



Continuous Mortality Investigation

Institute and Faculty of Actuaries

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CMI Postcode Mapping Tool

Background: analysis of experience by socio-economic status

To enable analysis of experience by socio-economic status, the CMI decided – after seeking views from a sample of data contributors – to collect two measures based on the Index of Multiple Deprivation (IMD), a population-based statistic described below, for all of our investigations.

The first version of the CMI Postcode Mapping Tool was released in 2018; the second version is released to CMI Subscribers alongside this document on the [“CMI Data” page of the IFoA website](#). Data contributors can use it to provide a measure of socio-economic status for each life in their submissions without the need to submit full postcodes. Providing we have meaningful volumes of data, this allows the CMI to perform analyses of mortality and/or morbidity experience by socio-economic status for any of our investigations.

The mapping tool enables socio-economic indicators to be determined from an individual’s postcode via mapping to a census data area for which IMD measures are calculated. The indicators in the tool are IMD deciles, which we consider to be sufficiently broad to avoid any risk that the measure could be reverse-engineered to identify the individual.

Updating the mapping tool

Alongside 2018 v01 of the mapping tool, we set out an intention to issue an updated version of the CMI Postcode Mapping Tool regularly. This document accompanies the first such update.

This version, 2020 v01, incorporates the August 2020 version of the Office for National Statistics Postcode Directory (ONSPD)¹, which contains an additional 30,208 postcodes (an increase of 1% from the August 2018 version of the ONSPD, used in the 2018 v01 version of the mapping tool), and updated nation-specific IMDs for England, Scotland and Wales. (We currently do not intend updating the UK-wide measure unless/until an updated UK-wide measure becomes available.)

A small proportion of postcodes (around 0.3%) are mapped to different LSOAs² in this version of the ONSPD. Our understanding is that this can arise as a result of:

- Postcode grid reference allocation updates;
- Demolition and new-build shifting the centroid grid references of postcodes; and
- In some circumstances, re-use of a previously terminated postcode in a different location.

The impact of this update is relatively small with a total of 63% of postcodes remaining in the same IMD decile and a further 34% moving to an adjacent IMD decile.

We recognise that there will be some movement in the postcodes being mapped to each decile, and to IMD versions, over time, and are happy to accept data mapped using the earlier version of the tool. Consequently,

¹ The ONSPD as at August 2020 is available from: <https://geoportal.statistics.gov.uk/datasets/ons-postcode-directory-august-2020>

² Lower-layer super output areas; these are described further under “How do we get from postcode to IMD decile?”, below.

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aggregate results for any single year may be based on data mapped using more than one version of the tool; however we expect the overall impact of such changes on the analysis to be limited from year to year.

Method for collecting IMD-based data

The mapping tool consists of a text file that provides a mapping from postcode to two measures of socio-economic status, both based on the IMD produced for each of the nations of the UK. Specifically, these are:

- Deciles within each nation's own measures of IMD, combined with an indicator for the 12 'NUTS 1' regions of the UK – Northern Ireland, Scotland, Wales and nine English regions³ – plus the Channel Islands and Isle of Man (for which IMDs are not computed); and
- Deciles within the UK, based on a UK-wide measure of IMD.

Note that the mapping tool does not include IMD deciles for Northern Ireland (although this is included as a region); these are subject to different licencing requirements.

UK-wide and nation-specific IMDs

Each of the four nations of the UK produces its own IMD. These are used primarily by local governments/authorities to target funding at the most deprived areas. However, they are also widely used in other fields to provide an indicator of socio-economic status, and the ONS has published population mortality data by IMD deciles⁴.

The construction of each country's IMD is different but follows a similar approach, based on a series of seven or eight 'domains', of which income and employment levels carry the most weight (currently 44%-56%). IMD scores are published for geographical areas used in national censuses. The absolute values of these scores have little meaning, but they are used to rank the areas according to their level of deprivation. The CMI Postcode Mapping Tool includes deciles for every postcode, with 1 representing the most deprived and 10 the least deprived (the order commonly used by the ONS and others).

