the characteristics of individual patients and the areas where they live on the other hand. These models are used to decide which factors to include in the formula to predict future need per head and the relative weight on each of the factors.

Typically, the models estimate need related to age and sex and additional need over and above that due to age and sex as a single set of weights, rather than separately estimating weights for age and additional need. This is because additional need varies by age group. For instance, the health impact of living in a deprived area may be greater for an older person than a younger one.

The statistical models also include 'supply' variables to take account of the availability of health care services; where services are more easily available this generally leads to higher use. As utilisation driven by available capacity is not a reflection of need, where the supply variables are included in the models they are

sterilised and set to the national average when calculating relative need. This means areas are not penalised in the formula for lower utilisation due to relatively lower or less accessible capacity.

1.2.3 Impact of the COVID-19 pandemic

The data used in the development the general and acute model are from before the COVID-19 pandemic. Additional resources are being allocated outside of the core formula to support additional costs associated with the impact of Covid.

2. The general and acute model

2.1 The historic development of the model

The general and acute model covers:

- inpatient spells in hospital and community settings;
- outpatient attendances;
- accident and emergency attendances; and
- critical care.

Mental health, community (non-inpatient) and maternity services are excluded as they are covered by separate components in the allocations formulae. Specialised services are excluded as they are covered by a separate formula, as are other services commissioned nationally by NHS England.

Since the 2014/15 allocations, ACRA has recommended that relative need per head for general and acute services is estimated using a person-based approach, first developed by the Nuffield Trust[4]. The person-based approach uses anonymised data at the individual level to provide accurate estimates of need for small and atypical populations.

For the 2016/17 allocations, NHS England refreshed the Nuffield research using more recent data and re-estimated the models to produce updated weights for different drivers of need[5]. The same approach and methodology as the Nuffield Trust were followed.

A large range of candidate variables were tested for association with subsequent utilisation of healthcare services. The variables that were found to be to have a plausible, statistically significant association were:

- age;
- sex;

[4] See Bardsley M and Dixon J (2011) Person-based Resource Allocation: New approaches to estimating commissioning budgets for GP practices. Research summary. Nuffield Trust.

[5] https://www.england.nhs.uk/wp-content/uploads/2016/04/3-rep-elland-all-sections.pdf

- past diagnoses, based on SUS+ diagnosis codes;
- CCG dummies;
- being newly registered with a GP practice;
- having received private healthcare in the previous two years[6];
- log of the variance between registered and resident populations
- a range of attributed variables from the 2011 Census – population counts, proportion single pensioner households, proportion aged 16-74 never worked, proportion single, proportion divorced, proportion renting, proportion with not good health
- GP survey indicator – average number of medical conditions for those with at least one
- Quality Outcomes Framework (QOF) indicators – kidney disease total exceptions, epilepsy prevalence, mental health prevalence
- Index of Multiple Deprivation – Health and Disability score
- gravity weighted supply variables – adult critical care beds, median waiting times for dermatology patients, median weighting times of the 95th percentile for neurosurgery patients

The general and acute model has been part of ACRA's development programme for 2022/23 allocations and a new formula has been developed using updated data and some additions and changes to the model specification. These are described in the next section.

2.2 Changes to the general and acute model

2.2.1 Overview

As part of the usual cycle of review and revision, ACRA has updated its recommendations for the general and acute model, including an update to the data used for the model – both in terms of the costs being modelled and the explanatory variables used in the modelling. The datasets used for the modelling are built using pseudonymised patient data that cannot be attributed to individuals. The data has been pseudonymised and created according to all relevant GDPR principles and in line with the requirements of NHS Digital. There have also been some amendments and changes to the model specification, driven by changes in the evidence of how we can best estimate need for services.

2.2.2 Data changes

2.2.2.1 Update of the costing data

As the needs estimates from the model are used to inform the distribution of revenue, we build models that best predict the future spend on each individual.

[6] Previous use of private healthcare has been found to be indicative of lower use of NHS funded healthcare

Costs per head in 2018/19 were calculated for each individual registered with a GP practice in April 2018 by applying a cost to each inpatient spell, outpatient attendance, A&E attendance and critical care day. The costs used were 2018/19 National Tariff prices, where available, and otherwise reference costs. In a small minority of cases, the specialty average was used in the absence of tariff prices and reference costs. This is consistent with the costing methodology used in the previous model iteration. The existing general and acute model was developed using costed activity in 2013/14, using 2013/14 National Tariff prices.

Critically, the later prices are based on a different currency specification, HRG4+, rather than HRG4. We discuss the impact of this in section 4. Before proceeding with the modelling of costs, the distribution of spending was examined for outlier values that might skew the distribution and affect model fit. The previous iteration of the formula removed any cost above £100K. We now consider that such costs are unlikely to be the result of a mistake but more likely special cases with high values, and therefore we have sought to explore different ways to accommodate them.

Two alternatives were tested – removing outliers, or capping outliers and including a high-cost dummy variable for individuals where costs were capped. Different thresholds were tested, above £100k the differences in model fit were minimal. The option chosen was to cap high cost outliers at £100k and include a high-cost indicator dummy in the model for the model estimation, which was subsequently sterilised for predictions.

2.2.2.2 Explanatory variables

An extensive set of explanatory variables were gathered for testing in the model. The starting point for this list were the variables tested in previous iterations of the general and acute model. The need and supply variables tested in the model are summarised in tables 1 and 2. A full list is in Annex B.

Table 1: Need variables

Explanatory variable	Description	Change since last update
Morbidity flags, comorbidity flags and number of diagnoses	Historical diagnosis data were collated for all inpatient episodes and spells in 2016/17 and 2017/18 from the SUS+ dataset for the April 2018 cohort of GP registered patients. SUS+ is the Secondary Uses Service dataset that contains patient level data for hospital activity. These diagnoses data are used to create morbidity flags, indicating a past diagnosis of a condition in one of the World Health Organisation defined sub-chapter of the International Classification of Diseases (ICD). The use of two years of historical diagnosis data is consistent with both the Nuffield PBRA 2011 model and the 2016/17 update. This reflects the diminishing explanatory power of historical data on future hospital costs with time. Additional comorbidity flags are also included that take account of how having two diagnoses can increase or decrease the relative need compared to the sum of having each diagnosis alone. These are based on the higher level ICD chapters.	Data taken from 2016/17 and 2017/18 SUS+ rather than 2011/12 and 2012/13.
Age, sex and area of residence	Age, sex and Lower Super Output Area of residence were taken from the GP registrations data Master Patient Index (MPI).	Data based on April 2018 rather than April 2013.

Explanatory variable	Description	Change since last update
Ethnicity	Matched each individual's ethnic group using a range of patient level health datasets. This has identified the ethnic group for 61% of individuals. For the remaining population an area-based proportion is used. Ethnicity is now included at ethnic group (16 groups).	Previously ethnicity was included as an attributed area-based variable from the Census - the proportion of the population resident in the LSOA in each of four broad ethnic categories.
Privately funded care flag	A flag was created for anyone with any privately funded care episodes recorded in SUS+ in 2016/17 or 2017/18.	Data taken from 2016/17 and 2017/18 SUS+ rather than 2011/12 and 2012/13.
New registrations	A flag for whether someone was newly registered with their current GP, based on the previous 12 months. Modelling has consistently found that being newly registered with a GP was associated with higher need and therefore higher cost.	Based on registration in 2017/18 rather than 2012/13.
Variables from the ONS Census of Population	A range of variables relating to population characteristics from the 2011 census. Only available for small geographical areas (lower layer super output areas - LSOAs) rather than for individuals, so individuals are 'attributed' with the value for the LSOA in which they reside.	No change
Index of Multiple deprivation	The underlying indicators from the Index of Multiple Deprivation. Only available for small geographical areas (lower layer super output areas - LSOAs) rather than for individuals, so individuals are 'attributed' with the value for the LSOA in which they reside.	Updated for IMD2019 Use underlying indicators rather than composite scores
Log population variance	Log of the variance between registered and resident populations for each LSOA. To account for possible list inflation	Updated to 2018 populations

Explanatory variable	Description	Change since last update
Variables from the Department of Work and Pensions	Eligibility for Disability Living Allowance (DLA) or Personal Independence Payment (PIP)	New variable
Quality Outcomes Framework prevalence data	Prevalence data from the Quality Outcomes Framework (QOF) were also tested as need variables. Individual flags are not available and so individuals are 'attributed' with the value for the practice they are registered with.	Updated from 2012/13 to 2018/19.
GP survey	A range of indicators from the GP survey. Individual flags are not available and so individuals are 'attributed' with the value for the practice they are registered with.	Updated to 2018
New need variables tested in this round		
Household composition	Linking the MPI to the anonymised Unique Property Reference Number (UPRN) allows us to identify all individuals resident in a property and derive a household type variable that indicates the composition of the household as: care home; other communal establishment; two adults and one or more children; multi-adult and one or more children; two adults of the same gender; two adults of different gender; one adult and one or more children; or single person.	

Explanatory variable	Description	Change since last update
Morbidity counts	As well as the morbidity flags and a variable constructed for the number of different diagnosis recorded for an individual, an additional morbidity count variable was constructed for testing in the model. A morbidity count variable was constructed which indicated where an individual had had a particular diagnosis recorded three or more times during 2016/17 and 2017/18. This was based on the hypothesis that having a diagnosis recorded more frequently indicates a higher level of need. The count of diagnoses recording was capped at three or more to avoid included access effects in the model.	

The utilisation of health care may also be affected by the relative availability of health care services. Variables were tested in the modelling to adjust for this, known as supply variables. These variables included for example, waiting times and distances to hospitals. While these variables were included in the models as they affected utilisation, they were not included in the formula to calculate weighted populations; instead their value for each area was set to the national average (sterilised). This means if an area has lower use of health care services because of lower capacity or longer distance, this is corrected for in the formula.

Table 2: Supply variables

Explanatory variable	Description	Change since last update
Travel duration to hospital sites	Gravity weighted travel duration for an LSOA to all hospital sites	Updated list of hospital sites and travel duration calculations
CCG dummy	A flag for each individual indicating which CCG is responsible for commissioning their health care – based on the GP practice at which they are registered	Configuration of CCGs in 2018/19 rather than in 2013/14.
Quality Outcomes Framework scores and exception rates	Weighted scores and exception rates from the Quality Outcomes Framework (QOF) were also tested as supply variables. Individual flags are not available and so individuals are 'attributed' with the value for the practice they are registered with.	Updated from 2012/13 to 2018/19.
Hospital supply variables	A range of gravity weighted variables for each LSOA, including median waiting times, diagnostics and numbers of beds/operating theatres.	Updated from 2012/13 to 2018/19.
GP workforce survey	A range of variables relating to GP workforce. Individual flags are not available and so individuals are 'attributed' with the value for the practice they are registered with.	Updated to 2018

Due to the high number of attributed need variables, rationalisation of the variables tested in the model was undertaken by splitting the variables into thematic groups and using principal components analysis (PCA) to identify the most important variables. The large number of attributed need variables available to the model requires a large degree of variable selection that is mostly statistically driven through test statistics of coefficients. Preliminary selection using principal components was

used to reduce data and the necessary computational power required in this final variable selection.

The attributed variables were split into thematic groups. For each group of variables all possible components were created and variables were kept which on their own captured at least 5% of the variance each or cumulatively capture at least 90% of the variance, whichever condition is met first. For groups that contain more than 10 variables, the 3 most important variables from the first principal component were selected, 2 variables from the second and 1 variable from each subsequent component. For groups of 10 or less variables, the 2 most important variables were selected from the first principal component and 1 variable from each subsequent component. If any suggested-to-be-selected variable had already been selected in a previous component we move one to select the next most important variable of the current component.

Before performing the PCA on each of the groups of variables, the Kaiser-Meyer-Olkin measure of sampling adequacy was calculated, which characterises the appropriateness of the group to be data reduced through PCA. For any groups that fail to meet this criterion PCA is not undertaken and all variables of that group are included in the final model. Ten groups of variables were created:

i. QOF Prevalence
ii. QOF Scores
iii. QOF Exception rates
iv. GP immunisation rates
v. Hospital supply variables
vi. Barriers (subset of IMD variables)
vii. Education (subset of IMD and census variables)
viii. Health (subset of IMD and census variables)
ix. Income (subset of IMD and census variables)
x. Living Environment (subset of IMD variables)

Of the 10 groups, only Living Environment could not be reduced through PCA. The full set of variables used in the modelling, following this PCA process are listed in Annex B.

2.2.3 Changes in the model specification

2.2.3.1 Age functional form

In the previous model iteration, age was introduced as a series of 18 dummies each representing an age group in 5 year intervals up to 85 plus. Such age dummies were interacted with gender for gender-specific age costs. During the model development an alternative method of accounting for age and gender was tested through using linear or cubic splines with a number of different knots (5 to 18 knots). The use of splines allows the impact of age on predicted costs to vary within age groups.

The use of splines improved the performance of the model. Linear splines with 17 or 18 knots performed virtually identically and performed the best in the model. To allow for more flexibility in the older groups, the decision was to implement linear splines with 18 knots.

2.2.3.2 Number of diagnostic positions

In the updated dataset the number of secondary diagnostic positions that can be recorded has increased to 23 (compared to 13 diagnostic positions in the dataset for the 2016/17 model update). As such the optimal number of positions used to create the morbidity binary flags was examined. Changes in model fit were minimal after the use of 13 secondary positions, although 23 diagnostic positions performed best in terms of model fit.

However, significant variation in the depth of coding between providers was observed which could introduce bias into the model as patients attending providers with greater depth of coding could have more morbidities and comorbidities identified. About 95% of individuals had 14 diagnoses or less recorded per provider. Consideration of the 95 percentile of diagnoses recording suggested that the vast majority of providers coded to around 10 to 12 positions with all providers having a maximum number of diagnoses of at least 12.

Other tests included looking at the same individual being treated at different providers and the way that other model variables change as the number or secondary diagnoses included in the model change.

Considering depth of coding, goodness of fit statistics and provider coding distributions and the diagnostics testing, 12 secondary diagnostic positions were chosen as this struck the best balance between making the best use of the data that is available without introducing bias into the model due to differences in depth of coding by providers.

2.2.3.3 Interaction of age-gender with household type

Following testing in the model, it was recommended that household type was interacted with age to allow for heterogenous effects of household type across the age distribution.

2.3 Final recommended model for general and acute services

2.3.1 Model specification

The model specification ACRA has now recommended for the general and acute model is shown in table 3. The changes from the previous specification are also detailed in this table.

Statistical modelling was used to select the ‘best fit’ drivers of relative costs from the set of explanatory variables at the person level and the relative weights for each driver. The quantified relationships found were taken to be predictors of relative

future, cost-weighted need for health care services, with the exception of the supply variables.

Consistent with previous person-based resource allocation modelling approaches, three random samples were used to estimate and validate the models:

- Sample S1 – the individual level estimation sample. This was a 15% randomly selected sample of 8,870,118 individuals from 7,218 GP practices.
- Sample S2 – the individual level validation sample. This was a random sample of 15% of 8,861,680 individuals from 7,220 GP practices. Samples S1 and S2 were mutually exclusive, so no individual was in both samples S1 and S2.
- Sample 3 – GP practice level validation sample (containing all registered patients from a sample of GP practices). This was all those registered with a randomly selected sample of 15% of GP practices with 1,000 or more patients. This sample had 8,432,418 individuals from 1,044 GP practices.

Given the large number of candidate variables in the model and the associated risk of overfitting the model, a variable selection process was conducted to obtain a list of attributed variables that are associated with costs of hospital services. A stepwise approach as described below is used to select variables for the final model. Variable selection is undertaken on the estimation sample, S1. The final coefficients for the selected variables are then calculated using the whole dataset. In line with ACRA's previous recommendations some groups of variables are treated as a group of variables and if any are significant, the whole group are retained in the model. For the general and acute model this is true for age, gender, ethnicity, household type, age and household type interactions, historic diagnoses and CCG dummies.

