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Communities &
Local Government

The English Indices of Deprivation 2019

Technical report

September 2019

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Ministry of Housing, Communities and Local Government



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Preface

The English Indices of Deprivation are an important tool for identifying the most deprived areas in England. Local policy makers and communities can also use this tool to ensure that their activities prioritise the areas with greatest need for services.

The English Indices of Deprivation 2019 is the sixth release in a series of statistics produced to measure multiple forms of deprivation at the small spatial scale. Following engagement with key user groups and data providing departments, and a significant programme of work by the research team, the Indices of Deprivation 2019 retain broadly the same methodology, domains and indicators as the earlier Indices of Deprivation 2015, 2010, 2007, 2004 and 2000.

This report outlines the theory underpinning the model of multiple deprivation, the methods that were used, and describes the domains and indicators that make up the Indices of Deprivation 2019. A small number of changes to the indicators have been made, for example due to better availability of data, which are described in this report.

In addition to the technical details presented in this report, the Statistical Release produced by the Ministry of Housing Communities and Local Government (MHCLG) contains information on how to use and interpret the Indices, and there is further detail in the Research Report. MHCLG has also produced short, accessible guidance and responses to frequently asked questions. All these documents, and the datasets underpinning the Indices of Deprivation 2019, can be accessed at: www.gov.uk/government/statistics/english-indices-of-deprivation-2019

The data has also been loaded into the Ministry of Housing, Communities and Local Government's Open Data Communities platform¹.

¹ Ministry of Housing, Communities and Local Government's Open Data Communities website <http://opendatacommunities.org/>

Acknowledgements

The English Indices of Deprivation 2019 were constructed by a joint research partnership between Deprivation.org and Oxford Consultants for Social Inclusion (OCSI). The Deprivation.org research team comprised: David McLennan, Michael Noble and Gemma Wright. The OCSI research team comprised: Stefan Noble and Emma Plunkett.

In addition, some indicators from the Health Deprivation and Disability Domain were constructed by Karen Bloor, Nils Gutacker and Veronica Dale at the University of York; the air quality indicator by Jon Fairburn at Staffordshire University; the housing affordability indicator by Glen Bramley at Heriot-Watt University; and the housing condition indicator by the Building Research Establishment.

External quality assurance was carried out by Alex Sutherland and geographic information system work was undertaken by David Avenell. Additional support at OCSI was provided by Luke Murray, Obi Sargoni and Mary Silk.

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Chapter 1. Introduction

1.1 Introduction

- 1.1.1 The Ministry of Housing, Communities and Local Government commissioned Deprivation.org and Oxford Consultants for Social Inclusion (OCSI) to update the English Indices of Deprivation 2015. The project remit was to produce a direct update of the Indices of Deprivation 2015 wherever possible, and only introduce changes where this was necessary, due to developments in the data landscape, for example.
- 1.1.2 Following a significant programme of work by the research team, the Indices of Deprivation 2019 have been produced using the same approach, structure and methodology used to create the previous Indices of Deprivation 2015. The existing domains and sub-domains have been retained, although certain changes to the data landscape have necessitated a modest number of minor modifications to the basket of indicators used in some domains.
- 1.1.3 The updated Indices continue to be based on the 2011 Lower-layer Super Output Area geography².

1.2 Overview of the Indices of Deprivation 2019

- 1.2.1 The Indices of Deprivation 2019 provide a set of relative measures of deprivation for small geographical areas (Lower-layer Super Output Areas) across England, based on seven different domains of deprivation:
- Income Deprivation
 - Employment Deprivation
 - Education, Skills and Training Deprivation
 - Health Deprivation and Disability
 - Crime
 - Barriers to Housing and Services
 - Living Environment Deprivation
- 1.2.2 Each of these domains is based on a basket of indicators. As far as is possible, each indicator is based on data from the most recent time point available.
- 1.2.3 The Index of Multiple Deprivation 2019 combines information from the seven domains to produce an overall relative measure of deprivation. The domains are combined according to their respective weights as described in section 3.7. In addition, there are seven domain-level indices, and two supplementary indices: the Income Deprivation Affecting Children Index and the Income Deprivation Affecting Older People Index.