Note: As the IMD scores are calculated independently for each nation, the countries' deciles are not comparable. For example, England decile 2 does not necessarily imply the same level of deprivation as Scotland decile 2.

Each country's IMD tends to be updated every few years, at a different time. The latest version of each⁵ is listed in Table 1, together with the version included in the UK-wide adjusted IMD (described below).

Table 1: Latest IMD for each country and the version included in the UK-wide adjusted IMD

Country	Latest IMD version	UK-wide adjusted IMD version
England	2019	2015
Scotland	2020	2012
Wales	2019	2014

As noted above, all three of the nation-specific IMDs used in the mapping tool have been updated since the 2018 v01 version of the mapping tool was released; England (previously 2015), Scotland (2016) and Wales (2014).

³ NUTS (https://en.wikipedia.org/wiki/Nomenclature_of_Territorial_Units_for_Statistics) is an EU standard. The English regions are: South West, South East, London, East of England, West Midlands, East Midlands, Yorkshire and the Humber, North West, and North East.

⁴ For example, population and deaths by single year of age and IMD decile for England and Wales, 2001-2016: <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/adhocs/007710numberofdeathsandpopulationsindeprivationdecileareasbysexandsingleyearofageenglandandwalesregisteredyears2001to2016>

⁵ The latest versions of each country's IMD are available at the following locations:

England: <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019>

Scotland: <https://www.gov.scot/publications/scottish-index-of-multiple-deprivation-2020v2-ranks/>

Wales: <https://gov.wales/welsh-index-multiple-deprivation-full-index-update-ranks-2019>

Nation-specific measures of IMD

The underlying motive for capturing IMD is to allow us to analyse mortality (and morbidity) experience for 'similar' groups of lives. By mapping postcodes to deciles for each country separately, we might then find that an appropriate grouping for the lightest mortality/morbidity rates comprises (say) English deciles 8-10, Scottish deciles 8-10 and Welsh deciles 9 and 10.

Given the disparity in size of the four countries, we have chosen to incorporate a regional indicator in the mapping file, to further sub-divide England. This uses the 12 'NUTS 1' regions of the UK and could allow us to explore regional differentials in English insured and pensioner mortality if data volumes permit. For the avoidance of doubt, the IMD deciles for England are national measures, not regional measures – e.g. in population data, we might expect a greater weighting to less-deprived deciles in the South East than in the North East.

UK-wide measure of IMD

A method for standardising IMD scores of the four countries, based on the underlying elements for income and employment, was published by [Abel, Barclay and Payne \(BMJ, 2016\)](#). This updated previous work by two of these authors, published by the Office for National Statistics ([Health Statistics Quarterly 53, 2012](#)). Using this method allows us to collect consistent data for the UK as a whole. However, it does have some drawbacks. In particular, it relies on:

- The IMD calculation methodologies being similar for each country; and
- The background levels of each domain (e.g. employment rates) being stable over time.

The first of these appeared to be a reasonable assumption for the latest available indices at the time of Abel et al's latest report (shown in Table 1 for England, Scotland and Wales, and for 2010 for Northern Ireland).

However, it is not necessarily the case that future versions of each country's index will retain similar methodologies. Indeed, the latest version of Northern Ireland's index (2017, known as the Multiple Deprivation Measure) introduced a different definition for its income domain, based on median incomes in Northern Ireland alone.

The second assumption, that the background levels of each domain are stable, is also far from certain, particularly given economic conditions over the past decade. This may explain, at least in part, why updating Abel et al's paper to include, for example, Scotland's IMD (2016) resulted in a materially higher proportion of the Scottish population in the least deprived quintile (26% of data zones, compared with 20% previously) of the UK population as a whole.

As a result, and the risk of similar future changes, we have chosen to base our UK-wide measure on the indices shown in Table 1 (including corrections to the Welsh IMD data made after Abel et al's work was completed), and not more recent versions. We do not currently intend updating this measure in future, as noted above, unless/until an updated UK-wide measure becomes available.