Stepwise T-statistic selection method:

a. The first step selects the relevant comorbidity flags and morbidity intensity counts. Starting from a baseline model containing age splines, sex, their interaction, morbidity flags and co-morbidity flags, comorbidities and morbidity intensity with t-statistic> 3.27 are only kept as highly significant and relevant.

b. In the second step, the method estimates at the person level a 'full model' containing age splines, sex, morbidity flags, selected comorbidity flags, selected morbidity intensity counts, CCGs, new GP practice, private utilisation, population variance and all of the candidate variables.

c. After running the model though ordinary least squares regression, we remove all attributed variables with t-statistic less than 0.2.

d. After step c, we re-run the model but without variables omitted in stage c. We then remove all attributed variables with t-statistics lower than 0.4.

e. We repeat this process, increasing the t-statistic by 0.2 for each iteration, until we have removed all attributed variables with a t-statistic of under 2.58.

Morbidity (previous diagnoses) and age were the most important variables in the model. The final model explains 89.4% of variation in costs at the GP practice level. This is compared to 85.0% for the previous general and acute model. The coefficients for the variables selected for the general and acute model are in Annex C.

Table 3: General and acute model specification

Model component	Change from existing model
Age linear splines interacted with gender	Change to splines for age as opposed to five year age groups
Morbidity and comorbidity flags	Change in number of diagnostic positions used – from seven to 13 (one primary and 12 secondary)
Diagnosis count	Change in number of diagnostic positions used – from seven to 13 (one primary and 12 secondary)
Morbidity count	New variable - count of individual diagnoses, capped at 3 or more
Household types	New individual level variable derived from the Master Patient Index
CCG dummies	Unchanged
Ethnicity	Individual ethnicity used where it is available, compared to broad area based ethnic categories in previous model
Interaction of age and household type	New
New GP practice flag	Unchanged
Private care utilisation	Unchanged
Logarithm of population variance	Unchanged
Gravity weighted travel duration	Unchanged – updated travel duration calculations
Attributed need and supply variables	Similar set of attributed need and supply variables but pre-selected using Principal Components Analysis

2.3.2 Impact of final model

2.3.2.1 Calculation of need indices

Once the variables in the model had been determined, weighted populations were produced for GP practices, which were summed to CCGs to reflect relative need for healthcare in each area. As part of this process the supply variables are ‘sterilised’.

In addition, ACRA have recommended that where ethnic groups had negative coefficients in the model (indicating lower use of health services) these should be set

to zero (i.e. matching the White-British group) as they are assumed to reflect unmet need rather than lower levels of need for these groups. It is likely that in many cases these groups should have a positive coefficient, reflecting greater need than the White-British group, but this work does not provide any indication of what the true value should be. The health inequalities adjustment, which is applied separately, targets additional funding at the most challenged areas and will adjust for any additional underlying need.

Weighted populations are used to calculate a 'need index' for each CCG by dividing the weighted population by the total registered population. A value above 1 indicates higher than average need and a value below one indicates lower than average need.

To allow comparison of the underlying models, the need indices have been calculated for the existing model and the proposed model using the same 2018/19 populations so that any changes observed are due to the update of the data or the changes in the model specification and not due to population changes. They have been calculated for the current configuration of 106 CCGs as of April 2021.

2.3.2.2 Impact by age and deprivation

The need indices for the resulting model by age and IMD quintiles are shown in Table 4. These quintiles are derived by assigning each GP practice to an age (proportion aged over 65 years) and deprivation (IMD score) quintile based on the characteristics of their registered population. In this way it is possible to examine how need indices vary by age and deprivation for different models. Tables 4 shows that the new model, like the existing model, has the expected pattern of higher need for areas with older more deprived populations and a lower level of need in areas with younger less deprived populations.

The new model is showing a shift in relative need, with the weighted populations increasing in areas with younger populations, across all levels of deprivation. This reflects improvements in data quality rather than increased underlying need for younger populations or reduced underlying need for older populations.

Table 4: GP practice need indices for new model by age and IMD quintile

		Age quintile (A1 = youngest quintile, A5 = oldest quintile)					
		A1	**A2**	**A3**	**A4**	**A5**	
Deprivation quintile (D1 = least deprived, D5 = most deprived)	**D1**	**0.60**	**0.80**	**0.90**	**0.99**	**1.10**	**0.96**
	D2	**0.61**	**0.86**	**0.97**	**1.05**	**1.15**	**1.00**
	D3	**0.69**	**0.92**	**1.04**	**1.12**	**1.22**	**1.00**
	D4	**0.76**	**0.98**	**1.10**	**1.18**	**1.26**	**1.00**
	D5	**0.86**	**1.07**	**1.18**	**1.24**	**1.42**	**1.06**
		0.74	**0.95**	**1.03**	**1.08**	**1.16**	

2.3.2.3 Differential impact of data updates and model updates

Changes in the relative need and the need indices for a CCG can be due to:

- the updating of the underlying data that is used in the model, such as changes in age-gender distribution, deprivation distributions or changes in the data about activity, such as the diagnoses that are reported in SUS; or
- due to the implementation of the new model, which leads to changes in the weighting of different individual characteristics, reflecting changes in relative patterns of utilisation or pricing policy.

In this case both the data update and the model update lead to a shift in relative need towards practices with younger populations, generally the impact of the data update is larger than the impact of the model update. The exception to this is for practices with oldest and most deprived populations where the shift in relative need is larger from the model update. However, the model update still leads to a steeper deprivation gradient than the existing model.

When aggregated to a whole CCG geography the balance between the impact of the model change and the impact of data updates swings more decisively towards the data update. For over two thirds of CCGs, the percentage change in weighted population due to the updating of the data in the model is greater than the percentage change due to implementing the new model. For all the 18 CCGs with a percentage fall in weighted population of more than 5%, the percentage change in the weighted population due to the data update is greater than due to the model update. Across all 18 of these CCGs the data update accounts for 85% of the fall in weighted populations. For the nine CCGs where the weighted population increases by more than 5% the picture is more mixed with some having a larger proportion of change due to the data update and some due the model update. Across these nine CCGs the data update accounts for 57% of the increase in weighted populations.

2.3.2.4 Reasons for change

Our analysis leads us to conclude that the size of the change in relative need that is due to data updates, rather than changes in the model parameters, reflects two things.

First, improvements in diagnostic recording have meant that there is now increased uniformity in the depth of diagnostic recording in different parts of the country. Analysis of the change in the average number of diagnoses recorded per patient spell between 2013/14 and 2018/19 as shown in table 9 shows that the average number of diagnoses recorded per spell has been increasing across all regions and this increase has started before the introduction of HRG4+. The changes have led to more uniformity in the depth of diagnostic recording between different parts of the country.

The changes in depth of diagnostic recording will have had a differential impact on patients with lower levels of complexities and comorbidities (such as younger

patients) as those patients with the highest need (with more complexities and comorbidities) are likely to already have a high number of diagnoses recorded. Therefore, depth of diagnostic recording is likely to increase more in areas with a younger population.

Table 9: Average number of diagnoses recorded per spell

	2013	2014	2015	2016	2017	2018
North East and Yorkshire	3.99	4.16	4.17	4.36	4.76	5.07
North West	4.22	4.38	4.44	4.62	4.94	5.15
Midlands	3.92	4.12	4.19	4.39	4.66	5.04
East of England	4.08	4.17	4.25	4.58	4.84	5.13
London	3.83	4.01	4.09	4.37	4.85	5.37
South West	4.11	4.22	4.31	4.50	4.73	4.96
South East	3.83	3.92	4.01	4.21	4.59	4.96

Secondly, the HRG4+ currency design was implemented in 2017/18, between the development of the two models. HRG4+ has around 2,000 prices (compared to 1,300 in the previous HRG4 design) and was designed to better reflect patient complexity. The enhanced importance of complexity and comorbidities in determining prices led to further improvements in the quality and depth of coding of diagnoses.

When HRG4+ was implemented, an impact assessment showed a differential impact across regions. Provider income (and so costs to commissioners) increased in London, with all other regions showing a reduction, with the greatest reduction in North East and Yorkshire. A set of non-recurrent adjustments[7] were made to allocations for 2017/18 and 2018/19 to reflect this differential impact of the introduction of HRG4+.

Both the data update and the model update (including changes in patterns of utilisation) have led to a shift in relative need from older to younger populations. This reflects an increase in relative need being identified for younger populations, both through a change in the pattern of utilisation and price relativities through the introduction of HRG4+, and through the increased uniformity of diagnostic coding.

We do not believe that this shift in relative need toward younger populations reflects increased need in these groups or reduced need for older populations, but that improvements in data recording are allowing improved estimation of need for younger populations.

This increase in the relative need for populations that have lower levels of need means that relative need has to reduce elsewhere. The increase in relative need at the lower end of the need distribution leads to a reduction in relative need at the top

[7] https://www.england.nhs.uk/publication/clinical-comissionning-group-allocation-adjustments/

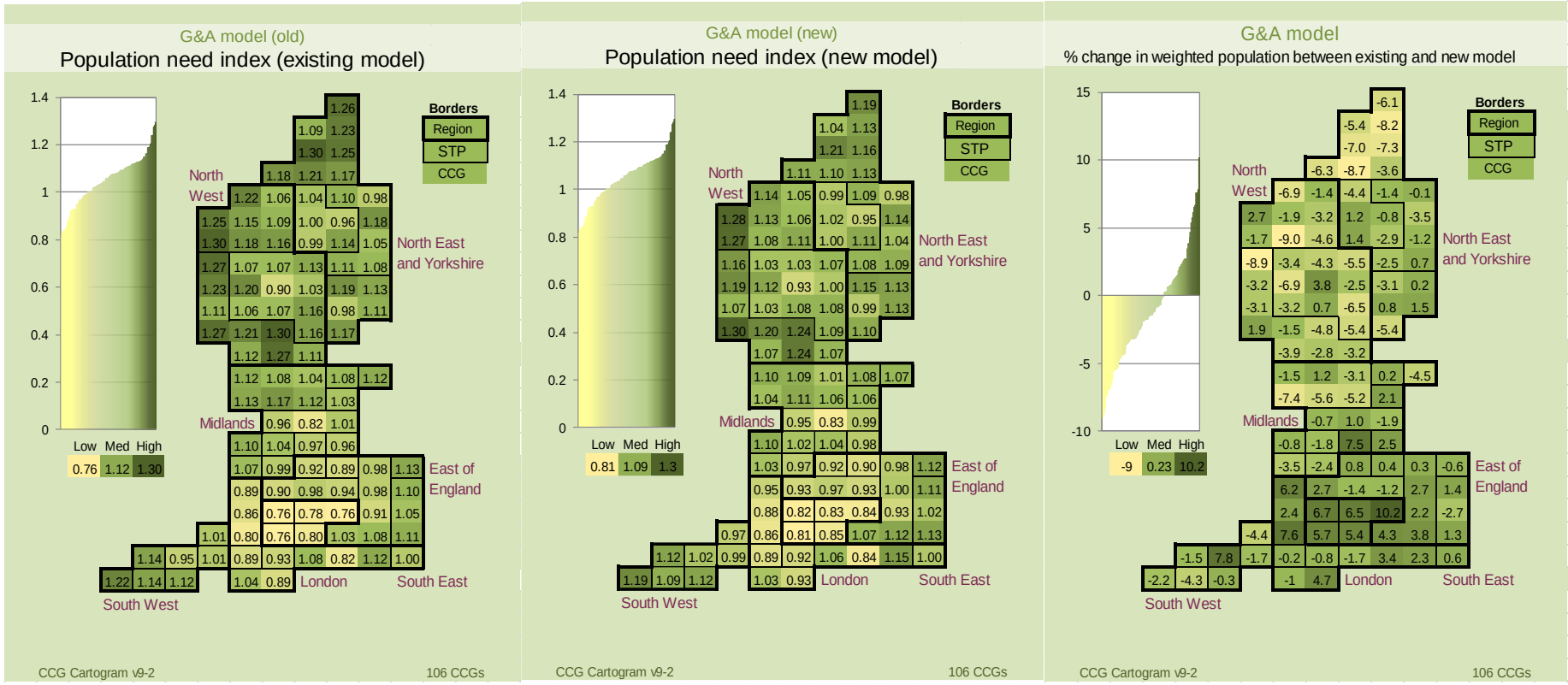
end of the distribution. This has the effect of narrowing the distribution of relative need between areas.

This change in relative need and the narrowing of the need distribution has led to a differential impact on the estimated relative need of different places depending on the population and need profile of each area. Areas with a younger population are now assessed to have a somewhat higher relative need than previously, and within a zero sum relative distribution this necessarily means that other areas have a somewhat lower relative need. At regional level, overall this results in an increase in, for example, London's assessed relative need and a reduction in the relative need in the North East and Yorkshire which has an older population. This will more closely match the target allocations against the cost of provision in those regions as the allocations catch up with the implementation of HRG4+.

2.3.2.5 Geographical impact

Cartograms showing the general and acute need indices for the existing and proposed new models and the percentage change in weighted populations between the two models are shown in figure 2 below. Each box in the cartogram represents one of the 106 CCGs. A reference map for the cartograms is in Annex E and a list of the need indices for each CCG and STP/ICS are in Annex F. These cartograms show that in general, the geographical pattern of need is very similar between the existing and new models for general and acute services.

Figure 2: General and acute need indices



Annex A: ACRA's criteria for assessing formulae

Criteria	*Definition*
Transparency and simplicity	The construction and application of the formula should aim for simplicity, be well documented and be open to scrutiny.
Comprehensibility	The formula and its derivation should be explainable to non-specialists in plain English and be capable of common sense justification, even if the detail is understood only by specialists.
Evidence base	The formulae are based on the best evidence available.
Technical robustness	The techniques used must be consistent with best practice methods for statistical and econometric modelling and be applied appropriately.
Objectivity	Formula should be based on plausible relationships and there should be tests of bias, robustness, statistical significance and explanatory power.
Flexibility	The recommendations can respond to changes of commissioning responsibilities (e.g. coverage of services) and size.
Parsimony	The formula should not include relationships of low materiality. All other things being equal fewer rather than more variables are preferred.
Plausibility	The measures & relationships in the formula should be plausible and have face validity.
Clarity of contribution of indicators	The contribution made by individual components in the formula should avoid ambiguity. Where multiple indicators are used the purpose, weighting and selection must be clear.
Reliability of data	The data are available and consistent for all local areas (units of allocation) where possible and not subject to local variations in reporting.
Freedom from perverse incentives	The methods and data sources used to calculate the formula should not create perverse incentives either for manipulating data or other negative behaviours.
Durability and stability	The relationships used to drive the formula should be durable and the data used to derive the formula should be stable.
Updateable	The scale of the work required to update the formula is manageable within the time constraints of the allocation cycle.

