



# Small area level data based on patient postcode

## Documentation and Data Dictionary (set 18)

Version 2.7

Date: 06 Dec 2019

## Documentation Control Sheet

Over time, it may be necessary to issue amendments or clarifications to parts of this document. This form must be updated whenever changes are made.

Version	Affected Areas: Summary of Change	Prepared By	Reviewed By
0.9	Initial Draft	Dan Dedman	Rachael Boggon, Shivani Padmanabhan
1.0	Modified	Dan Dedman	
1.1	Modified	Dan Dedman	Rachael Williams
1.2	Formatted	Grant Lee	Sophia Amjad
1.3	Modified	Dan Dedman	Sophia Amjad
2.0	Modified	Helen Strongman	Arlene Gallagher
2.1	Modified	Helen Strongman	Shivani Padmanabhan
2.2	Modified	Rebecca Ghosh	Helen Strongman
2.3	Modified and formatted	Rebecca Ghosh	Arlene Gallagher
2.4	Modified	Rebecca Ghosh	Elizabeth Crellin
2.5	Modified	Susan Hodgson	Elizabeth Crellin
2.6	Modified	Susan Hodgson	Elizabeth Crellin
2.7	Modified	Susan Hodgson	Rebecca Ghosh

### Summary of Changes

#### Version 1.0

- Release version
- Incorporated changes to ordering of deprivation quintiles\deciles (1=least deprived) and corrections to dataset description for Townsend scores
- Added section on choosing which classification to use for a single study

#### Version 1.1

- Updated for set 10

#### Version 1.2

- Formatted document with new agency branding

#### Version 1.3

- Updated for set 11
- Amended description of eligibility criteria, missing values, and hyperlinks

#### Version 2.0

- Updated for set 12
- Addition of 2015 English Index of Multiple Deprivation references and data updated

#### Version 2.1

- Updated for set 13
- NHS postcode directory updated to May 2016
- Linkage summary results updated

#### Version 2.2

- Updated for set 14

- Linkage summary results and quintile methodology updated

#### Version 2.3

- Updated for set 15
- Updated header and footer with new agency branding

#### Version 2.4

- Updated for set 16

#### Version 2.5

- Updated link for reference 12

#### Version 2.6

- Updated to include individual IMD domains
- Updated to include Carstairs 2011 Index
- Updated to include Rural Urban Classification
- Updated for set 17

#### Version 2.7

- Updated for set 18

## Background

Classifications based on the population characteristics of small areas or neighbourhoods (and the individuals who live there) have been in use for several decades. In health research they have many applications, including: as a proxy for individual level measures of socioeconomic status; for planning and targeting of health and social care services; for ecological studies of environmental effects on health; and for individual level studies where characteristics of place of residence are of particular interest. [1] There are a wide range of small area data available from many sources. CPRD has linked the patient postcodes for both CPRD GOLD and CPRD Aurum to some of the most commonly requested area level data. This includes several measures of area level deprivation and a rural-urban classification.

### **Census geography [2]:**

The small area data provided is based on census geography which is the main geography directly associated with the UK Census in England, Wales and Northern Ireland. The base unit of this geography is the Output Areas (OA) which are built from clusters of adjacent postcode units [3]. Output areas usually contain around 110-140 households and are designed to be similar in population size and social characteristics based on tenure of household and dwelling type. Output Areas can be aggregated into Super Output Areas (SOA) which can be sub-divided into lower layer super output areas (LSOA) and middle layer super output areas (MSOA) in England and Wales [2].

The small area data provided by CPRD is at LSOA level which are typically built up from 4-6 OAs and have a notional minimum size of 1,000 residents and 300 households, and an average of 1,600 residents [4]. In Northern Ireland data Super Output Area (SOA) are used which have a population of 2,100 people [5]. In Scotland a similar geography known as data zones (DZ) are used which are slightly smaller than LSOAs, with the majority having a population of 500-1,000 residents.