² Lower-layer Super Output Areas are homogenous small areas of relatively even population size containing approximately 1,500 people. The Indices of Deprivation 2010 and earlier versions used the 2001 Lower-layer Super Output Area geography. The Office for National Statistics then produced an updated version of the Lower-layer Super Output Area geography using population data from the 2011 Census. The changes made between the 2001 and 2011 versions were minimal: the boundaries of approximately 2.5% of the 2001 Lower-layer Super Output were modified.

- 1.2.4 A range of summary measures are available for higher-level geographies including Local Authority Districts and upper tier Local Authorities, Local Enterprise Partnerships, and Clinical Commissioning Groups. These summary measures are produced for the overall Index of Multiple Deprivation, each of the seven domains and the supplementary indices.
- 1.2.5 The Index of Multiple Deprivation 2019 (IMD2019), domain indices and the supplementary indices, together with the higher area summaries, are collectively referred to as the Indices of Deprivation 2019 (IoD2019).

1.3 About this Technical Report

- 1.3.1 This report presents the conceptual framework of the Indices of Deprivation 2019; the methodology for creating the domains and the overall Index of Multiple Deprivation; the component indicators and domains and the quality assurance carried out to ensure reliability of the data outputs.
- 1.3.2 The main findings from the Indices of Deprivation are presented in the MHCLG Statistical Release³, and an accompanying research report⁴ gives a fuller account with examples of how to use the Indices.
- 1.3.3 The reports produced for the Indices of Deprivation 2019 follow the same structure and content as the respective reports from the Indices of Deprivation 2015.
- 1.3.4 All project outputs are available to download from www.gov.uk/government/statistics/english-indices-of-deprivation-2019

³ Ministry of Housing Communities and Local Government (2019). The English Indices of Deprivation 2019, Statistical Release.

⁴ Ministry of Housing Communities and Local Government (2019). The Indices of Deprivation 2019. Research Report.

Chapter 2. Measuring deprivation at the small area level: The conceptual framework

2.1 Overview

- 2.1.1 The Index of Multiple Deprivation 2019 is a measure of multiple deprivation at the small area level. The model of multiple deprivation which underpins the Index is the same as that which underpinned its predecessors⁵ and is based on the idea of distinct dimensions of deprivation which can be recognised and measured separately.
- 2.1.2 These dimensions (or domains) of deprivation are experienced by individuals living in an area. The overall Index of Multiple Deprivation is a measure of multiple deprivation based on combining together these specific dimensions of deprivation.

2.2 Poverty, deprivation and multiple deprivation

- 2.2.1 In his 1979 account of *Poverty in the United Kingdom* Townsend sets out the case for defining poverty in relative terms: 'Individuals, families and groups can be said to be in poverty if they lack the resources to obtain the types of diet, participate in the activities and have the living conditions and amenities which are customary, or at least widely encouraged or approved in the societies to which they belong'⁶. Townsend further argues that 'people can be said to be *deprived* if they lack the types of diet, clothing, housing, household facilities and fuel and environmental, educational, working and social conditions, activities and facilities which are customary ...'⁷.
- 2.2.2 Though 'poverty' and 'deprivation' have often been used interchangeably, many have argued that a clear distinction should be made between them⁸. People are in *poverty* if they lack the financial resources to meet their needs, whereas people can be regarded as *deprived* due to a lack of resources of all kinds, not just income. 'Deprivation' thus refers to people's unmet needs, whereas 'poverty' refers to the lack of resources required to meet those needs. The Index of Multiple Deprivation framework follows Townsend, in defining deprivation in a broad way to encompass a wide range of aspects of an individual's living conditions.