Annex B: Variables tested in the model

Individual Characteristics

Age/gender splines	
Age <1	Age 40-44
Age 1-4	Age 45-49
Age 5-9	Age 50-54
Age 10-14	Age 55-59
Age 15-19	Age 60-64
Age 20-24	Age 65-69
Age 25-29	Age 70-74
Age 30-34	Age 75-79
Age 35-39	Age 80-84
Age 40-44	Age 85+
Household type	
Care home	Single person
Multi-adult	Two adult family
Multi-adult-child	Two adults diff gender
Multi-child	Two adults same gender
Other communal	Unknown
Single parent	
Age and household type interactions	
Ethnic Group	
White: Irish	Bangladeshi
White: Other White	Chinese
White and Black Caribbean	Other Asian
White and Black African	African
White and Asian	Caribbean
Other Mixed	Other Black
Indian	Any other ethnic group
Pakistani	
Newly registered with a GP practice	**Private care in last two years**

Diagnoses – included as individual diagnostic flags and as morbidity count variables

A00-A09 Intestinal infectious diseases	K65-K67 Diseases of peritoneum
A15-A19 Tuberculosis	K70-K77 Diseases of liver
A20-A49 Certain bacterial diseases	K80-K87 Disorders of gall bladder, biliary tract & pancreas
A50-A64 Infections with predominantly sexual mode of transmission	K90-K93 Other diseases of the digestive system
A65-A79 Other infectious and parasitic disorders	L00-L14 L55-L99 Other infections and disorders of the skin
A80-A89 Viral infections of the central nervous system	L20-L30 Dermatitis and eczema
A90-A99 Arthropod-borne viral fevers & viral haemorrhagic fevers	L40-L45 Papulosquamous disorders (including Psoriasis)
B00-B09 Viral infections characterized by skin & mucous mem. lesns.	L50-L54 Urticaria and erythems
B15-B19 Viral hepatitis	M00-M25 Arthropathies
B20-B24 Human immunodeficiency virus [HIV] disease	M30-M36 Systemic connective tissue disorders
B25-B34 Other viral diseases	M40-M54 Dorsopathies
B35-B49 Mycoses	M60-M79 Soft tissue disorders
B50-B64 Protozoal diseases	M80-M94 Osteopathies and chondropathies
B65-B83 Helminthiases	M95-M99 Other disorders of the musculoskeletal system & conn. tiss.
B85-B99 Other infectious and parasitic diseases	N00-N08, N10-N16 Diseases of the kidney
C00-C14 Malignant neoplasm of liporal cavity and pharynx	N17-N19 Renal failure
C15-C26 Malignant neoplasm of digestive organs	N20-N23 Urolithiasis
C30-C39 Malignant neoplasms of respiratory & intrathoracic organs	N25-N29 Other disorders of kidney & ureter
C40-C41 Malignant neoplasm of bone and articular cartilage	N30-N39 Other diseases of the urinary system
C43-C44 Malignant neoplasms of skin	N40-N51 Diseases of male genital organs
C45-C49 Malignant neoplasms of mesothelial and soft tissue	N60-N64 Disorders of breast
C50 Malignant neoplasm of breast	N70-N77 Inflammatory diseases of female pelvic organs
C51-C58 Malignant neoplasms of female genital organs	N80-N98 Noninflammatory disorders of female genital tract
C60-C63 Malignant neoplasms of male genital organs	N99 Other disorders of the genitourinary system
C64-C68 Malignant neoplasms of urinary tract	O00-O08 Pregnancy with abortive outcome
C69-C72 Malignant neoplasms of eye, brain & other parts of CNS	O10-O75, O85-O92, O94-O99 Complications of labour and delivery
C73-C80, C97 Malignant neoplasm. of thyroid and oth. endo. Glands etc.	O80-O84 Delivery
C81-C96 Malignant neoplasms of lymphoid, haematopoietic & rel. tiss.	P00-P04 Complications of foetus/neonate affected by maternal
D00-D48 In situ & benign neoplasms and others of uncertainty	P05-P96 Other conditions originating in the perinatal period

D50-D64 Anaemias	Q00-Q89 Congenital malformations
D65-D89 Diseases of the blood and blood-forming organs	Q90-Q99 Chromosomal abnormalities
E00-E07 Disorders of thyroid gland	R00-R09 Symptoms & signs inv. the circulatory/respiratory system
E10-E14 Diabetes Mellitus	R10-R19 Symptoms & signs inv. the digestive system & abdomen
E15-E90 Endocrine nutritional and metabolic diseases	R20-R23 Symptoms & signs inv. the skin & subcutaneous tissue
F00-F03 Dementia	R25-R29 Symptoms & signs inv. the nervous & musculoskeletal sys.
F04-F09 Other organic including symptomatic mental disorders	R30-R39 Symptoms & signs involving the urinary system
F10-F19 Mental and behavioural disorders due to psychoactive subst.	R40-R46 Symptoms & signs inv. Cognition, perception etc.
F20-F29 Schizophrenia, schizotypal and delusional disorders	R47-R49 Symptoms & signs inv. speech & voice
F30-F39 Mood [affective] disorders	R50-R68 General symptoms & signs
F40-F69 Neurotic, behavioural & personality disorders	R69 Unknown & unspecified causes of morbidity
F70-F79 Mental retardation	R70-R89 Abnormal findings of bodily fluids or samples without diag.
F80-F99 Other mental and behavioural disorders	R90-R94 Abnormal findings on diagnostic imaging/function studies
G00-G09 Inflammatory diseases of the central nervous system	R95-R99 Ill-defined & unknown causes of mortality
G10-G14, G30-G32 Other degenerative diseases (incl. Alzheimer).	S00-S09 Injuries to the head
G20-G26 Extrapyramidal & movement disorders (incl. Parkinsonism).	S10-S19 Injuries to the neck
G35-G37 Demyelinating diseases (incl Multiple Sclerosis) of the CNS.	S20-S29 Injuries to the thorax
G40-G47 Epilepsy, migraine & other episodic disorders	S30-S39 Injuries to abdomen, lower back, lumbar spine & pelvis
G50-G73 G90-G99 Other diseases & disorders of the nervous syst.	S40-S49 Injuries to the shoulder & upper arm
G80-G83 Cerebral palsy & other paralytic syndromes	S50-S59 Injuries to the elbow & forearm
H00-H06, H15-H22, H30-H36, H43-H59 Other disorders of the eye etc.	S60-S69 Injuries to the wrist & hand
H10-H13 Disorders of conjunctiva (including conjunctivitis)	S70-S79 Injuries to the hip & thigh
H25-H28 Disorders of lens (including cataracts)	S80-S89 Injuries to the knee & lower leg
H40-H42 Glaucoma	S90-S99 Injuries to the ankle & foot
H60-H95 Diseases of the ear and mastoid process	T00-T07 Injuries involving multiple body regions
I00-I09 Rheumatic heart disease	T08-T14 Injuries to unspecified part of trunk limb or body
I10-I15 Hypertensive diseases	T15-T19 Effects of foreign body entering through natural orifice
I20-I25 Ischaemic heart diseases	T20-T32 Burns and corrosions

I26-I28 Pulmonary heart disease & diseases of pulmonary circulation	T33-T35 Frostbite
I30-I52 Other forms of heart disease	T36-T50 Poisonings by drugs medicaments & biological substances
I60-I69 Cerebrovascular diseases	T51-T65 Tox. effcts. of substances. chiefly non-medicinal as to source
I70-I79 Diseases of arteries, arterioles & capillaries	T66-T78 Other and unspecified effects of external causes
I80-I89 Diseases of veins & lymphatic system nec.	T79 Certain early complications of trauma
I95-I99 Other & unspecified disorders of the circulatory system	T80-T88 Complications of surgical & medical care nec.
J00-J06 Acute upper respiratory infections	T90-T98 Sequelae of injuries of poisoning & other consequences
J09-J18 Influenza & pneumonia	VVV
J20-J22 Other acute lower respiratory infections	WWW
J30-J39 Other diseases of upper respiratory tract	XXX
J40-J47 Chronic lower respiratory diseases	YYY
J60-J70 Lung diseases due to external agents	Z00-Z13 Examination and investigation
J80-J99 Other diseases of the respiratory system	Z20-Z29 Potential health hazards related to communicable diseases
K00-K14 Diseases of oral cavity, salivary glands & jaws	Z30-Z39 Health services in circumstances related to reproduction
K20-K31 Diseases of oesophagusstomach & duodenum	Z40-Z54 Persons encountering health services for specific care
K35-K38 Diseases of appendix	Z55-Z65 Potential health hazards reltd. to socioeconomic & psychosoc.l
K40-K46 Hernia	Z70-Z76 Persons encountering health services in other circs.
K50-K52 Noninfective enteritis & colitis	Z80-Z99 Persons with potential health hazards related to family
K55-K64 Other diseases of intestines	U Unclassified

Number of diagnoses

2 diagnoses	7 diagnoses
3 diagnoses	8 diagnoses
4 diagnoses	9 diagnoses
5 diagnoses	10 diagnoses
6 diagnoses	

Comorbidities

Neoplasms x Certain infectious and parasitic diseases	Certain conditions originating in the perinatal period x Certain infectious and parasitic diseases
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism x Certain infectious and parasitic diseases	Certain conditions originating in the perinatal period x Neoplasms
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism x Neoplasms	Certain conditions originating in the perinatal period x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
Endocrine, nutritional and metabolic diseases x Certain infectious and parasitic diseases	Certain conditions originating in the perinatal period x Endocrine, nutritional and metabolic diseases
Endocrine, nutritional and metabolic diseases x Neoplasms	Certain conditions originating in the perinatal period x Mental and behavioural disorders
Endocrine, nutritional and metabolic diseases x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Certain conditions originating in the perinatal period x Diseases of the nervous system
Mental and behavioural disorders x Certain infectious and parasitic diseases	Certain conditions originating in the perinatal period x Diseases of the eye and adnexa
Mental and behavioural disorders x Neoplasms	Certain conditions originating in the perinatal period x Diseases of the ear and mastoid process
Mental and behavioural disorders x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Certain conditions originating in the perinatal period x Diseases of the circulatory system
Mental and behavioural disorders x Endocrine, nutritional and metabolic diseases	Certain conditions originating in the perinatal period x Diseases of the respiratory system
Diseases of the nervous system x Certain infectious and parasitic diseases	Certain conditions originating in the perinatal period x Diseases of the digestive system
Diseases of the nervous system x Neoplasms	Certain conditions originating in the perinatal period x Diseases of the skin and subcutaneous tissue
Diseases of the nervous system x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Certain conditions originating in the perinatal period x Diseases of the musculoskeletal system and connective tissue
Diseases of the nervous system x Endocrine, nutritional and metabolic diseases	Certain conditions originating in the perinatal period x Diseases of the genitourinary system
Diseases of the nervous system x Mental and behavioural disorders	Certain conditions originating in the perinatal period x Pregnancy, childbirth and the puerperium

Diseases of the eye and adnexa x Certain infectious and parasitic diseases	Congenital malformations, deformations and chromosomal abnormalities x Certain infectious and parasitic diseases
Diseases of the eye and adnexa x Neoplasms	Congenital malformations, deformations and chromosomal abnormalities x Neoplasms
Diseases of the eye and adnexa x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Congenital malformations, deformations and chromosomal abnormalities x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
Diseases of the eye and adnexa x Endocrine, nutritional and metabolic diseases	Congenital malformations, deformations and chromosomal abnormalities x Endocrine, nutritional and metabolic diseases
Diseases of the eye and adnexa x Mental and behavioural disorders	Congenital malformations, deformations and chromosomal abnormalities x Mental and behavioural disorders
Diseases of the eye and adnexa x Diseases of the nervous system	Congenital malformations, deformations and chromosomal abnormalities x Diseases of the nervous system
Diseases of the ear and mastoid process x Certain infectious and parasitic diseases	Congenital malformations, deformations and chromosomal abnormalities x Diseases of the eye and adnexa
Diseases of the ear and mastoid process x Neoplasms	Congenital malformations, deformations and chromosomal abnormalities x Diseases of the ear and mastoid process
Diseases of the ear and mastoid process x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Congenital malformations, deformations and chromosomal abnormalities x Diseases of the circulatory system
Diseases of the ear and mastoid process x Endocrine, nutritional and metabolic diseases	Congenital malformations, deformations and chromosomal abnormalities x Diseases of the respiratory system
Diseases of the ear and mastoid process x Mental and behavioural disorders	Congenital malformations, deformations and chromosomal abnormalities x Diseases of the digestive system
Diseases of the ear and mastoid process x Diseases of the nervous system	Congenital malformations, deformations and chromosomal abnormalities x Diseases of the skin and subcutaneous tissue
Diseases of the ear and mastoid process x Diseases of the eye and adnexa	Congenital malformations, deformations and chromosomal abnormalities x Diseases of the musculoskeletal system and connective tissue
Diseases of the circulatory system x Certain infectious and parasitic diseases	Congenital malformations, deformations and chromosomal abnormalities x Diseases of the genitourinary system
Diseases of the circulatory system x Neoplasms	Congenital malformations, deformations and chromosomal abnormalities x Pregnancy, childbirth and the puerperium
Diseases of the circulatory system x Diseases of the blood and blood-forming	Congenital malformations, deformations and chromosomal abnormalities x Certain conditions originating in the perinatal period

organs and certain disorders involving the immune mechanism	
Diseases of the circulatory system x Endocrine, nutritional and metabolic diseases	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Certain infectious and parasitic diseases
Diseases of the circulatory system x Mental and behavioural disorders	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Neoplasms
Diseases of the circulatory system x Diseases of the nervous system	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
Diseases of the circulatory system x Diseases of the eye and adnexa	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Endocrine, nutritional and metabolic diseases
Diseases of the circulatory system x Diseases of the ear and mastoid process	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Mental and behavioural disorders
Diseases of the respiratory system x Certain infectious and parasitic diseases	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the nervous system
Diseases of the respiratory system x Neoplasms	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the eye and adnexa
Diseases of the respiratory system x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the ear and mastoid process
Diseases of the respiratory system x Endocrine, nutritional and metabolic diseases	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the circulatory system
Diseases of the respiratory system x Mental and behavioural disorders	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the respiratory system
Diseases of the respiratory system x Diseases of the nervous system	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the digestive system
Diseases of the respiratory system x Diseases of the eye and adnexa	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the skin and subcutaneous tissue
Diseases of the respiratory system x Diseases of the ear and mastoid process	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the musculoskeletal system and connective tissue
Diseases of the respiratory system x Diseases of the circulatory system	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the genitourinary system
Diseases of the digestive system x Certain infectious and parasitic diseases	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Pregnancy, childbirth and the puerperium

Diseases of the digestive system x Neoplasms	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Certain conditions originating in the perinatal period
Diseases of the digestive system x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Congenital malformations, deformations and chromosomal abnormalities
Diseases of the digestive system x Endocrine, nutritional and metabolic diseases	Injury, poisoning and certain other consequences of external causes x Certain infectious and parasitic diseases
Diseases of the digestive system x Mental and behavioural disorders	Injury, poisoning and certain other consequences of external causes x Neoplasms
Diseases of the digestive system x Diseases of the nervous system	Injury, poisoning and certain other consequences of external causes x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
Diseases of the digestive system x Diseases of the eye and adnexa	Injury, poisoning and certain other consequences of external causes x Endocrine, nutritional and metabolic diseases
Diseases of the digestive system x Diseases of the ear and mastoid process	Injury, poisoning and certain other consequences of external causes x Mental and behavioural disorders
Diseases of the digestive system x Diseases of the circulatory system	Injury, poisoning and certain other consequences of external causes x Diseases of the nervous system
Diseases of the digestive system x Diseases of the respiratory system	Injury, poisoning and certain other consequences of external causes x Diseases of the eye and adnexa
Diseases of the skin and subcutaneous tissue x Certain infectious and parasitic diseases	Injury, poisoning and certain other consequences of external causes x Diseases of the ear and mastoid process
Diseases of the skin and subcutaneous tissue x Neoplasms	Injury, poisoning and certain other consequences of external causes x Diseases of the circulatory system
Diseases of the skin and subcutaneous tissue x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Injury, poisoning and certain other consequences of external causes x Diseases of the respiratory system
Diseases of the skin and subcutaneous tissue x Endocrine, nutritional and metabolic diseases	Injury, poisoning and certain other consequences of external causes x Diseases of the digestive system
Diseases of the skin and subcutaneous tissue x Mental and behavioural disorders	Injury, poisoning and certain other consequences of external causes x Diseases of the skin and subcutaneous tissue
Diseases of the skin and subcutaneous tissue x Diseases of the nervous system	Injury, poisoning and certain other consequences of external causes x Diseases of the musculoskeletal system and connective tissue