### **Area level measures of deprivation:**

There are a number of well-known area-based measures of deprivation available at the LSOA level for linkage to CPRD primary care data through the patient postcode. These measures are:

### **The English Index of Multiple Deprivation (IMD):**

One of the most commonly used measures of deprivation is the Index of Multiple Deprivation (IMD). This is a composite measure derived from a number of indicators covering different aspects ('domains') of material deprivation: income, employment, education and skills, health, housing, crime, access to services, and living environment. Each domain index can itself be a composite score derived from two or more sub-domain indicators. The overall composite index, the Index of Multiple Deprivation (IMD), is calculated as a weighted sum of the domain indices. As of linkage set 17, individual IMD domains are available on request for the most recent IMD release for England

The first official 'Indices of Deprivation' for England [6] were produced by the UK Department for Communities and Local Government in 2000, replacing the 1998 Index of Local Deprivation. Updates for 2004, 2007, 2010 and 2015 were calculated at lower layer super output area (LSOA) level [7].

Similar indices exist for Wales [8], Scotland [9] and Northern Ireland [5] [10] but are not currently linked to CPRD primary care data at the patient postcode level. It is important to note that differences in methodology and source data mean that the indices are not directly comparable between different countries. Note also that all the indices measure relative rather than absolute deprivation. As such it is the ranking of areas provided by the IMD score, rather than the actual score itself, which is of primary interest.

### **Townsend Score: [11] [12]**

This indicator was devised by Townsend *et al* in 1988 as an index of material deprivation and disadvantage. Originally calculated at ward level, it was based on 4 measures from the 1981 census:

- Unemployment: proportion of the economically active population aged 16-59/64 who are unemployed.
- Car ownership: proportion of households with no car.
- Home ownership: proportion of households not owning their own home.
- Household overcrowding: proportion of private households with  $\geq 1$  resident per room.

The index is created as the sum of scores for each standardised measure. Townsend scores have been recalculated using data from the 1991 and 2001 census, and for different geographies – for example census output areas (OA) and LSOA. As with IMD scores, it is the ranking of areas provided by the Townsend score, rather than the actual score itself, which is of primary interest.

### **Carstairs Index: [13]**

This indicator was devised in the 1980s by Carstairs and Morris as an index of material deprivation at the small area level. Originally developed for Scotland, and now covering England and Wales as well, it is based on four measures from the UK census:

- Male unemployment: proportion of the economically active population of males age 16-74 who are unemployed.
- Car ownership: proportion of households with no car
- Overcrowding: proportion of all persons living in private households with a density of more than one person per room.
- Social Class: proportion of persons in private households with an economically active head of household in a low social class. Social class score was originally created using the Registrar General's Social Class [14], but as of 2001, this measure is approximated from the operational categories of the National Statistics Socio-Economic Classification

The index is created from the sum of scores for each standardised measure. Carstairs scores have been recalculated using data from the 1991, 2001 and 2011 census. In England and Wales, Carstairs scores are calculated at LSOA level, while scores for Scotland are calculated using data zones. As with IMD scores, it is the ranking of areas provided by the Carstairs Index, rather than the actual score itself, that is of primary interest. However, unlike IMD, Carstairs 2011 scores are comparable between the different countries, as the scores are calculated based on the total distribution across all LSOA/DZs with data available. The Carstairs index is available linked to CPRD patient postcode at the LSOA level for the 2011 census [15].

### **Rural Urban Classification:**

It may be important to distinguish between rural and urban areas when investigating differences in social and economic characteristics of small areas. Populations can vary in their composition between urban and rural areas, as can access to services, employment and educational opportunities, and quality of life.

The Rural Urban classifications (RUC) for England and Wales are produced by the Office for National Statistics and are based on census population data [16]. The "Urban" or "Rural" designation is given based on resident population only, and do not reflect the land use, policy, or financial characteristics of an area. Similar classifications exist for Scotland [17] and Northern Ireland [18]. It is important to note that the methodologies and source data for England and Wales differ from those for Northern Ireland and Scotland.

This means that the classifications for England and Wales are comparable, however the classifications for England and Wales, Scotland, and Northern Ireland are not comparable.