⁵ The previous versions consist of the Index of Multiple Deprivation 2015, 2010, 2007, 2004 and 2000. See Smith et al. (2015) <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015>; McLennan et al. (2011) <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2010>; Noble et al. (2008) <http://webarchive.nationalarchives.gov.uk/+http://www.communities.gov.uk/communities/neighbourhoodrenewal/deprivation/deprivation07/>; Noble et al. (2004) <http://webarchive.nationalarchives.gov.uk/20100410180038/http://www.communities.gov.uk/archived/general-content/communities/indicesofdeprivation/216309/> and Noble et al (2000) <http://webarchive.nationalarchives.gov.uk/20100410180038/http://www.communities.gov.uk/archived/general-content/communities/indicesofdeprivation/indicesofdeprivation/>.

⁶ Townsend (1979), *Poverty in the United Kingdom*, p.31.

⁷ Townsend (1987), *Deprivation*, p.125-126, our italics.

⁸ See for example the discussion in Nolan and Whelan (1996).

- 2.2.3 Townsend also lays down the foundation for articulating multiple deprivation as an accumulation of several types of deprivation. This formulation of multiple deprivation is the starting point for the model of small area deprivation which is presented here.

2.3 Dimensions of deprivation

- 2.3.1 The approach allows the separate measurement of different dimensions of deprivation. Seven main types of deprivation are considered in the Index of Multiple Deprivation 2019 – income, employment, education, health, crime, access to housing and services, and living environment – and these are combined to form the overall measure of multiple deprivation.
- 2.3.2 There is a question as to whether low income or the lack of socially perceived necessities (for example adequate diet, consumer durables, ability to afford social activities etc) should be one of the dimensions⁹. To follow Townsend, within a multiple deprivation measure only the types of deprivation resulting from a low income would be included. So low income itself would not be a component, but lack of socially perceived necessities would. However, there is no readily available small area data on the lack of socially perceived necessities, and therefore low income is an important proxy for these aspects of material deprivation.
- 2.3.3 Despite recognising income deprivation in its own right, it should not be the only measure of area deprivation. Other dimensions of deprivation contribute crucial further information about an area. However, low income remains a central component of the definition of multiple deprivation used here. As Townsend writes ‘while people experiencing some forms of deprivation may not all have low income, people experiencing multiple or single but very severe forms of deprivation are in almost every instance likely to have very little income and little or no other resources’¹⁰.

2.4 Combining dimensions of deprivation into a multiple deprivation measure

- 2.4.1 Measuring different aspects of deprivation and combining these into an overall multiple deprivation measure raises a number of questions. Perhaps the most important one is the extent to which area deprivation in one dimension can be *cancelled* out by lack of deprivation in another dimension. Thus, if an area is found to have high levels of income deprivation but relatively low levels of education deprivation, should the latter cancel out the former and if so to what extent? The Index of Multiple Deprivation 2019 is essentially based on a weighted cumulative model and the methodology is designed to ensure that cancellation effects are minimised¹¹.
- 2.4.2 Another question concerns the extent to which the same people or households are represented in more than one of the dimensions of deprivation. The position taken in the Index of Multiple Deprivation 2019 is that if an individual, family or area experiences more

⁹ Gordon et al. (2000).

¹⁰ Townsend (1987), *Deprivation*, p.131.

¹¹ See Appendix F for details of how the Indices of Deprivation 2019 methodology minimises cancellation effects across the domains.

than one form of deprivation this is 'worse' than experiencing only one form of deprivation. The aim is not to eliminate double counting *between* domains – indeed it is desirable and appropriate to measure situations where deprivation occurs on more than one dimension.

- 2.4.3 On the other hand, it is desirable to eliminate double counting of people or households *within* domains. So, for example, the Income Deprivation Domain, Employment Deprivation Domain and the Adult Skills Sub-Domain, are each constructed from non-overlapping counts of people experiencing such deprivation. However, in practice, it is not always possible to avoid double counting in the indicators within domains.