We consider that the different measures offer their own benefits. In summary:

- The UK-wide measure, using normalised data:
 - offers a simpler starting point for analysing mortality experience and building models.
 - may be useful to Subscribers as a 'standard' normalised UK-wide IMD dataset that they can use for their own analysis.
- However the nation-specific measure:
 - avoids spurious accuracy that could arise from the published method of adjustment.
 - can be updated for each country separately when its IMD is updated.
 - allows more direct comparison with population mortality experience for England and Wales, at least, as the ONS has released exposure and deaths data by IMD decile. This is not (currently) possible on a UK-wide basis.
 - combined with the 'NUTS 1' regions, might enable the CMI to explore regional differentials in English insured and pensioner mortality if data volumes permit.

Postcodes

The postcodes included in the CMI Postcode Mapping Tool are those listed in the ONSPD. At August 2020, there were around 2.6m postcodes in the directory. Not all of these relate to UK residential addresses or remain in use but we have included them all in the tool for completeness. The ONSPD is updated quarterly.

The ONSPD includes postcodes in three different formats:

- i. 7-character fixed length, where the third and fourth characters may be blank
- ii. 8-character fixed length, where the fifth character is always blank and the third and fourth characters may be blank.
- iii. Up to 8-character variable length, with a single space between the two 'halves', known as inward and outward codes.

For ease of use, we have included each of these in the tool, e.g.:

- "AB1 0AA", "AB1 0AA", "AB1 0AA"; and
- "B1 1AA", "B1 1AA", "B1 1AA".

How do we get from postcode to IMD decile?

IMDs are calculated and published for each:

- Lower-layer super output area (LSOA, comprising around 1,500 people on average) in England and Wales; and
- Data zone (around 750 people) in Scotland⁶.

The ONSPD provides the applicable output area for each postcode, allowing for a straightforward mapping from postcode to IMD data. The nine 'NUTS 1' regions of England are similarly obtained.

Some postcodes do not have an assigned census output area, for example because the postcode does not apply to a geographical location or because it is no longer in use. These are relatively few in number (less than 1%); we have retained them in the mapping tool, with an 'unknown' IMD decile. They will thus be treated in the same way as unknown, incomplete or non-existent postcodes.

Using the mapping tool

The tool is intended to be very simple for data contributors (and other CMI Subscribers) to use. It is provided in a comma-separated value (CSV) format that is widely used and compatible with a wide range of systems. We envisage that data contributors will use it as a 'look-up' tool.

The fields contained in the tool are described in Table 2. By using the postcode data field(s) that correspond to the format used in their own systems, data contributors can add three additional fields to their data submissions – nation-specific IMD decile, region and UK-wide IMD decile.

Table 2: CMI Postcode Mapping Tool data format

Field	Description
PCD	Postcode; 7-character fixed length.
PCD2	Postcode; 8-character fixed length.
PCDS	Postcode; up to 8-character variable length.
NS_Decile	Nation-specific IMD decile, where 1 is most deprived and 10 is least deprived.
Region	'NUTS 1' region: Northern Ireland, Scotland, Wales and nine English regions.
UK_Decile	UK-wide IMD decile, where 1 is most deprived and 10 is least deprived.

⁶ For completeness, they are calculated for Super output areas (of around 2,000 people) in Northern Ireland.

The first few records from the mapping tool are shown below:

PCD	PCD2	PCDS	NS_Decile	Region	UK_Decile
AB1 0AA	AB1 0AA	AB1 0AA	10	SC	9
AB1 0AB	AB1 0AB	AB1 0AB	10	SC	9
AB1 0AD	AB1 0AD	AB1 0AD	10	SC	9
AB1 0AE	AB1 0AE	AB1 0AE	8	SC	8

For Northern Ireland postcodes, both NS_Decile and UK_Decile are coded as unknown (“U”).

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