Diseases of the skin and subcutaneous tissue x Diseases of the eye and adnexa	Injury, poisoning and certain other consequences of external causes x Diseases of the genitourinary system
Diseases of the skin and subcutaneous tissue x Diseases of the ear and mastoid process	Injury, poisoning and certain other consequences of external causes x Pregnancy, childbirth and the puerperium
Diseases of the skin and subcutaneous tissue x Diseases of the circulatory system	Injury, poisoning and certain other consequences of external causes x Certain conditions originating in the perinatal period
Diseases of the skin and subcutaneous tissue x Diseases of the respiratory system	Injury, poisoning and certain other consequences of external causes x Congenital malformations, deformations and chromosomal abnormalities
Diseases of the skin and subcutaneous tissue x Diseases of the digestive system	Injury, poisoning and certain other consequences of external causes x Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified
Diseases of the musculoskeletal system and connective tissue x Certain infectious and parasitic diseases	External causes of morbidity and mortality x Certain infectious and parasitic diseases
Diseases of the musculoskeletal system and connective tissue x Neoplasms	External causes of morbidity and mortality x Neoplasms
Diseases of the musculoskeletal system and connective tissue x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	External causes of morbidity and mortality x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
Diseases of the musculoskeletal system and connective tissue x Endocrine, nutritional and metabolic diseases	External causes of morbidity and mortality x Endocrine, nutritional and metabolic diseases
Diseases of the musculoskeletal system and connective tissue x Mental and behavioural disorders	External causes of morbidity and mortality x Mental and behavioural disorders
Diseases of the musculoskeletal system and connective tissue x Diseases of the nervous system	External causes of morbidity and mortality x Diseases of the nervous system
Diseases of the musculoskeletal system and connective tissue x Diseases of the eye and adnexa	External causes of morbidity and mortality x Diseases of the eye and adnexa
Diseases of the musculoskeletal system and connective tissue x Diseases of the ear and mastoid process	External causes of morbidity and mortality x Diseases of the ear and mastoid process
Diseases of the musculoskeletal system and connective tissue x Diseases of the circulatory system	External causes of morbidity and mortality x Diseases of the circulatory system
Diseases of the musculoskeletal system and connective tissue x Diseases of the respiratory system	External causes of morbidity and mortality x Diseases of the respiratory system
Diseases of the musculoskeletal system and connective tissue x Diseases of the digestive system	External causes of morbidity and mortality x Diseases of the digestive system
Diseases of the musculoskeletal system and connective tissue x Diseases of the skin and subcutaneous tissue	External causes of morbidity and mortality x Diseases of the skin and subcutaneous tissue

Diseases of the genitourinary system x Certain infectious and parasitic diseases	External causes of morbidity and mortality x Diseases of the musculoskeletal system and connective tissue
Diseases of the genitourinary system x Neoplasms	External causes of morbidity and mortality x Diseases of the genitourinary system
Diseases of the genitourinary system x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	External causes of morbidity and mortality x Pregnancy, childbirth and the puerperium
Diseases of the genitourinary system x Endocrine, nutritional and metabolic diseases	External causes of morbidity and mortality x Certain conditions originating in the perinatal period
Diseases of the genitourinary system x Mental and behavioural disorders	External causes of morbidity and mortality x Congenital malformations, deformations and chromosomal abnormalities
Diseases of the genitourinary system x Diseases of the nervous system	External causes of morbidity and mortality x Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified
Diseases of the genitourinary system x Diseases of the eye and adnexa	External causes of morbidity and mortality x Injury, poisoning and certain other consequences of external causes
Diseases of the genitourinary system x Diseases of the ear and mastoid process	Factors influencing health status and contact with health services x Certain infectious and parasitic diseases
Diseases of the genitourinary system x Diseases of the circulatory system	Factors influencing health status and contact with health services x Neoplasms
Diseases of the genitourinary system x Diseases of the respiratory system	Factors influencing health status and contact with health services x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
Diseases of the genitourinary system x Diseases of the digestive system	Factors influencing health status and contact with health services x Endocrine, nutritional and metabolic diseases
Diseases of the genitourinary system x Diseases of the skin and subcutaneous tissue	Factors influencing health status and contact with health services x Mental and behavioural disorders
Diseases of the genitourinary system x Diseases of the musculoskeletal system and connective tissue	Factors influencing health status and contact with health services x Diseases of the nervous system
Pregnancy, childbirth and the puerperium x Certain infectious and parasitic diseases	Factors influencing health status and contact with health services x Diseases of the eye and adnexa
Pregnancy, childbirth and the puerperium x Neoplasms	Factors influencing health status and contact with health services x Diseases of the ear and mastoid process
Pregnancy, childbirth and the puerperium x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	Factors influencing health status and contact with health services x Diseases of the circulatory system
Pregnancy, childbirth and the puerperium x Endocrine, nutritional and metabolic diseases	Factors influencing health status and contact with health services x Diseases of the respiratory system

Pregnancy, childbirth and the puerperium x Mental and behavioural disorders	Factors influencing health status and contact with health services x Diseases of the digestive system
Pregnancy, childbirth and the puerperium x Diseases of the nervous system	Factors influencing health status and contact with health services x Diseases of the skin and subcutaneous tissue
Pregnancy, childbirth and the puerperium x Diseases of the eye and adnexa	Factors influencing health status and contact with health services x Diseases of the musculoskeletal system and connective tissue
Pregnancy, childbirth and the puerperium x Diseases of the ear and mastoid process	Factors influencing health status and contact with health services x Diseases of the genitourinary system
Pregnancy, childbirth and the puerperium x Diseases of the circulatory system	Factors influencing health status and contact with health services x Pregnancy, childbirth and the puerperium
Pregnancy, childbirth and the puerperium x Diseases of the respiratory system	Factors influencing health status and contact with health services x Certain conditions originating in the perinatal period
Pregnancy, childbirth and the puerperium x Diseases of the digestive system	Factors influencing health status and contact with health services x Congenital malformations, deformations and chromosomal abnormalities
Pregnancy, childbirth and the puerperium x Diseases of the skin and subcutaneous tissue	Factors influencing health status and contact with health services x Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified
Pregnancy, childbirth and the puerperium x Diseases of the musculoskeletal system and connective tissue	Factors influencing health status and contact with health services x Injury, poisoning and certain other consequences of external causes
Pregnancy, childbirth and the puerperium x Diseases of the genitourinary system	Factors influencing health status and contact with health services x External causes of morbidity and mortality

Attributed need variables

Variables not included in PCA	
Log population variance	%DLA/PIP
% carer (GP survey)	Proportion Single Pensioner Households (Census)
% permanently sick or disabled (GP survey)	Proportion Single (never married) (Census)
% Full-time education (GP survey)	Proportion Separated (but still legally married) (Census)
% fully retired from work (GP survey)	Proportion Divorced (Census)
% Long-term health condition (GP survey)	Proportion Widowed (Census)
Average with (long term) medical condition for those with at least one (GP survey)	Proportion of students in population (aged 16-74) (Census)
% Long-term physical or mental health conditions, disabilities or illnesses - (GP survey)	Crime Score (IMD)
When last general practice appointment was - % In the past 3 months (GP survey)	
Quality Outcomes Framework prevalence measures	
QOF Hypertension Prevalence	QOF Osteoperosis Prevalence
QOF Coronary Heart Disease Prevalence	QOF Learning Disabilities Prevalence
QOF Stroke Prevalence	QOF Mental Health Prevalence
Barriers (IMD)	
Homelessness indicator (rate per 1000 households)	Road distance to a GP surgery (km)
Road distance to a post office indicator (km)	Road distance to a general store (km)
Road distance to a primary school (km)	Housing affordability indicator
Education	
Adult skills and English language proficiency indicators – combined (IMD)	Entry to higher education indicator (IMD)
Staying on in education post 16 indicator (IMD)	Proportion with no qualifications (Census)
Health	
Comparative illness and disability ratio indicator (IMD)	Proportion (un standardised) with LLTI (Census)
Potential years of life lost indicator (IMD)	Mood and anxiety disorders indicator (Census)
Income	
Income Score (IMD)	Proportion aged 16-74 in semi-routine occupation (Census)
Proportion aged 16+ in low grade work, long term unemployed or never worked (Census)	Proportion aged 16-74 in routine occupation (Census)
Living Environment (IMD)	
Housing in poor condition indicator	Air quality indicator
Houses without central heating indicator	Road traffic accidents indicator
Immunisation	
% immunised DTaP/IPV/Hib by 12 months	% immunised for Pneumococcal disease by 12 months
% immunised DTaP/IPV/Hib by 24 months	% receiving MMR 2nd dose by fifth birthday
% immunised for Meningitis B by 12 months	

Attributed supply variables

Variables not in PCA	
Gravity weighted travel duration to hospital	Proportion headcount GPs female (including retainers and registrars)
No FTE GPs per practice (excluding retainers and registrars)	Proportion of GPs aged 50 and over in practice (headcount, including retainers a
registrations per FTE (excluding retainers and registrars)	Proportion (headcount) GPs qualified in UK
Quality Outcomes Framework scores	
QOF Atrial Fibrillation Weighted Achievement Score	QOF Chronic kidney disease Weighted Achievement Score
QOF Coronary Heart Disease Weighted Achievement Score	QOF Obesity Weighted Achievement Score
QOF Stroke Weighted Achievement Score	QOF Osteoperosis Weighted Achievement Score
Quality Outcomes Framework Exception rates	
QOF Atrial Fibrillation Exception Rate	QOF Dementia Exception Rate
QOF Hypertension Exception Rate	QOF Rheumatoid arthritis Exception Rate
QOF Coronary Heart Disease Exception Rate	QOF Asthma Exception Rate
QOF Contraception Exception Rate	QOF Cancer Exception Rate
Hospital supply (gravity weighted)	
Plain Radiography	critical care beds (occupied)
General & Acute day beds	Median waiting times (weeks) for non-admitted patients
Total Operating theatres	

CCG Dummy variables

NHS Airedale, Wharfedale and Craven CCG	NHS Merton CCG
NHS Ashford CCG	NHS Mid Essex CCG
NHS Barking and Dagenham CCG	NHS Milton Keynes CCG
NHS Barnet CCG	NHS Morecambe Bay CCG
NHS Barnsley CCG	NHS Nene CCG
NHS Basildon and Brentwood CCG	NHS Newark and Sherwood CCG
NHS Bassetlaw CCG	NHS Newcastle Gateshead CCG
NHS Bath and North East Somerset CCG	NHS Newham CCG
NHS Bedfordshire CCG	NHS North Cumbria CCG
NHS Berkshire West CCG	NHS North Durham CCG
NHS Bexley CCG	NHS North East Essex CCG
NHS Birmingham and Solihull CCG	NHS North East Hampshire and Farnham CCG
NHS Blackburn with Darwen CCG	NHS North East Lincolnshire CCG
NHS Blackpool CCG	NHS North Hampshire CCG
NHS Bolton CCG	NHS North Kirklees CCG
NHS Bradford City CCG	NHS North Lincolnshire CCG
NHS Bradford Districts CCG	NHS North Norfolk CCG
NHS Brent CCG	NHS North Staffordshire CCG
NHS Brighton and Hove CCG	NHS North Tyneside CCG
NHS Bristol, North Somerset and South Gloucestershire CCG	NHS North West Surrey CCG
NHS Bromley CCG	NHS Northern, Eastern and Western Devon CCG
NHS Buckinghamshire CCG	NHS Northumberland CCG
NHS Bury CCG	NHS Norwich CCG
NHS Calderdale CCG	NHS Nottingham City CCG
NHS Cambridgeshire and Peterborough CCG	NHS Nottingham North and East CCG
NHS Camden CCG	NHS Nottingham West CCG
NHS Cannock Chase CCG	NHS Oldham CCG
NHS Canterbury and Coastal CCG	NHS Oxfordshire CCG
NHS Castle Point and Rochford CCG	NHS Portsmouth CCG
NHS Central London (Westminster) CCG	NHS Redbridge CCG
NHS Chorley and South Ribble CCG	NHS Redditch and Bromsgrove CCG
NHS City and Hackney CCG	NHS Richmond CCG
NHS Coastal West Sussex CCG	NHS Rotherham CCG
NHS Corby CCG	NHS Rushcliffe CCG
NHS Coventry and Rugby CCG	NHS Salford CCG
NHS Crawley CCG	NHS Sandwell and West Birmingham CCG
NHS Croydon CCG	NHS Scarborough and Ryedale CCG
NHS Darlington CCG	NHS Sheffield CCG
NHS Dartford, Gravesham and Swanley CCG	NHS Shropshire CCG
NHS Doncaster CCG	NHS Somerset CCG
NHS Dorset CCG	NHS South Cheshire CCG
NHS Dudley CCG	NHS South Devon and Torbay CCG
NHS Durham Dales, Easington and Sedgefield CCG	NHS South East Staffordshire and Seisdon Peninsula CCG

NHS Ealing CCG	NHS South Eastern Hampshire CCG
NHS East and North Hertfordshire CCG	NHS South Kent Coast CCG
NHS East Berkshire CCG	NHS South Lincolnshire CCG
NHS East Lancashire CCG	NHS South Norfolk CCG
NHS East Leicestershire and Rutland CCG	NHS South Sefton CCG
NHS East Riding of Yorkshire CCG	NHS South Tees CCG
NHS East Staffordshire CCG	NHS South Tyneside CCG
NHS East Surrey CCG	NHS South Warwickshire CCG
NHS Eastbourne, Hailsham and Seaford CCG	NHS South West Lincolnshire CCG
NHS Eastern Cheshire CCG	NHS South Worcestershire CCG
NHS Enfield CCG	NHS Southampton CCG
NHS Fareham and Gosport CCG	NHS Southend CCG
NHS Fylde and Wyre CCG	NHS Southport and Formby CCG
NHS Gloucestershire CCG	NHS Southwark CCG
NHS Great Yarmouth and Waveney CCG	NHS St Helens CCG
NHS Greater Huddersfield CCG	NHS Stafford and Surrounds CCG
NHS Greater Preston CCG	NHS Stockport CCG
NHS Greenwich CCG	NHS Stoke on Trent CCG
NHS Guildford and Waverley CCG	NHS Sunderland CCG
NHS Halton CCG	NHS Surrey Downs CCG
NHS Hambleton, Richmondshire and Whitby CCG	NHS Surrey Heath CCG
NHS Hammersmith and Fulham CCG	NHS Sutton CCG
NHS Haringey CCG	NHS Swale CCG
NHS Harrogate and Rural District CCG	NHS Swindon CCG
NHS Harrow CCG	NHS Tameside and Glossop CCG
NHS Hartlepool and Stockton-on-Tees CCG	NHS Telford and Wrekin CCG
NHS Hastings and Rother CCG	NHS Thanet CCG
NHS Havering CCG	NHS Thurrock CCG
NHS Herefordshire CCG	NHS Tower Hamlets CCG
NHS Herts Valleys CCG	NHS Trafford CCG
NHS Heywood, Middleton and Rochdale CCG	NHS Vale of York CCG
NHS High Weald Lewes Havens CCG	NHS Vale Royal CCG
NHS Hillingdon CCG	NHS Wakefield CCG
NHS Horsham and Mid Sussex CCG	NHS Walsall CCG
NHS Hounslow CCG	NHS Waltham Forest CCG
NHS Hull CCG	NHS Wandsworth CCG
NHS Ipswich and East Suffolk CCG	NHS Warrington CCG
NHS Isle of Wight CCG	NHS Warwickshire North CCG
NHS Islington CCG	NHS West Cheshire CCG
NHS Kernow CCG	NHS West Essex CCG
NHS Kingston CCG	NHS West Hampshire CCG
NHS Knowsley CCG	NHS West Kent CCG
NHS Lambeth CCG	NHS West Lancashire CCG
NHS Leeds CCG	NHS West Leicestershire CCG
NHS Leicester City CCG	NHS West London CCG
NHS Lewisham CCG	NHS West Norfolk CCG
NHS Lincolnshire East CCG	NHS West Suffolk CCG
NHS Lincolnshire West CCG	NHS Wigan Borough CCG