2.5 An area-based model of multiple deprivation

- 2.5.1 The model of multiple deprivation is based on the idea of separate dimensions of deprivation which can be recognised and measured separately. These are experienced by individuals living in an area, and an area-level measure of deprivation for each of the dimensions (or domains) can in principle be measured.
- 2.5.2 An area can be characterised as deprived *relative to other areas* on a particular dimension of deprivation, on the basis that a higher proportion of people in the area are experiencing the type of deprivation in question. In other words, the experience of the people in an area gives the area its deprivation characteristics.
- 2.5.3 The area itself is not deprived, though the presence of a concentration of people experiencing deprivation in an area may give rise to a compounding deprivation effect, but this is still measured by reference to those individuals. Having attributed the aggregate of individual experience of deprivation to the area, it is possible to say that an area is deprived in that particular dimension.
- 2.5.4 Having measured specific dimensions of deprivation, these can be understood as separate domains of multiple deprivation. The overall Index of Multiple Deprivation is constructed by combining together these specific dimensions to produce an area-level measure of multiple deprivation. As with the individual dimensions of deprivation, an area can be characterised as deprived relative to other areas but is not in itself deprived.
- 2.5.5 The following chapters outline how the Indices of Deprivation 2019 (IoD2019) and Index of Multiple Deprivation 2019 (IMD2019) have been designed and developed based on the conceptual model of multiple deprivation outlined in this chapter.

Chapter 3. Methods

3.1 Overview of the methodology used to construct the Indices of Deprivation 2019

3.1.1 The construction of the Indices of Deprivation 2019¹², including the Index of Multiple Deprivation, broadly consists of the seven following stages. As shown in Figure 3.1, these stages fulfil the purposes of defining the Indices, data inputs and data processing procedures, and producing the Index of Multiple Deprivation and summary measures. Each stage is described in the following sections. Figure 3.3 summarises how these stages are applied in producing each of the domain indices and the Index of Multiple Deprivation.

1. Dimensions (referred to as domains) of deprivation are identified.
2. Indicators are chosen to provide the best possible measure of each domain of deprivation.
3. 'Shrinkage estimation' is used to improve reliability of the small area data¹³.
4. Indicators are combined to form the domains, generating separate domain scores. These can be regarded as indices in their own right – the domain indices¹⁴.
5. Domain scores are ranked, and the domain ranks are transformed to a specified exponential distribution¹⁵.
6. The exponentially transformed domain scores are combined using appropriate domain weights to form an overall Index of Multiple Deprivation at small area level¹⁶. This stage completes the construction of the Indices of Deprivation 2019 at Lower-layer Super Output Area level.
7. The overall Index of Multiple Deprivation, the domains and the supplementary indices are summarised for higher level geographical areas such as Local Authority Districts.

¹² The Index of Multiple Deprivation 2019 (IMD2019), domain indices and the supplementary indices, together with the higher area summaries, are collectively referred to as the Indices of Deprivation 2019 (IoD2019).