In England and Wales, the Urban/Rural classification is available at the LSOA level using the 2011 census [19]. In Scotland, the classification is available by data zone for 2016 [17]. For England and Wales and Scotland the classifications are available as binary (rural/urban) variables, the full classification has up to eight categories, four urban and four rural. In Northern Ireland, the classification is available at the SOA level for 2015 and is provided as a three-level variable (rural/urban/mixed). CPRD may be able to provide different groupings of the categories on request and with an approved Independent Scientific Advisory Committee (ISAC) protocol.

## What data are available through this linkage?

For practices in England that have consented to participate in the linkage scheme, the patient postcode of residence is mapped to the 2001 and 2011 LSOA boundaries using a postcode lookup file. The LSOA of residence then allows linkage to the following LSOA-level deprivation measures [6]:

- 2004 English Index of Multiple Deprivation (2001 LSOA boundaries)
- 2007 English Index of Multiple Deprivation (2001 LSOA boundaries)
- 2010 English Index of Multiple Deprivation (2001 LSOA boundaries)
- 2015 English Index of Multiple Deprivation (2011 LSOA boundaries) composite and individual domains (available from set 17 for CPRD GOLD and CPRD Aurum)
- Townsend score: calculated at LSOA level using unadjusted 2001 census data [12]
- 2011 Carstairs Index (2011 LSOA boundaries)
- England and Wales Rural Urban Classification (2011 LSOA boundaries)

Linkages at the practice postcode level are available separately. This uses the practice postcode which is linked via LSOA, SOA (Northern Ireland) or datazone (DZ) (Scotland), to several measures of area level deprivation and a rural urban classification. These data are described in the documentation on small area data for practices.

## Which area-based classification should I use?

Only one patient level classification will be provided for a single study (see section on disclosure control). In deciding which classification is most appropriate, there are a number of things to consider:

- theoretical considerations: the four IMD classifications summarise a larger range of 'domains' of deprivation than Townsend or Carstairs which are intended to focus on material deprivation. It may be helpful to review the literature on the derivation of the different classifications.
- data coverage period: you may want to select a measure derived from data collected during a period which most closely coincides with your study period.
- external validity: you may wish to select a classification that allows your results to be most comparable with other published work.

Aside from these issues, it is worth noting that all of the available measures are very highly correlated. Spearman's rank correlation coefficients are between 0.94-0.97 for deciles of the four different IMD classifications, and between 0.83-0.89 for deciles of Townsend and 0.88-0.90 for decile of Carstairs versus the four IMD classifications. This means that for many applications, the choice of area-based deprivation measure is unlikely to have a significant impact on the results or interpretation.

### Disclosure control

The Rural Urban Classification and deprivation scores and rankings are in the public domain and can be used to identify individual LSOAs. Therefore, for IMD, Townsend and Carstairs, each LSOA is classified into quintile, decile or 'twentile' groupings based on the deprivation score or rank. These quantiles are calculated by ranking all national LSOAs from least deprived to most deprived and dividing them into equal groups. This ranking is not restricted to the CPRD population, no further processing is done on the data and the quantiles are not weighted.

*Technical note:* different approaches are available for assigning quantile membership (quintile, deciles etc) when the number of units to be grouped is not an exact multiple of the number of groups. The quintile, decile and 'twentile' groupings were created with the `-xtile-` command in Stata version [20], with the `-nquantile()` option to specify the number of equal sized groups to be created (quintiles=5 groups; deciles=10 groups; 'twentiles'=20 groups).

By cross-tabulating two or more classifications it is possible to identify very small groups of lower super output areas (LSOA). In order to minimise the possibility of deductive disclosure of a patients' area of residence, CPRD will only supply one of the area-based deprivation measures for any one study. If you feel you have a compelling justification for using two or more classifications in the same study you should contact CPRD to discuss your requirements.



## Eligibility for inclusion in patient-level postcode linkage

Patients are eligible for inclusion if ALL the following criteria are satisfied:

- they are registered with a practice which has consented to participate in the CPRD patient-level linkage scheme. Currently the linkage scheme is restricted to practices in England.
- the patient has no record indicating dissent from the transmission of personal confidential data to NHS Digital, formerly known as the Health and Social Care Information Centre (HSCIC).
- a full postcode of residence is recorded for the patient in the primary care data, and has a valid format.