NHS Liverpool CCG	NHS Wiltshire CCG
NHS Luton CCG	NHS Wirral CCG
NHS Manchester CCG	NHS Wolverhampton CCG
NHS Mansfield and Ashfield CCG	NHS Wyre Forest CCG
NHS Medway CCG	

Annex D: Coefficients for the general and acute model

Variable	Coefficient	Significance
Constant	45.0	0
High cost dummy variable	95613.7	0
Newly registered with GP practice	34.5	0
Privately funded care	-397.7	0

Age and gender

Variable	Coefficient	Significance
Male	76.9	0
Age <1	-118.3	0
Age 1-4	88.2	0
Age 5-9	56.3	0
Age 10-14	-25.5	0.269
Age 15-19	0.7	0.963
Age 20-24	-1.0	0.814
Age 25-29	4.2	0.002
Age 30-34	0.0	0.972
Age 35-39	-3.8	0.016
Age 40-44	10.5	0
Age 45-49	-3.5	0.046
Age 50-54	-2.3	0.133
Age 55-59	1.4	0.303
Age 60-64	10.9	0
Age 65-69	2.2	0.209
Age 70-74	20.6	0
Age 75-79	-13.7	0
Age 80-84	23.5	0
Age 85+	-47.9	0
Male: Age <1	-41.3	0
Male: Age 1-4	37.9	0
Male: Age 5-9	2.9	0.103
Male: Age 10-14	-7.6	0
Male: Age 15-19	4.7	0.001
Male: Age 20-24	0.8	0.554
Male: Age 25-29	-3.8	0.005
Male: Age 30-34	3.5	0.008
Male: Age 35-39	5.3	0
Male: Age 40-44	-3.3	0.016
Male: Age 45-49	0.9	0.514
Male: Age 50-54	6.4	0
Male: Age 55-59	2.4	0.072
Male: Age 60-64	0.3	0.839
Male: Age 65-69	-5.6	0
Male: Age 70-74	9.0	0
Male: Age 75-79	1.0	0.58
Male: Age 80-84	5.4	0.009

Male: Age 85+	-11.4	0

Household type

Variable	Coefficient	Significance
Care home	-9.4	0.975
Multi-adult-child	-31.4	0
Multi-child	52.7	0.163
Other communal	-41.6	0.004
Single parent	3.0	0.744
Single person	-4.4	0.874
Two adult family	-23.1	0.001
Two adults diff gender	-11.6	0.391
Two adults same gender	-0.3	0.985
Unknown	38.7	0

Household type/age interactions

Variable	Coefficient	Significance
Age<1		
Care home	-61.9	0.875
Multi-adult-child	-0.9	0.925
Multi-child	-109.9	0.017
Other communal	-4.1	0.813
Single parent	-35.2	0.002
Single person	-33.4	0.321
Two adult family	-0.8	0.924
Two adults diff gender	2.6	0.887
Two adults same gender	-1.9	0.917
Unknown	-54.7	0
Age 1-4		
Care home	88.6	0.844
Multi-adult-child	22.6	0.078
Multi-child	136.1	0.008
Other communal	22.7	0.268
Single parent	57.9	0
Single person	55.3	0.149
Two adult family	23.0	0.042
Two adults diff gender	1.7	0.952
Two adults same gender	-9.7	0.735
Unknown	72.3	0
Age 5-9		
Care home	37.4	0.789
Multi-adult-child	-48.6	0.002
Multi-child	-56.0	0.007
Other communal	-45.6	0.005
Single parent	-47.6	0.003
Single person	-48.8	0.015
Two adult family	-48.5	0.002
Two adults diff gender	-22.6	0.635
Two adults same gender	23.7	0.627

Unknown	-43.5	0.007
Age 10-14		
Care home	-88.8	0.385
Multi-adult-child	38.0	0.1
Multi-child	59.2	0.021
Other communal	34.0	0.146
Single parent	36.7	0.112
Single person	42.9	0.097
Two adult family	37.3	0.106
Two adults diff gender	37.7	0.592
Two adults same gender	-21.1	0.771
Unknown	36.8	0.115
Age 15-19		
Care home	71.9	0.322
Multi-adult-child	-6.9	0.643
Multi-child	-29.7	0.145
Other communal	3.0	0.846
Single parent	-9.0	0.548
Single person	-9.2	0.611
Two adult family	-9.9	0.506
Two adults diff gender	-18.2	0.689
Two adults same gender	18.4	0.693
Unknown	-9.0	0.551
Age 20-24		
Care home	-57.3	0.162
Multi-adult-child	-1.3	0.768
Multi-child	-1.8	0.92
Other communal	-12.7	0.017
Single parent	16.4	0.003
Single person	-7.2	0.322
Two adult family	11.1	0.02
Two adults diff gender	-0.4	0.975
Two adults same gender	-10.5	0.436
Unknown	-1.3	0.791
Age 25-29		
Care home	-35.5	0.199
Multi-adult-child	-3.7	0.058
Multi-child	-0.8	0.942
Other communal	5.2	0.121
Single parent	-29.4	0
Single person	1.4	0.671
Two adult family	-15.5	0
Two adults diff gender	-0.4	0.899
Two adults same gender	1.1	0.758
Unknown	4.3	0.078
Age 30-34		
Care home	46.5	0.065
Multi-adult-child	-2.4	0.239
Multi-child	0.0	
Other communal	-3.2	0.365
Single parent	7.7	0.025
Single person	3.0	0.261

Two adult family	-1.3	0.558
Two adults diff gender	1.9	0.417
Two adults same gender	-0.5	0.885
Unknown	-2.6	0.31
Age 35-39		
Care home	40.8	0.101
Multi-adult-child	4.9	0.023
Multi-child	0.0	
Other communal	0.1	0.971
Single parent	2.9	0.374
Single person	-1.3	0.644
Two adult family	2.7	0.159
Two adults diff gender	-1.0	0.689
Two adults same gender	3.1	0.403
Unknown	-1.2	0.67
Age 40-44		
Care home	-53.1	0.026
Multi-adult-child	-3.7	0.098
Multi-child	0.0	
Other communal	-4.0	0.378
Single parent	-6.9	0.046
Single person	-4.1	0.155
Two adult family	-4.1	0.039
Two adults diff gender	-7.6	0.005
Two adults same gender	-2.8	0.491
Unknown	-3.3	0.331
Age 45-49		
Care home	20.9	0.323
Multi-adult-child	0.7	0.758
Multi-child	0.0	
Other communal	7.1	0.164
Single parent	7.2	0.053
Single person	3.8	0.173
Two adult family	5.2	0.009
Two adults diff gender	7.2	0.005
Two adults same gender	2.8	0.486
Unknown	7.0	0.05
Age 50-54		
Care home	-11.3	0.545
Multi-adult-child	1.6	0.454
Multi-child	0.0	
Other communal	-6.8	0.243
Single parent	1.0	0.822
Single person	-1.4	0.562
Two adult family	3.2	0.134
Two adults diff gender	-0.1	0.971
Two adults same gender	-4.0	0.294
Unknown	-4.9	0.171
Age 55-59		
Care home	-15.9	0.346
Multi-adult-child	0.7	0.761
Multi-child	0.0	

Other communal	11.2	0.093
Single parent	7.3	0.487
Single person	2.5	0.275
Two adult family	-9.5	0.038
Two adults diff gender	-2.0	0.284
Two adults same gender	4.9	0.194
Unknown	3.6	0.326
Age 60-64		
Care home	-3.9	0.81
Multi-adult-child	-4.4	0.094
Multi-child	0.0	
Other communal	-3.1	0.688
Single parent	-258.5	0.183
Single person	-4.6	0.044
Two adult family	52.9	0
Two adults diff gender	-1.9	0.304
Two adults same gender	-2.2	0.601
Unknown	-4.0	0.314
Age 65-69		
Care home	-22.5	0.126
Multi-adult-child	5.8	0.074
Multi-child	0.0	
Other communal	-8.4	0.366
Single parent	343.0	0.19
Single person	3.7	0.122
Two adult family	-83.1	0.008
Two adults diff gender	2.9	0.135
Two adults same gender	-3.4	0.467
Unknown	-4.1	0.348
Age 70-74		
Care home	-31.1	0.012
Multi-adult-child	-14.7	0
Multi-child	0.0	
Other communal	-13.9	0.218
Single parent	0.0	
Single person	-6.6	0.011
Two adult family	54.4	0.205
Two adults diff gender	-4.9	0.026
Two adults same gender	4.2	0.438
Unknown	-6.1	0.208
Age 75-79		
Care home	52.8	0
Multi-adult-child	1.9	0.719
Multi-child	0.0	
Other communal	-3.3	0.805
Single parent	0.0	
Single person	13.0	0
Two adult family	-59.1	0.179
Two adults diff gender	10.7	0
Two adults same gender	9.2	0.146
Unknown	-0.9	0.873
Age 80-84		

Care home	-53.9	0
Multi-adult-child	5.2	0.439
Multi-child	0.0	
Other communal	-57.6	0
Single parent	-131.6	0.13
Single person	-5.5	0.118
Two adult family	46.4	0.102
Two adults diff gender	-2.5	0.467
Two adults same gender	3.6	0.604
Unknown	-30.2	0
Age 85+		
Care home	59.5	0
Multi-adult-child	-21.4	0.001
Multi-child	0.0	
Other communal	50.2	0
Single parent	-0.7	0.987
Single person	51.0	0
Two adult family	-30.9	0.056
Two adults diff gender	44.9	0
Two adults same gender	-4.2	0.465
Unknown	5.8	0.225

Ethnicity

Variable	Coefficient	Significance
White Irish	-2.5	0.532
Other White	-32.9	0
White and Black Caribbean	-136.3	0
White and Black African	-117.0	0
White and Asian	-163.2	0
Other Mixed	-41.8	0
Indian	-37.9	0
Pakistani	-18.8	0
Bangladeshi	-66.0	0
Chinese	-197.2	0
Other Asian	-43.2	0
African	-67.3	0
Caribbean	2.8	0.357
Other Black	-28.1	0
Any other ethnic group	2.3	0.198

Diagnoses

Variable	Coefficient	Significance
A00-A09 Intestinal infectious diseases	137.9	0
A15-A19 Tuberculosis	472.4	0
A20-A49 Certain bacterial diseases	293.9	0
A50-A64 Infections with predominantly sexual mode of transmission	-1094.1	0.541
A65-A79 Other infectious and parasitic disorders	-33.4	0.486
A80-A89 Viral infections of the central nervous system	41.0	0.03

A90-A99 Arthropod-borne viral fevers & viral haemorrhagic fevers	-126.4	0.152
B00-B09 Viral infections characterized by skin & mucous membrane lesions	24.1	0.007
B15-B19 Viral hepatitis	939.2	0
B20-B24 Human immunodeficiency virus [HIV] disease	0.0	
B25-B34 Other viral diseases	121.3	0
B35-B49 Mycoses	254.6	0
B50-B64 Protozoal diseases	3.8	0.896
B65-B83 Helminthiases	71.2	0.007
B85-B99 Other infectious and parasitic diseases	154.5	0
C00-C14 Malignant neoplasm of liporal cavity and pharynx	549.7	0
C15-C26 Malignant neoplasm of digestive organs	1073.4	0
C30-C39 Malignant neoplasms of respiratory & intrathoracic organs	657.5	0
C40-C41 Malignant neoplasm of bone and articular cartilage	327.5	0
C43-C44 Malignant neoplasms of skin	146.3	0
C45-C49 Malignant neoplasms of mesothelial and soft tissue	500.7	0
C50 Malignant neoplasm of breast	379.7	0
C51-C58 Malignant neoplasms of female genital organs	319.7	0
C60-C63 Malignant neoplasms of male genital organs	321.6	0
C64-C68 Malignant neoplasms of urinary tract	658.2	0
C69-C72 Malignant neoplasms of eye, brain & other parts of CNS	721.9	0
C73-C80, C97 Malignant neoplasm. of thyroid and other endo. Glands etc.	727.7	0
C81-C96 Malignant neoplasms of lymphoid, haematopoietic & rel. tissue	1482.2	0
D00-D48 In situ & benign neoplasms and others of uncertainty	170.6	0
D50-D64 Anaemias	267.8	0
D65-D89 Diseases of the blood and blood-forming organs	225.5	0
E00-E07 Disorders of thyroid gland	162.4	0
E10-E14 Diabetes Mellitus	520.8	0
E15-E90 Endocrine nutritional and metabolic diseases	128.1	0
F00-F03 Dementia	42.0	0
F04-F09 Other organic including symptomatic mental disorders	-50.1	0
F10-F19 Mental and behavioural disorders due to psychoactive subst.	172.0	0
F20-F29 Schizophrenia, schizotypal and delusional disorders	511.6	0
F30-F39 Mood [affective] disorders	213.0	0
F40-F69 Neurotic, behavioural & personality disorders	108.5	0
F70-F79 Mental retardation	431.4	0
F80-F99 Other mental and behavioural disorders	323.1	0
G00-G09 Inflammatory diseases of the central nervous system	-31.8	0.012
G10-G14, G30-G32 Other degenerative diseases (incl. Alzheimer).	162.5	0

G20-G26 Extrapyramidal & movement disorders (incl. Parkinsonism).	628.8	0
G35-G37 Demyelinating diseases (incl Multiple Sclerosis) of the CNS.	699.0	0
G40-G47 Epilepsy, migraine & other episodic disorders	288.1	0
G50-G73 G90-G99 Other diseases & disorders of the nervous syst.	366.4	0
G80-G83 Cerebral palsy & other paralytic syndromes	513.9	0
H00-H06, H15-H22, H30-H36, H43-H59 Other disorders of the eye etc.	197.0	0
H10-H13 Disorders of conjunctiva (including conjunctivitis)	7.7	0.418
H25-H28 Disorders of lens (including cataracts)	-44.5	0
H40-H42 Glaucoma	73.8	0
H60-H95 Diseases of the ear and mastoid process	176.5	0
I00-I09 Rheumatic heart disease	88.3	0
I10-I15 Hypertensive diseases	110.8	0
I20-I25 Ischaemic heart diseases	252.4	0
I26-I28 Pulmonary heart disease & diseases of pulmonary circulation	273.5	0
I30-I52 Other forms of heart disease	408.7	0
I60-I69 Cerebrovascular diseases	154.4	0
I70-I79 Diseases of arteries, arterioles & capillaries	579.1	0
I80-I89 Diseases of veins & lymphatic system nec.	332.8	0
I95-I99 Other & unspecified disorders of the circulatory system	184.4	0
J00-J06 Acute upper respiratory infections	96.5	0
J09-J18 Influenza & pneumonia	413.9	0
J20-J22 Other acute lower respiratory infections	243.6	0
J30-J39 Other diseases of upper respiratory tract	52.1	0
J40-J47 Chronic lower respiratory diseases	328.8	0
J60-J70 Lung diseases due to external agents	353.8	0
J80-J99 Other diseases of the respiratory system	329.4	0
K00-K14 Diseases of oral cavity, salivary glands & jaws	128.2	0
K20-K31 Diseases of oesophagus, stomach & duodenum	153.5	0
K35-K38 Diseases of appendix	-41.7	0
K40-K46 Hernia	77.8	0
K50-K52 Noninfective enteritis & colitis	382.8	0
K55-K64 Other diseases of intestines	131.7	0
K65-K67 Diseases of peritoneum	-64.1	0
K70-K77 Diseases of liver	469.4	0
K80-K87 Disorders of gall bladder, biliary tract & pancreas	242.2	0
K90-K93 Other diseases of the digestive system	200.1	0
L00-L14 L55-L99 Other infections and disorders of the skin	150.1	0
L20-L30 Dermatitis and eczema	-24.5	0
L40-L45 Papulosquamous disorders (including Psoriasis)	48.3	0
L50-L54 Urticaria and erythems	-30.1	0.002
M00-M25 Arthropathies	387.6	0
M30-M36 Systemic connective tissue disorders	391.2	0
M40-M54 Dorsopathies	309.9	0
M60-M79 Soft tissue disorders	293.8	0
M80-M94 Osteopathies and chondropathies	416.2	0