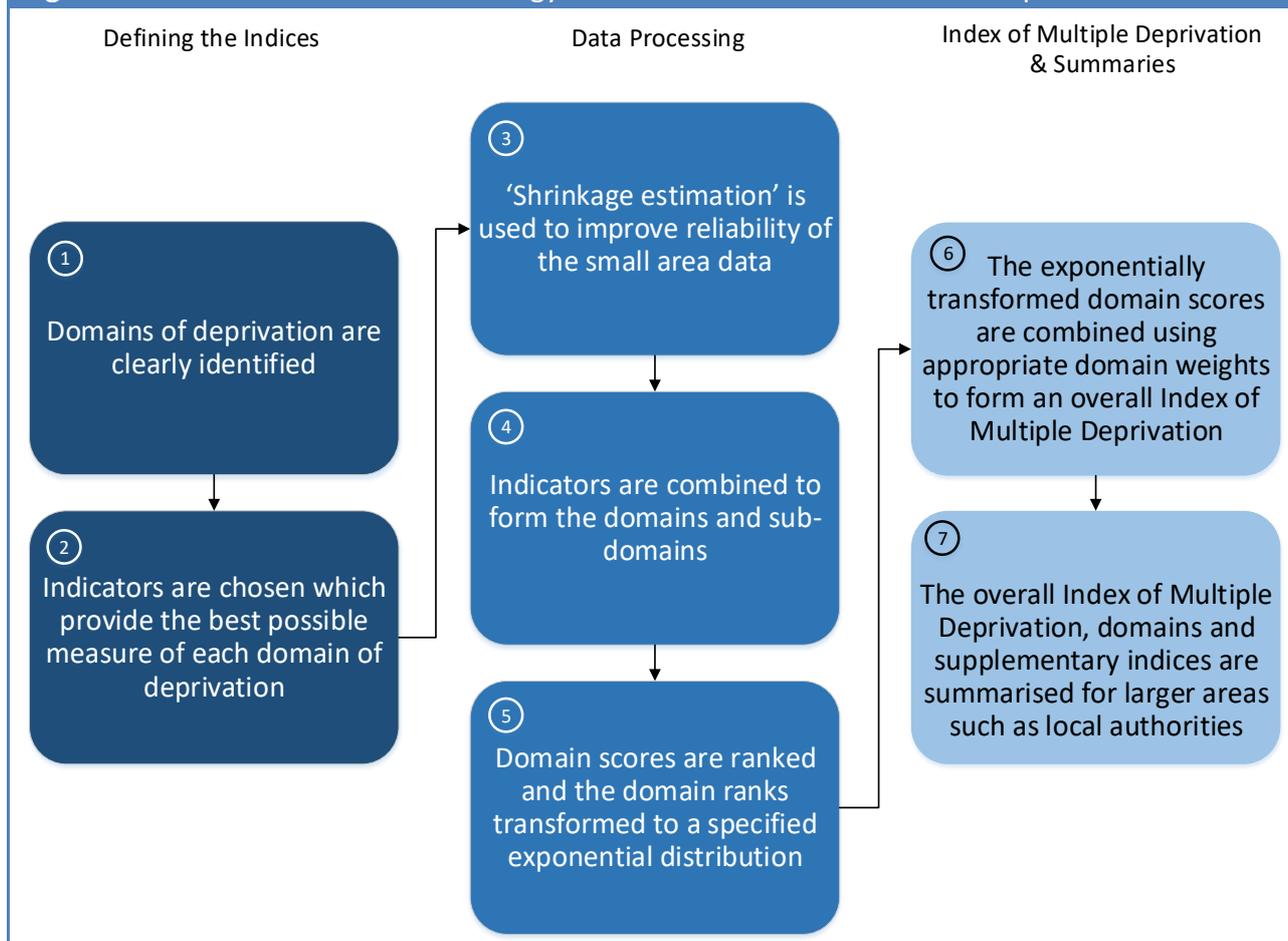
¹³ See Section 3.4 and Appendix D for description of the shrinkage technique.

¹⁴ In domains where there are sub-domains, this stage involves first combining the indicators into a sub-domain score. The sub-domain scores are then ranked and transformed to an exponential distribution before being combined into their respective domain scores. The supplementary indices are also created at this stage as a subset of Income Deprivation Domain scores.

¹⁵ See Section 3.6 and Appendix F for description of the exponential transformation.

¹⁶ See Section 3.7 and Appendix G for description of the domain weights.

Figure 3.1. Overview of the methodology used to construct the Indices of Deprivation 2019



Robustness of the methods and datasets

- 3.1.2 The methods used to construct the Indices of Deprivation 2019 have been carefully designed to ensure the robustness and reliability of the output datasets. Chapter 5 describes how the design of the Indices contributes to this, along with many other quality management actions and quality assurance checks.
- 3.1.3 As will be reiterated when considering the selection of indicators, the robustness of the index methodology is reinforced by the fact that a consistent and uniform methodology is applied across the country. The indices are a *relative* measure of multiple deprivation. The national comparisons that a relative measure enables are only possible if the same methodology is consistently applied irrespective of local conditions or the local availability of data.

Changes since the Indices of Deprivation 2015

- 3.1.4 Maintaining comparability with previous versions of the Indices is important to users¹⁷. The methods used in developing the Indices of Deprivation 2019 update have therefore remained consistent with those used in 2015.