### Related files

- **Linkage eligibility file** (linkage\_eligibility.txt) - this file contains a record for every patient registered with a linked practice prior to transmission of identifiers to the trusted third party, along with flags to indicate the patients' eligibility for inclusion in each of the available linkages. Note that eligibility for linkage does not necessarily mean that the patient will appear in the linked dataset. For patient level deprivation measures, the relevant columns are:
  - [patid]: the unique CPRD patient identifier
  - [Isoa\_e]: this flag is set to 1 if the patient is eligible for inclusion in linkages based on patient postcode of residence (based on eligibility criteria above), and 0 otherwise.

### NHS Postcode Directory (NHSPD) [21]

The Office for National Statistics (ONS) supplies postcode-related data to the Organisation Data Service (ODS). The Organisation Data Service (ODS) is provided by NHS Digital and is responsible for the publication of all organisation and practitioner codes and NHS data standards. NHSPD is updated on a quarterly basis and can be downloaded from:

<https://digital.nhs.uk/organisation-data-service/data-downloads/national-statistics>

The current version used is the 2018 November postcode directory.

## Linkage summary results - set 18

- *Coverage period for linkage*: undefined. The patient postcode is available only for the last recorded address, and is valid up to the time of the data extract used for the linkage i.e. the linkage date. Researchers should bear in mind the time period to which the source data used in the IMD classification relate and consider the extent to which this is valid for their particular study period. Historic postcodes for patients are not maintained.
- *Postcode lookup file version* (maps unit postcodes to LSOA): NHSPD, November 2018

### CPRD GOLD

- Number of practices in linkage (see linkage\_eligibility.txt file): 416
- Number of patients in linked practices (see linkage\_eligibility.txt file): 10,800,187
- Number of patients eligible for postcode linkage (Isoa\_e=1 in linkage\_eligibility.txt): 10,295,394
- Number of records in each IMD/Townsend/Carstairs/Rural urban classification data file: 10,295,394
- Number of patients with valid area-based deprivation score data: 10,253,182
- Number of patients with a postcode having a valid format, but which could **not** be linked to an English LSOA based on the 2001 and 2011 LSOA classifications: 42,212 (deprivation quantiles and Rural urban classification set to missing for these patients).

## CPRD Aurum

- Number of practices in linkage (see linkage\_eligibility.txt file): 890
- Number of patients in linked practices (see linkage\_eligibility.txt file): 28,618,186
- Number of patients eligible for postcode linkage (Isoa\_e=1 in linkage\_eligibility.txt): 27,195,478
- Number of records in each IMD/Townsend/Carstairs/Rural urban classification data file: 27,195,478
- Number of patients with valid area-based deprivation score data: 27,071,926
- Number of patients with a postcode having a valid format, but which could **not** be linked to an English LSOA based on the 2001 and 2011 LSOA classifications: 123,552 (deprivation quantiles and Rural urban classification set to missing for these patients).

## Dataset specification - set 18

### Missing values

Where a postcode appears in a valid format but cannot be linked to an English LSOA (2001 / 2011 classification as appropriate), the above area-level data are set to missing. This may occur for a number of reasons:

- a non-geographic postcode
- a new postcode which is not included in the version of the NHS postcode directory used at the time of the linkage processing
- a postcode which is not in England
- an invalid postcode (but having the correct format)

### Index of Multiple Deprivation:

File name: patient\_imd2004.txt

Column name	Description	Format
patid	The encrypted unique key given to a patient in CPRD GOLD or CPRD Aurum [primary key]	integer: 20
pracid	The encrypted unique key given to a practice in CPRD GOLD or CPRD Aurum	integer: 5
imd2004_5	IMD 2004 quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
imd2004_10	IMD 2004 decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
imd2004_20	IMD 2004 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2

File name: patient\_imd2007.txt

Column name	Description	Format
patid	The encrypted unique key given to a patient in CPRD GOLD or CPRD Aurum [primary key]	integer: 20
pracid	The encrypted unique key given to a practice in CPRD GOLD or CPRD Aurum	integer: 5
imd2007_5	IMD 2007 quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
imd2007_10	IMD 2007 decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
imd2007_20	IMD 2007 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2