M95-M99 Other disorders of the musculoskeletal system & connective tissue	294.4	0
N00-N08, N10-N16 Diseases of the kidney	582.5	0
N17-N19 Renal failure	471.9	0
N20-N23 Urolithiasis	77.8	0
N25-N29 Other disorders of kidney & ureter	175.3	0
N30-N39 Other diseases of the urinary system	199.8	0
N40-N51 Diseases of male genital organs	24.6	0
N60-N64 Disorders of breast	89.5	0
N70-N77 Inflammatory diseases of female pelvic organs	73.9	0
N80-N98 Noninflammatory disorders of female genital tract	105.4	0
N99 Other disorders of the genitourinary system	-34.7	0.04
O00-O08 Pregnancy with abortive outcome	174.1	0
O10-O75, O85-O92, O94-O99 Complications of labour and delivery	123.6	0
O80-O84 Delivery	81.7	0
P00-P04 Complications of foetus/neonate affected by maternal	76.9	0
P05-P96 Other conditions originating in the perinatal period	80.3	0
Q00-Q89 Congenital malformations	127.9	0
Q90-Q99 Chromosomal abnormalities	527.2	0
R00-R09 Symptoms & signs inv. the circulatory/respiratory system	102.8	0
R10-R19 Symptoms & signs inv. the digestive system & abdomen	137.9	0
R20-R23 Symptoms & signs inv. the skin & subcutaneous tissue	84.6	0
R25-R29 Symptoms & signs inv. the nervous & musculoskeletal sys.	367.1	0
R30-R39 Symptoms & signs involving the urinary system	89.7	0
R40-R46 Symptoms & signs inv. Cognition, perception etc.	117.0	0
R47-R49 Symptoms & signs inv. speech & voice	112.3	0
R50-R68 General symptoms & signs	140.1	0
R69 Unknown & unspecified causes of morbidity	-80.0	0.033
R70-R89 Abnormal findings of bodily fluids or samples without diag.	123.6	0
R90-R94 Abnormal findings on diagnostic imaging/function studies	120.9	0
R95-R99 Ill-defined & unknown causes of mortality	74.2	0.839
S00-S09 Injuries to the head	127.7	0
S10-S19 Injuries to the neck	168.3	0
S20-S29 Injuries to the thorax	98.9	0
S30-S39 Injuries to abdomen, lower back, lumbar spine & pelvis	101.2	0
S40-S49 Injuries to the shoulder & upper arm	179.5	0
S50-S59 Injuries to the elbow & forearm	58.3	0
S60-S69 Injuries to the wrist & hand	66.6	0
S70-S79 Injuries to the hip & thigh	-77.0	0
S80-S89 Injuries to the knee & lower leg	160.0	0
S90-S99 Injuries to the ankle & foot	218.4	0
T00-T07 Injuries involving multiple body regions	143.3	0
T08-T14 Injuries to unspecified part of trunk limb or body	163.8	0

T15-T19 Effects of foreign body entering through natural orifice	161.9	0
T20-T32 Burns and corrosions	97.6	0
T33-T35 Frostbite	901.4	0
T36-T50 Poisonings by drugs medicaments & biological substances	258.3	0
T51-T65 Toxic effects. of substances. chiefly non-medicinal as to source	-51.7	0
T66-T78 Other and unspecified effects of external causes	211.1	0
T79 Certain early complications of trauma	14.6	0.345
T80-T88 Complications of surgical & medical care nec.	389.0	0
T90-T98 Sequelae of injuries of poisoning & other consequences	155.7	0
VVV	165.7	0
WWW	63.5	0
XXX	92.1	0
YYY	95.6	0
Z00-Z13 Examination and investigation	12.1	0
Z20-Z29 Potential health hazards related to communicable diseases	127.3	0
Z30-Z39 Health services in circumstances related to reproduction	-33.4	0
Z40-Z54 Persons encountering health services for specific care	134.7	0
Z55-Z65 Potential health hazards related. to socioeconomic & psychosoc.l	105.4	0
Z70-Z76 Persons encountering health services in other circumstances	86.7	0
Z80-Z99 Persons with potential health hazards related to family	152.9	0
U Unclassified	290.3	0

Morbidity Count

Variable	Coefficient	Significance
A00-A09 Intestinal infectious diseases	615.7	0
A20-A49 Certain bacterial diseases	485.2	0
B00-B09 Viral infections characterized by skin & mucous membrane lesions	-374.7	0
B15-B19 Viral hepatitis	1719.4	0
B25-B34 Other viral diseases	-211.9	0
B85-B99 Other infectious and parasitic diseases	499.3	0
C00-C14 Malignant neoplasm of liporal cavity and pharynx	-968.9	0
C15-C26 Malignant neoplasm of digestive organs	-274.9	0
C30-C39 Malignant neoplasms of respiratory & intrathoracic organs	-215.8	0
C40-C41 Malignant neoplasm of bone and articular cartilage	-956.6	0
C45-C49 Malignant neoplasms of mesothelial and soft tissue	-671.6	0
C50 Malignant neoplasm of breast	-44.3	0
C51-C58 Malignant neoplasms of female genital organs	-191.5	0
C60-C63 Malignant neoplasms of male genital organs	105.3	0

C64-C68 Malignant neoplasms of urinary tract	85.6	0
C69-C72 Malignant neoplasms of eye, brain & other parts of CNS	-230.7	0
C73-C80, C97 Malignant neoplasm. of thyroid and other endo. Glands etc.	324.7	0
C81-C96 Malignant neoplasms of lymphoid, haematopoietic & rel. tissue	614.5	0
D00-D48 In situ & benign neoplasms and others of uncertainty	1197.0	0
D50-D64 Anaemias	183.5	0
D65-D89 Diseases of the blood and blood-forming organs	834.6	0
E10-E14 Diabetes Mellitus	341.3	0
E15-E90 Endocrine nutritional and metabolic diseases	289.9	0
F00-F03 Dementia	-955.3	0
F04-F09 Other organic including symptomatic mental disorders	-720.3	0
F10-F19 Mental and behavioural disorders due to psychoactive subst.	329.3	0
F20-F29 Schizophrenia, schizotypal and delusional disorders	66.5	0
F30-F39 Mood [affective] disorders	254.8	0
F40-F69 Neurotic, behavioural & personality disorders	388.2	0
F70-F79 Mental retardation	-85.5	0.025
F80-F99 Other mental and behavioural disorders	360.5	0
G10-G14, G30-G32 Other degenerative diseases (incl. Alzheimer).	-85.3	0
G20-G26 Extrapyramidal & movement disorders (incl. Parkinsonism).	242.3	0
G35-G37 Demyelinating diseases (incl Multiple Sclerosis) of the CNS.	278.7	0
G40-G47 Epilepsy, migraine & other episodic disorders	570.2	0
G50-G73 G90-G99 Other diseases & disorders of the nervous syst.	630.4	0
G80-G83 Cerebral palsy & other paralytic syndromes	372.5	0
H00-H06, H15-H22, H30-H36, H43-H59 Other disorders of the eye etc.	644.1	0
H10-H13 Disorders of conjunctiva (including conjunctivitis)	-957.9	0
H25-H28 Disorders of lens (including cataracts)	-254.2	0
H40-H42 Glaucoma	-198.8	0
H60-H95 Diseases of the ear and mastoid process	-88.6	0
I00-I09 Rheumatic heart disease	340.9	0
I10-I15 Hypertensive diseases	-138.4	0
I20-I25 Ischaemic heart diseases	66.1	0
I26-I28 Pulmonary heart disease & diseases of pulmonary circulation	285.2	0
I30-I52 Other forms of heart disease	195.6	0
I70-I79 Diseases of arteries, arterioles & capillaries	575.7	0
I80-I89 Diseases of veins & lymphatic system nec.	640.0	0
I95-I99 Other & unspecified disorders of the circulatory system	663.0	0
J09-J18 Influenza & pneumonia	1125.4	0
J20-J22 Other acute lower respiratory infections	1128.7	0

J30-J39 Other diseases of upper respiratory tract	210.9	0
J40-J47 Chronic lower respiratory diseases	437.0	0
J60-J70 Lung diseases due to external agents	877.9	0
J80-J99 Other diseases of the respiratory system	614.0	0
K20-K31 Diseases of oesophagus, stomach & duodenum	238.4	0
K40-K46 Hernia	118.6	0
K50-K52 Noninfective enteritis & colitis	1097.6	0
K55-K64 Other diseases of intestines	221.8	0
K65-K67 Diseases of peritoneum	801.0	0
K70-K77 Diseases of liver	1118.4	0
K80-K87 Disorders of gall bladder, biliary tract & pancreas	60.6	0
K90-K93 Other diseases of the digestive system	695.7	0
L00-L14 L55-L99 Other infections and disorders of the skin	805.1	0
L20-L30 Dermatitis and eczema	13.5	0.444
L40-L45 Papulosquamous disorders (including Psoriasis)	315.9	0
L50-L54 Urticaria and erythems	510.2	0
M00-M25 Arthropathies	301.7	0
M30-M36 Systemic connective tissue disorders	151.2	0
M40-M54 Dorsopathies	286.5	0
M80-M94 Osteopathies and chondropathies	360.2	0
N00-N08, N10-N16 Diseases of the kidney	1794.8	0
N17-N19 Renal failure	1769.4	0
N20-N23 Urolithiasis	-193.8	0
N25-N29 Other disorders of kidney & ureter	1254.8	0
N30-N39 Other diseases of the urinary system	79.6	0
N40-N51 Diseases of male genital organs	-153.5	0
N80-N98 Noninflammatory disorders of female genital tract	98.4	0
N99 Other disorders of the genitourinary system	-30.8	0.734
O10-O75, O85-O92, O94-O99 Complications of labour and delivery	-123.7	0
P05-P96 Other conditions originating in the perinatal period	188.3	0
Q00-Q89 Congenital malformations	290.7	0
R00-R09 Symptoms & signs inv. the circulatory/respiratory system	775.2	0
R10-R19 Symptoms & signs inv. the digestive system & abdomen	713.2	0
R25-R29 Symptoms & signs inv. the nervous & musculoskeletal sys.	-180.6	0
R30-R39 Symptoms & signs involving the urinary system	-19.8	0.098
R40-R46 Symptoms & signs inv. Cognition, perception etc.	253.6	0
R47-R49 Symptoms & signs inv. speech & voice	-30.3	0.455
R50-R68 General symptoms & signs	324.3	0
R69 Unknown & unspecified causes of morbidity	1929.4	0
R90-R94 Abnormal findings on diagnostic imaging/function studies	-45.2	0.044
S10-S19 Injuries to the neck	-791.0	0
S30-S39 Injuries to abdomen, lower back, lumbar spine & pelvis	298.6	0
S60-S69 Injuries to the wrist & hand	-23.7	0.534
S70-S79 Injuries to the hip & thigh	-105.9	0.021
S80-S89 Injuries to the knee & lower leg	-210.7	0
T00-T07 Injuries involving multiple body regions	327.9	0.038

T15-T19 Effects of foreign body entering through natural orifice	3247.0	0
T36-T50 Poisonings by drugs medicaments & biological substances	807.9	0
T66-T78 Other and unspecified effects of external causes	739.7	0
T80-T88 Complications of surgical & medical care nec.	1475.2	0
WWW	-29.3	0.056
YYY	281.6	0
Z00-Z13 Examination and investigation	22.9	0.023
Z30-Z39 Health services in circumstances related to reproduction	-76.6	0
Z40-Z54 Persons encountering health services for specific care	3268.5	0
Z55-Z65 Potential health hazards related. to socioeconomic & psychosoc.l	350.2	0
Z70-Z76 Persons encountering health services in other circumstances	455.6	0
Z80-Z99 Persons with potential health hazards related to family	189.1	0
U Unclassified	796.8	0

Comorbidities

Variable	Coefficient	Significance
Endocrine, nutritional and metabolic diseases x Certain infectious and parasitic diseases	75.7	0
Endocrine, nutritional and metabolic diseases x Neoplasms	-86.0	0
Mental and behavioural disorders x Certain infectious and parasitic diseases	16.7	0
Mental and behavioural disorders x Neoplasms	-97.3	0
Mental and behavioural disorders x Endocrine, nutritional and metabolic diseases	20.1	0
Diseases of the nervous system x Certain infectious and parasitic diseases	139.7	0
Diseases of the nervous system x Neoplasms	-144.9	0
Diseases of the nervous system x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	-50.5	0
Diseases of the nervous system x Mental and behavioural disorders	-32.9	0
Diseases of the eye and adnexa x Certain infectious and parasitic diseases	145.0	0
Diseases of the eye and adnexa x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	39.5	0
Diseases of the eye and adnexa x Endocrine, nutritional and metabolic diseases	49.5	0
Diseases of the eye and adnexa x Diseases of the nervous system	100.6	0
Diseases of the ear and mastoid process x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	-159.5	0

Diseases of the ear and mastoid process x Endocrine, nutritional and metabolic diseases	-56.5	0
Diseases of the ear and mastoid process x Diseases of the eye and adnexa	-139.1	0
Diseases of the circulatory system x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	41.1	0
Diseases of the circulatory system x Endocrine, nutritional and metabolic diseases	-85.2	0
Diseases of the circulatory system x Diseases of the nervous system	36.6	0
Diseases of the circulatory system x Diseases of the ear and mastoid process	-119.6	0
Diseases of the respiratory system x Neoplasms	-51.5	0
Diseases of the respiratory system x Mental and behavioural disorders	10.0	0
Diseases of the respiratory system x Diseases of the nervous system	8.7	0.02
Diseases of the respiratory system x Diseases of the ear and mastoid process	-63.2	0
Diseases of the respiratory system x Diseases of the circulatory system	69.0	0
Diseases of the digestive system x Neoplasms	-54.5	0
Diseases of the digestive system x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	-129.1	0
Diseases of the digestive system x Endocrine, nutritional and metabolic diseases	-61.6	0
Diseases of the digestive system x Mental and behavioural disorders	38.0	0
Diseases of the digestive system x Diseases of the nervous system	20.3	0
Diseases of the digestive system x Diseases of the circulatory system	-51.8	0
Diseases of the digestive system x Diseases of the respiratory system	-46.9	0
Diseases of the skin and subcutaneous tissue x Certain infectious and parasitic diseases	91.8	0
Diseases of the skin and subcutaneous tissue x Neoplasms	-163.7	0
Diseases of the skin and subcutaneous tissue x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	127.6	0
Diseases of the skin and subcutaneous tissue x Endocrine, nutritional and metabolic diseases	171.3	0
Diseases of the skin and subcutaneous tissue x Mental and behavioural disorders	-75.9	0
Diseases of the skin and subcutaneous tissue x Diseases of the nervous system	131.0	0
Diseases of the skin and subcutaneous tissue x Diseases of the eye and adnexa	133.8	0
Diseases of the skin and subcutaneous tissue x Diseases of the circulatory system	137.1	0

Diseases of the skin and subcutaneous tissue x Diseases of the respiratory system	-56.2	0
Diseases of the skin and subcutaneous tissue x Diseases of the digestive system	-9.3	0.04
Diseases of the musculoskeletal system and connective tissue x Certain infectious and parasitic diseases	31.2	0
Diseases of the musculoskeletal system and connective tissue x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	-78.6	0
Diseases of the musculoskeletal system and connective tissue x Mental and behavioural disorders	-57.7	0
Diseases of the musculoskeletal system and connective tissue x Diseases of the nervous system	-96.2	0
Diseases of the musculoskeletal system and connective tissue x Diseases of the eye and adnexa	-137.8	0
Diseases of the musculoskeletal system and connective tissue x Diseases of the circulatory system	-8.0	0.002
Diseases of the genitourinary system x Certain infectious and parasitic diseases	-127.7	0
Diseases of the genitourinary system x Neoplasms	-146.5	0
Diseases of the genitourinary system x Endocrine, nutritional and metabolic diseases	44.5	0
Diseases of the genitourinary system x Diseases of the nervous system	101.4	0
Diseases of the genitourinary system x Diseases of the eye and adnexa	66.6	0
Diseases of the genitourinary system x Diseases of the respiratory system	-52.5	0
Diseases of the genitourinary system x Diseases of the skin and subcutaneous tissue	2.6	0.608
Diseases of the genitourinary system x Diseases of the musculoskeletal system and connective tissue	-144.6	0
Pregnancy, childbirth and the puerperium x Certain infectious and parasitic diseases	-132.1	0
Pregnancy, childbirth and the puerperium x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	-272.9	0
Pregnancy, childbirth and the puerperium x Endocrine, nutritional and metabolic diseases	-70.7	0
Pregnancy, childbirth and the puerperium x Mental and behavioural disorders	-164.2	0
Pregnancy, childbirth and the puerperium x Diseases of the nervous system	-209.2	0
Pregnancy, childbirth and the puerperium x Diseases of the circulatory system	-109.1	0
Pregnancy, childbirth and the puerperium x Diseases of the respiratory system	-219.2	0
Pregnancy, childbirth and the puerperium x Diseases of the digestive system	57.1	0
Pregnancy, childbirth and the puerperium x Diseases of the musculoskeletal system and connective tissue	-175.7	0
Certain conditions originating in the perinatal period x Neoplasms	-129.5	0

Certain conditions originating in the perinatal period x Endocrine, nutritional and metabolic diseases	234.7	0
Certain conditions originating in the perinatal period x Mental and behavioural disorders	582.5	0
Certain conditions originating in the perinatal period x Diseases of the ear and mastoid process	141.8	0
Certain conditions originating in the perinatal period x Diseases of the circulatory system	122.9	0
Certain conditions originating in the perinatal period x Diseases of the digestive system	151.3	0
Certain conditions originating in the perinatal period x Diseases of the genitourinary system	-60.2	0.001
Congenital malformations, deformations and chromosomal abnormalities x Certain infectious and parasitic diseases	133.8	0
Congenital malformations, deformations and chromosomal abnormalities x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	209.4	0
Congenital malformations, deformations and chromosomal abnormalities x Diseases of the ear and mastoid process	79.4	0
Congenital malformations, deformations and chromosomal abnormalities x Diseases of the circulatory system	-18.0	0.025
Congenital malformations, deformations and chromosomal abnormalities x Diseases of the digestive system	85.3	0
Congenital malformations, deformations and chromosomal abnormalities x Diseases of the musculoskeletal system and connective tissue	120.7	0
Congenital malformations, deformations and chromosomal abnormalities x Certain conditions originating in the perinatal period	75.2	0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Certain infectious and parasitic diseases	-67.2	0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Neoplasms	112.0	0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Mental and behavioural disorders	51.8	0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the respiratory system	-15.2	0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the skin and subcutaneous tissue	64.2	0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Diseases of the musculoskeletal system and connective tissue	-39.3	0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Certain conditions originating in the perinatal period	-29.8	0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified x Congenital	-54.2	0

malformations, deformations and chromosomal abnormalities		
Injury, poisoning and certain other consequences of external causes x Neoplasms	-133.7	0
Injury, poisoning and certain other consequences of external causes x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	7.3	0.229
Injury, poisoning and certain other consequences of external causes x Diseases of the circulatory system	88.3	0
Injury, poisoning and certain other consequences of external causes x Diseases of the respiratory system	-98.9	0
Injury, poisoning and certain other consequences of external causes x Diseases of the digestive system	15.7	0
Injury, poisoning and certain other consequences of external causes x Diseases of the musculoskeletal system and connective tissue	-28.6	0
Injury, poisoning and certain other consequences of external causes x Diseases of the genitourinary system	48.6	0
Injury, poisoning and certain other consequences of external causes x Congenital malformations, deformations and chromosomal abnormalities	163.2	0
External causes of morbidity and mortality x Certain infectious and parasitic diseases	44.1	0
External causes of morbidity and mortality x Neoplasms	-169.1	0
External causes of morbidity and mortality x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	-122.8	0
External causes of morbidity and mortality x Endocrine, nutritional and metabolic diseases	40.5	0
External causes of morbidity and mortality x Mental and behavioural disorders	4.7	0.322
External causes of morbidity and mortality x Diseases of the ear and mastoid process	-112.1	0
External causes of morbidity and mortality x Diseases of the circulatory system	-133.1	0
External causes of morbidity and mortality x Diseases of the digestive system	26.1	0
External causes of morbidity and mortality x Diseases of the musculoskeletal system and connective tissue	9.3	0.064
External causes of morbidity and mortality x Diseases of the genitourinary system	78.4	0
External causes of morbidity and mortality x Certain conditions originating in the perinatal period	-81.1	0.003
External causes of morbidity and mortality x Injury, poisoning and certain other consequences of external causes	-124.6	0
Factors influencing health status and contact with health services x Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	52.1	0
Factors influencing health status and contact with health services x Mental and behavioural disorders	36.9	0

Factors influencing health status and contact with health services x Diseases of the eye and adnexa	-27.6	0
Factors influencing health status and contact with health services x Diseases of the skin and subcutaneous tissue	43.8	0
Factors influencing health status and contact with health services x Diseases of the musculoskeletal system and connective tissue	49.6	0
Factors influencing health status and contact with health services x Diseases of the genitourinary system	78.8	0
Factors influencing health status and contact with health services x Pregnancy, childbirth and the puerperium	-66.9	0
Factors influencing health status and contact with health services x Injury, poisoning and certain other consequences of external causes	40.5	0
Factors influencing health status and contact with health services x External causes of morbidity and mortality	-63.8	0

Diagnosis count

Variable	Coefficient	Significance
2 diagnoses	-49.4	0
3 diagnoses	-137.8	0
4 diagnoses	-207.2	0
5 diagnoses	-271.2	0
6 diagnoses	-322.0	0
7 diagnoses	-372.6	0
8 diagnoses	-404.5	0
9 diagnoses	-441.2	0
10 diagnoses	-509.4	0

Attributed need variables

Variable	Coefficient	Significance
Log population variance	-13.8	0
% fully retired from work (GP survey)	-48.2	0
% Long-term health condition (GP survey)	42.3	0
Average number of conditions for those with at least one long term medical condition (GP survey)	10.7	0
% DLA/PIP	815.8	0
Proportion Single -never married	20.3	0
Proportion Divorced	117.7	0
QOF mental health prevalence	18.0	0
Homelessness indicator (rate per 1000 households) (IMD)	2.8	0
Road distance to a primary school (km) (IMD)	-3.7	0
Proportion with no qualifications (Census)	192.7	0
Entry to higher education indicator (IMD)	80.1	0
Comparative illness and disability ratio indicator (IMD)	-0.3	0
Potential years of life lost indicator (IMD)	-0.1	0
Housing in poor condition indicator	-62.3	0

Attributed supply variables

Variable	Coefficient	Significance
Median waiting time for no-admitted patients	6.3	0

CCGs

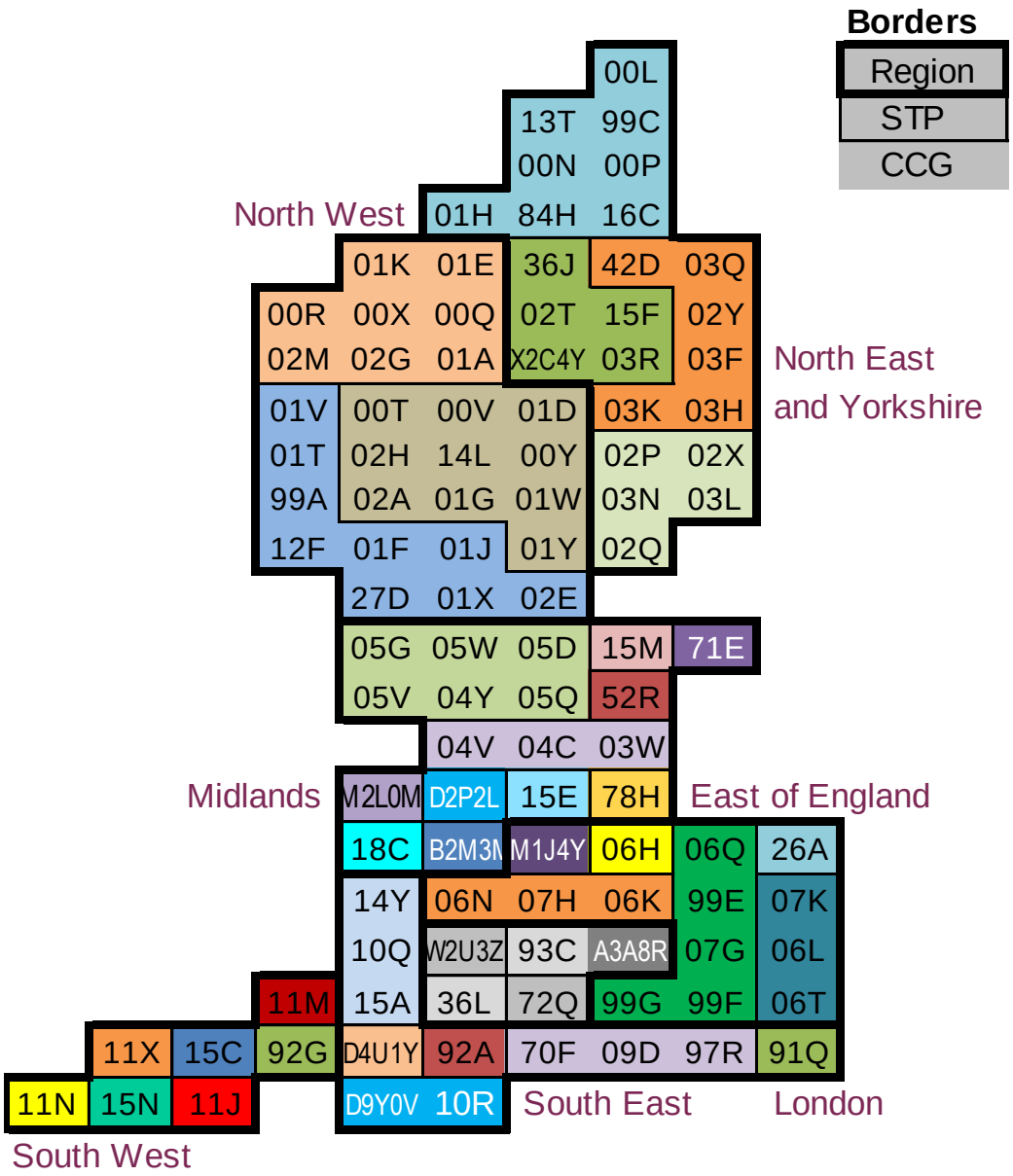
Variable	Coefficient	Significance
NHS Airedale, Wharfedale and Craven CCG	8.9	0.109
NHS Ashford CCG	61.9	0
NHS Barking and Dagenham CCG	33.3	0
NHS Barnet CCG	93.1	0
NHS Barnsley CCG	85.8	0
NHS Basildon and Brentwood CCG	28.2	0
NHS Bassetlaw CCG	18.3	0.003
NHS Bath and North East Somerset CCG	28.2	0
NHS Bedfordshire CCG	72.2	0
NHS Berkshire West CCG	135.8	0
NHS Bexley CCG	90.2	0
NHS Birmingham and Solihull CCG	51.1	0
NHS Blackburn with Darwen CCG	67.3	0
NHS Blackpool CCG	-35.6	0
NHS Bolton CCG	13.9	0.002
NHS Bradford City CCG	26.0	0
NHS Bradford Districts CCG	47.5	0
NHS Brent CCG	100.8	0
NHS Brighton and Hove CCG	13.7	0.003
NHS Bristol, North Somerset and South G	-31.0	0
NHS Bromley CCG	97.5	0
NHS Buckinghamshire CCG	16.0	0
NHS Bury CCG	10.6	0.038
NHS Calderdale CCG	17.0	0.001
NHS Cambridgeshire and Peterborough CCG	41.9	0
NHS Camden CCG	79.6	0
NHS Cannock Chase CCG	71.9	0
NHS Canterbury and Coastal CCG	-0.2	0.973
NHS Castle Point and Rochford CCG	37.1	0
NHS Central London (Westminster) CCG	28.0	0
NHS Chorley and South Ribble CCG	69.8	0
NHS City and Hackney CCG	20.5	0
NHS Coastal West Sussex CCG	48.2	0
NHS Corby CCG	79.5	0
NHS Coventry and Rugby CCG	74.5	0
NHS Crawley CCG	57.4	0
NHS Croydon CCG	78.1	0
NHS Darlington CCG	19.4	0.002
NHS Dartford, Gravesham and Swanley CCG	114.2	0
NHS Derby and Derbyshire CCG	44.4	0
NHS Dorset CCG	15.1	0
NHS Dudley CCG	66.7	0
NHS Durham Dales, Easington and Sedgefi	14.5	0.002
NHS Ealing CCG	66.7	0

NHS East Berkshire CCG	188.1	0
NHS East Lancashire CCG	29.8	0
NHS East Leicestershire and Rutland CCG	42.1	0
NHS East Riding of Yorkshire CCG	0.7	0.881
NHS East Staffordshire CCG	86.8	0
NHS East Surrey CCG	127.7	0
NHS East and North Hertfordshire CCG	61.4	0
NHS Eastbourne, Hailsham and Seaford CC	10.7	0.041
NHS Eastern Cheshire CCG	9.7	0.056
NHS Enfield CCG	79.5	0
NHS Fareham and Gosport CCG	41.1	0
NHS Fylde and Wyre CCG	-6.3	0.239
NHS Gloucestershire CCG	19.1	0
NHS Great Yarmouth and Waveney CCG	10.5	0.032
NHS Greater Huddersfield CCG	-3.9	0.424
NHS Greater Preston CCG	75.1	0
NHS Greenwich CCG	76.2	0
NHS Guildford and Waverley CCG	103.7	0
NHS Halton CCG	96.3	0
NHS Hambleton, Richmondshire and Whitby	-8.5	0.141
NHS Hammersmith and Fulham CCG	59.8	0
NHS Haringey CCG	98.5	0
NHS Harrogate and Rural District CCG	55.9	0
NHS Harrow CCG	115.4	0
NHS Hartlepool and Stockton-on-Tees CCG	54.3	0
NHS Hastings and Rother CCG	2.0	0.706
NHS Havering CCG	36.3	0
NHS Herefordshire CCG	85.8	0
NHS Herts Valleys CCG	45.4	0
NHS Heywood, Middleton and Rochdale CCG	26.7	0
NHS High Weald Lewes Havens CCG	15.1	0.006
NHS Hillingdon CCG	87.0	0
NHS Horsham and Mid Sussex CCG	61.8	0
NHS Hounslow CCG	50.3	0
NHS Hull CCG	-3.4	0.465
NHS Ipswich and East Suffolk CCG	143.0	0
NHS Isle of Wight CCG	-28.7	0
NHS Islington CCG	91.8	0
NHS Kernow CCG	12.5	0.002
NHS Kingston CCG	158.9	0
NHS Knowsley CCG	34.0	0
NHS Lambeth CCG	88.0	0
NHS Leeds CCG	17.7	0
NHS Leicester City CCG	45.7	0
NHS Lewisham CCG	109.2	0
NHS Lincolnshire East CCG	34.2	0
NHS Lincolnshire West CCG	8.4	0.085
NHS Liverpool CCG	51.9	0
NHS Luton CCG	97.5	0
NHS Manchester CCG	59.1	0
NHS Mansfield and Ashfield CCG	-3.5	0.501
NHS Medway CCG	49.4	0