File name: patient\_imd2010.txt

Column name	Description	Format
patid	The encrypted unique key given to a patient in CPRD GOLD or CPRD Aurum [primary key]	integer: 20
pracid	The encrypted unique key given to a practice in CPRD GOLD or CPRD Aurum	integer: 5
imd2010_5	IMD 2010 quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
imd2010_10	IMD 2010 decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
imd2010_20	IMD 2010 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2

File name: patient\_imd2015.txt

Column name	Description	Format
patid	The encrypted unique key given to a patient in CPRD GOLD or CPRD Aurum [primary key]	integer: 20
pracid	The encrypted unique key given to a practice in CPRD GOLD or CPRD Aurum	integer: 5

imd2015_5	IMD 2015 quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
imd2015_10	IMD 2015 decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
imd2015_20	IMD 2015 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2

File name: patient\_imddomains.txt

<i>Column name</i>	<i>Description</i>	<i>Format</i>
patid	The encrypted unique key given to a patient in CPRD GOLD or CPRD Aurum [primary key]	integer: 20
pracid	Encrypted unique key given to a practice in CPRD GOLD or CPRD Aurum	integer: 5
e2015_income_5	England: IMD2015 income domain: quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
e2015_income_10	England: IMD2015 income domain: decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
e2015_income_20	England: IMD2015 income domain: 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2
e2015_employment_5	England: IMD2015 employment domain: quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
e2015_employment_10	England: IMD2015 employment domain: decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
e2015_employment_20	England: IMD2015 employment domain: 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2
e2015_education_5	England: IMD2015 education domain: quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
e2015_education_10	England: IMD2015 education domain: decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
e2015_education_20	England: IMD2015 education domain: 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2
e2015_health_5	England: IMD2015 health domain: quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
e2015_health_10	England: IMD2015 health domain: decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
e2015_health_20	England: IMD2015 health domain: 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2
e2015_crime_5	England: IMD2015 crime domain: quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
e2015_crime_10	England: IMD2015 crime domain: decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
e2015_crime_20	England: IMD2015 crime domain: 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2
e2015_access_5	England: IMD2015 access domain: decile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
e2015_access_10	England: IMD2015 access domain: quintile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
e2015_access_20	England: IMD2015 access domain: 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2
e2015_environment_5	England: IMD2015 environment domain: quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
e2015_environment_10	England: IMD2015 environment domain: decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
e2015_environment_20	England: IMD2015 environment domain: 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2

**Townsend:**

File name: patient\_townsend2001.txt

<i>Column name</i>	<i>Description</i>	<i>Format</i>
patid	The encrypted unique key given to a patient in CPRD GOLD or CPRD Aurum [primary key]	integer: 20
pracid	The encrypted unique key given to a practice in CPRD GOLD or CPRD Aurum	integer: 5
townsend2001_5	Townsend 2001 quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
townsend2001_10	Townsend 2001 decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
townsend2001_20	Townsend 2001 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2

**Carstairs:**

File name: patient\_carstairs.txt

<i>Column name</i>	<i>Description</i>	<i>Format</i>
patid	The encrypted unique key given to a patient in CPRD GOLD or CPRD Aurum [primary key]	integer: 20
pracid	The encrypted unique key given to a practice in CPRD GOLD or CPRD Aurum	integer: 5
carstairs2011_5	Carstairs 2011 quintile (1=LEAST deprived,..., 5=MOST deprived)	integer: 1
carstairs2011_10	Carstairs 2011 decile (1=LEAST deprived,..., 10=MOST deprived)	integer: 2
carstairs2011_20	Carstairs 2011 'twentile' (1=LEAST deprived,..., 20=MOST deprived)	integer: 2

**Rural urban classification**

File name: patient\_urbanrural.txt

<i>Column name</i>	<i>Description</i>	<i>Format</i>
patid	The encrypted unique key given to a patient in CPRD GOLD or CPRD Aurum [primary key]	integer: 20
pracid	The encrypted unique key given to a practice in CPRD GOLD or CPRD Aurum	integer: 5
e2011_urban_rural	England: 2011 Urban-Rural classification 1=Urban 2=Rural	integer: 1

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