NHS Merton CCG	158.1	0
NHS Mid Essex CCG	6.1	0.164
NHS Milton Keynes CCG	116.3	0
NHS Morecambe Bay CCG	27.5	0
NHS Nene CCG	39.7	0
NHS Newark and Sherwood CCG	6.8	0.243
NHS Newcastle Gateshead CCG	112.1	0
NHS Newham CCG	26.5	0
NHS North Cumbria CCG	0.3	0.955
NHS North Durham CCG	10.0	0.036
NHS North East Essex CCG	11.0	0.013
NHS North East Hampshire and Farnham CC	158.9	0
NHS North East Lincolnshire CCG	29.2	0
NHS North Hampshire CCG	90.2	0
NHS North Kirklees CCG	10.5	0.043
NHS North Lincolnshire CCG	32.4	0
NHS North Norfolk CCG	-25.0	0
NHS North Staffordshire CCG	54.8	0
NHS North Tyneside CCG	118.9	0
NHS North West Surrey CCG	225.3	0
NHS Northern, Eastern and Western Devon	2.7	0.473
NHS Northumberland CCG	125.9	0
NHS Norwich CCG	-16.6	0.001
NHS Nottingham City CCG	-2.1	0.628
NHS Nottingham North and East CCG	-15.2	0.007
NHS Nottingham West CCG	-6.6	0.321
NHS Oldham CCG	80.0	0
NHS Oxfordshire CCG	20.0	0
NHS Portsmouth CCG	39.2	0
NHS Redbridge CCG	66.1	0
NHS Redditch and Bromsgrove CCG	91.3	0
NHS Richmond CCG	111.2	0
NHS Rotherham CCG	-7.0	0.14
NHS Rushcliffe CCG	0.8	0.891
NHS Salford CCG	27.1	0
NHS Sandwell and West Birmingham CCG	89.2	0
NHS Scarborough and Ryedale CCG	123.7	0
NHS Sheffield CCG	61.2	0
NHS Shropshire CCG	74.8	0
NHS Somerset CCG	27.2	0
NHS South Cheshire CCG	-47.2	0
NHS South Devon and Torbay CCG	-4.8	0.303
NHS South East Staffordshire and Seisdo	79.7	0
NHS South Eastern Hampshire CCG	43.9	0
NHS South Kent Coast CCG	52.9	0
NHS South Lincolnshire CCG	15.2	0.005
NHS South Norfolk CCG	-8.7	0.08
NHS South Sefton CCG	77.7	0
NHS South Tees CCG	13.3	0.004
NHS South Tyneside CCG	167.0	0
NHS South Warwickshire CCG	102.4	0
NHS South West Lincolnshire CCG	52.1	0

NHS South Worcestershire CCG	69.2	0
NHS Southampton CCG	22.4	0
NHS Southend CCG	33.6	0
NHS Southport and Formby CCG	70.8	0
NHS Southwark CCG	107.9	0
NHS St Helens CCG	18.5	0
NHS Stafford and Surrounds CCG	72.8	0
NHS Stockport CCG	83.6	0
NHS Stoke on Trent CCG	62.8	0
NHS Sunderland CCG	267.9	0
NHS Surrey Downs CCG	144.1	0
NHS Surrey Heath CCG	216.2	0
NHS Sutton CCG	184.7	0
NHS Swale CCG	66.6	0
NHS Swindon CCG	31.4	0
NHS Tameside and Glossop CCG	55.2	0
NHS Telford and Wrekin CCG	97.5	0
NHS Thanet CCG	28.7	0
NHS Thurrock CCG	31.9	0
NHS Tower Hamlets CCG	44.0	0
NHS Trafford CCG	82.6	0
NHS Vale Royal CCG	-44.5	0
NHS Vale of York CCG	127.8	0
NHS Wakefield CCG	12.7	0.003
NHS Walsall CCG	61.2	0
NHS Waltham Forest CCG	54.0	0
NHS Wandsworth CCG	138.1	0
NHS Warrington CCG	99.9	0
NHS Warwickshire North CCG	120.8	0
NHS West Cheshire CCG	63.6	0
NHS West Essex CCG	34.1	0
NHS West Hampshire CCG	46.1	0
NHS West Kent CCG	44.6	0
NHS West Lancashire CCG	91.2	0
NHS West Leicestershire CCG	43.7	0
NHS West London CCG	45.5	0
NHS West Norfolk CCG	-9.0	0.094
NHS West Suffolk CCG	115.8	0
NHS Wigan Borough CCG	149.7	0
NHS Wiltshire CCG	59.5	0
NHS Wirral CCG	3.4	0.472
NHS Wolverhampton CCG	96.4	0
NHS Wyre Forest CCG	56.5	0

Annex E: Cartogram reference map



Annex F: CCG and ICS/STP (in bold) need indices for the general and acute model

CCG code	CCG	Existing model need index	Proposed model need index	% change in weighted population
92G	NHS Bath and North East Somerset, Swindon and Wiltshire CCG	1.01	0.99	-1.70
	Bath, Swindon and Wiltshire	**1.01**	**0.99**	**-1.70**
M1J4Y	NHS Bedfordshire, Luton and Milton Keynes CCG	0.92	0.92	0.80
	Bedfordshire, Luton and Milton Keynes	**0.92**	**0.92**	**0.80**
15E	NHS Birmingham and Solihull CCG	0.97	1.04	7.54
	Birmingham and Solihull	**0.97**	**1.04**	**7.54**
10Q	NHS Oxfordshire CCG	0.86	0.88	2.39
14Y	NHS Buckinghamshire CCG	0.89	0.95	6.16
15A	NHS Berkshire West CCG	0.80	0.86	7.60
	BOB (Berkshire West, Oxford and Buckinghamshire)	**0.85**	**0.89**	**5.02**
15C	NHS Bristol, North Somerset and South Gloucestershire CCG	0.95	1.02	7.84
	Bristol, North Somerset, South Gloucestershire	**0.95**	**1.02**	**7.84**
06H	NHS Cambridgeshire and Peterborough CCG	0.89	0.90	0.36
	Cambridgeshire and Peterborough	**0.89**	**0.90**	**0.36**
01V	NHS Southport and Formby CCG	1.27	1.16	-8.93
01J	NHS Knowsley CCG	1.30	1.24	-4.81
27D	NHS Cheshire CCG	1.12	1.07	-3.94
02E	NHS Warrington CCG	1.11	1.07	-3.21
01T	NHS South Sefton CCG	1.23	1.19	-3.18
99A	NHS Liverpool CCG	1.11	1.07	-3.09
01X	NHS St Helens CCG	1.27	1.24	-2.78
01F	NHS Halton CCG	1.21	1.20	-1.48
12F	NHS Wirral CCG	1.27	1.30	1.85
	Cheshire and Merseyside	**1.18**	**1.14**	**-2.97**
11N	NHS Kernow CCG	1.22	1.19	-2.18
	Cornwall and the Isles of Scilly	**1.22**	**1.19**	**-2.18**
B2M3M	NHS Coventry and Warwickshire CCG	0.99	0.97	-2.43
	Coventry and Warwickshire	**0.99**	**0.97**	**-2.43**

15M	NHS Derby and Derbyshire CCG	1.08	1.08	0.23
	Derbyshire	**1.08**	**1.08**	**0.23**
15N	NHS Devon CCG	1.14	1.09	-4.31
	Devon	**1.14**	**1.09**	**-4.31**
11J	NHS Dorset CCG	1.12	1.12	-0.27
	Dorset	**1.12**	**1.12**	**-0.27**
D4U1Y	NHS Frimley CCG	0.89	0.89	-0.15
	Frimley	**0.89**	**0.89**	**-0.15**
11M	NHS Gloucestershire CCG	1.01	0.97	-4.41
	Gloucestershire	**1.01**	**0.97**	**-4.41**
02H	NHS Wigan Borough CCG	1.20	1.12	-6.87
01W	NHS Stockport CCG	1.16	1.08	-6.50
01D	NHS Heywood, Middleton and Rochdale CCG	1.13	1.07	-5.52
01Y	NHS Tameside and Glossop CCG	1.16	1.09	-5.44
00V	NHS Bury CCG	1.07	1.03	-4.26
00T	NHS Bolton CCG	1.07	1.03	-3.41
02A	NHS Trafford CCG	1.06	1.03	-3.22
00Y	NHS Oldham CCG	1.03	1.00	-2.49
01G	NHS Salford CCG	1.07	1.08	0.66
14L	NHS Manchester CCG	0.90	0.93	3.83
	Greater Manchester	**1.06**	**1.03**	**-2.84**
D9Y0V	NHS Hampshire, Southampton and Isle of Wight CCG	1.04	1.03	-0.97
10R	NHS Portsmouth CCG	0.89	0.93	4.69
	Hampshire and the Isle of Wight	**1.02**	**1.01**	**-0.36**
18C	NHS Herefordshire and Worcestershire CCG	1.07	1.03	-3.47
	Herefordshire and Worcestershire	**1.07**	**1.03**	**-3.47**
07H	NHS West Essex CCG	0.98	0.97	-1.38
06K	NHS East and North Hertfordshire CCG	0.94	0.93	-1.17
06N	NHS Herts Valleys CCG	0.90	0.93	2.72
	Hertfordshire and West Essex	**0.93**	**0.93**	**0.35**
02Y	NHS East Riding of Yorkshire CCG	1.18	1.14	-3.54
03K	NHS North Lincolnshire CCG	1.11	1.08	-2.54
42D	NHS North Yorkshire CCG	1.10	1.09	-1.44

03F	NHS Hull CCG	1.05	1.04	-1.19
03Q	NHS Vale of York CCG	0.98	0.98	-0.07
03H	NHS North East Lincolnshire CCG	1.08	1.09	0.69
	Humber Coast and Vale	**1.08**	**1.06**	**-1.45**
91Q	NHS Kent and Medway CCG	1.00	1.00	0.63
	Kent and Medway	**1.00**	**1.00**	**0.63**
02G	NHS West Lancashire CCG	1.18	1.08	-9.04
01K	NHS Morecambe Bay CCG	1.22	1.14	-6.86
01A	NHS East Lancashire CCG	1.16	1.11	-4.64
00Q	NHS Blackburn with Darwen CCG	1.09	1.06	-3.18
00X	NHS Chorley and South Ribble CCG	1.15	1.13	-1.91
02M	NHS Fylde and Wyre CCG	1.30	1.27	-1.73
01E	NHS Greater Preston CCG	1.06	1.05	-1.41
00R	NHS Blackpool CCG	1.25	1.28	2.68
	Lancashire and South Cumbria (Blackpool and Fylde Coast)	**1.18**	**1.14**	**-3.53**
03W	NHS East Leicestershire and Rutland CCG	1.01	0.99	-1.91
04V	NHS West Leicestershire CCG	0.96	0.95	-0.68
04C	NHS Leicester City CCG	0.82	0.83	0.99
	Leicester, Leicestershire and Rutland	**0.92**	**0.92**	**-0.54**
71E	NHS Lincolnshire CCG	1.12	1.07	-4.54
	Lincolnshire	**1.12**	**1.07**	**-4.54**
06Q	NHS Mid Essex CCG	0.98	0.98	0.28
07G	NHS Thurrock CCG	0.91	0.93	2.16
99E	NHS Basildon and Brentwood CCG	0.98	1.00	2.66
99F	NHS Castle Point and Rochford CCG	1.08	1.12	3.83
99G	NHS Southend CCG	1.03	1.07	4.26
	Mid and South Essex	**0.99**	**1.01**	**2.29**
26A	NHS Norfolk and Waveney CCG	1.13	1.12	-0.63
	Norfolk and Waveney	1.13	1.12	-0.63
93C	NHS North Central London CCG	0.78	0.83	6.53
	North Central London	**0.78**	**0.83**	**6.53**
84H	NHS County Durham CCG	1.21	1.10	-8.70
99C	NHS North Tyneside CCG	1.23	1.13	-8.24

00P	NHS Sunderland CCG	1.25	1.16	-7.28
00N	NHS South Tyneside CCG	1.30	1.21	-7.02
01H	NHS North Cumbria CCG	1.18	1.11	-6.30
00L	NHS Northumberland CCG	1.26	1.19	-6.07
13T	NHS Newcastle Gateshead CCG	1.09	1.04	-5.42
16C	NHS Tees Valley CCG	1.17	1.13	-3.62
	North East and North Cumbria	**1.19**	**1.12**	**-6.25**
A3A8R	NHS North East London CCG	0.76	0.84	10.15
	North East London (East London)	**0.76**	**0.84**	**10.15**
W2U3Z	NHS North West London CCG	0.76	0.82	6.68
	North West London	**0.76**	**0.82**	**6.68**
78H	NHS Northamptonshire CCG	0.96	0.98	2.54
	Northamptonshire	**0.96**	**0.98**	**2.54**
52R	NHS Nottingham and Nottinghamshire CCG	1.03	1.06	2.07
	Nottinghamshire	**1.03**	**1.06**	**2.07**
M2L0M	NHS Shropshire, Telford and Wrekin CCG	1.10	1.10	-0.82
	Shropshire	**1.10**	**1.10**	**-0.82**
11X	NHS Somerset CCG	1.14	1.12	-1.54
	Somerset	**1.14**	**1.12**	**-1.54**
72Q	NHS South East London CCG	0.80	0.85	5.37
	South East London	**0.80**	**0.85**	**5.37**
36L	NHS South West London CCG	0.76	0.81	5.71
	South West London	**0.76**	**0.81**	**5.71**
02Q	NHS Bassetlaw CCG	1.17	1.10	-5.39
02P	NHS Barnsley CCG	1.19	1.15	-3.10
02X	NHS Doncaster CCG	1.13	1.13	0.18
03N	NHS Sheffield CCG	0.98	0.99	0.82
03L	NHS Rotherham CCG	1.11	1.13	1.46
	South Yorkshire and Bassetlaw	**1.08**	**1.08**	**-0.43**
05V	NHS Stafford and Surrounds CCG	1.13	1.04	-7.43
04Y	NHS Cannock Chase CCG	1.17	1.11	-5.58
05Q	NHS South East Staffordshire and Seisdon Peninsula CCG	1.12	1.06	-5.25
05D	NHS East Staffordshire CCG	1.04	1.01	-3.14

05G	NHS North Staffordshire CCG	1.12	1.10	-1.45
05W	NHS Stoke on Trent CCG	1.08	1.09	1.20
	Staffordshire and Stoke-on-Trent	**1.11**	**1.07**	**-3.01**
06L	NHS Ipswich and East Suffolk CCG	1.05	1.02	-2.71
06T	NHS North East Essex CCG	1.11	1.13	1.35
07K	NHS West Suffolk CCG	1.10	1.11	1.42
	Suffolk and North East Essex	**1.08**	**1.08**	**-0.22**
92A	NHS Surrey Heartlands CCG	0.93	0.92	-0.79
	Surrey Heartlands	**0.93**	**0.92**	**-0.79**
70F	NHS West Sussex CCG	1.08	1.06	-1.71
97R	NHS East Sussex CCG	1.12	1.15	2.29
09D	NHS Brighton and Hove CCG	0.82	0.84	3.43
	Sussex	**1.04**	**1.05**	**0.37**
D2P2L	NHS Black Country and West Birmingham CCG	1.04	1.02	-1.78
	The Black Country	**1.04**	**1.02**	**-1.78**
36J	NHS Bradford District and Craven CCG	1.04	0.99	-4.36
03R	NHS Wakefield CCG	1.14	1.11	-2.94
15F	NHS Leeds CCG	0.96	0.95	-0.85
02T	NHS Calderdale CCG	1.00	1.02	1.23
X2C4Y	NHS Kirklees CCG	0.99	1.00	1.45
	West Yorkshire and Harrogate Health and Care Partnership	**1.02**	**1.00**	**-1.52**