¹⁷ Feedback from users during the consultation stages of the Indices of Deprivation 2015 project was supportive of the decision not to make major changes to the Indices.

3.1.5 Therefore, changes since the Indices of Deprivation 2015 are mainly confined to updates to the data and a small number of new or modified indicators. These are outlined in Stage 2 below and discussed in more detail in Chapter 4 and Appendix C under the appropriate domains.

3.2 Stage 1: Domains of deprivation are identified

3.2.1 The central idea of the Index of Multiple Deprivation is that deprivation is multi-dimensional and can be experienced in relation to a number of distinct domains. Multiple deprivation is measured at an area level by combining these domains. It is therefore important that each dimension of deprivation is clearly identified and reflects a particular aspect of deprivation.

3.2.2 The Indices of Deprivation 2019 are based on the same seven domains used in the previous 2015, 2010, 2007 and 2004 Indices:

- Income Deprivation
- Employment Deprivation
- Education, Skills and Training Deprivation
- Health Deprivation and Disability
- Crime
- Barriers to Housing and Services
- Living Environment Deprivation

3.2.3 Appendix L on the history of the indices gives a high-level account of the changes to domains and component indicators since the inception of the indices in their current form with the Indices of Deprivation 2000.

3.3 Stage 2: Indicators are chosen which provide the best possible measure of each domain of deprivation

Indicator criteria

3.3.1 For each of the seven domains of deprivation, an assessment has been made about whether the indicators in the Indices of Deprivation 2015:

- are still appropriate measures of deprivation for that domain
- can be updated
- can be strengthened, for example due to better available data.

3.3.2 All indicators have to meet the same criteria as for the Indices of Deprivation 2015 and its predecessors. Indicators should:

- be 'domain specific' and appropriate for the purpose (as far as possible, being direct measures of that form of deprivation)
- measure major features of that domain of deprivation (not conditions just experienced by a small number of people or areas)

- be up-to-date and (as far as possible) updateable¹⁸
- be statistically robust at the small area level
- be available for the whole of England at a small area level in a consistent form.

3.3.3 The aim for each domain was to include a parsimonious selection of indicators that comprehensively captured the deprivation for each domain, within the constraints of data availability and the criteria listed above.

Indicators used in the Indices of Deprivation 2019

3.3.4 There are 39 indicators in the Indices of Deprivation 2019. Almost all of the indicators in the Indices of Deprivation 2015 have been updated with little or, at most, minor changes. There are a small number of new or modified indicators:

- two new indicators have been added due to the introduction of Universal Credit into the benefits system,
- two indicators have been modified due to changes to the benefit system.

3.3.5 There have been minor changes to a further ten indicators, for example where it has been possible to base an indicator on a longer time series of data in order to increase the robustness of the results.

3.3.6 Appendix C provides details of the changes to the indicators used in the Indices of Deprivation 2015 in the 2019 update. This includes minor changes made to indicators, for example due to changes in available data.

3.3.7 Figure 3.2 summarises the updated, new and modified indicators for each of the domains. Details are given in the appropriate place in Chapter 5.

¹⁸ Wherever possible, indicators are used that can be regularly updated. However not all indicators can be regularly updated, for example those based on Census 2011. Census data is used only when alternative data from administrative sources is not available.

Figure 3.2. Domains and indicators for the Indices of Deprivation 2019

Income Deprivation 22.5%	Adults and children in Income Support families Adults and children in income-based Jobseeker's Allowance families Adults and children in income-based Employment and Support Allowance families Adults and children in Pension Credit (Guarantee) families Adults and children in Working Tax Credit and Child Tax Credit families, below 60% median income not already counted Asylum seekers in England in receipt of subsistence support, accommodation support, or both Adults and children in Universal Credit families where no adult is in 'Working - no requirements' conditionality regime ++
Employment Deprivation 22.5%	Claimants of Jobseeker's Allowance, aged 18-59/64 Claimants of Employment and Support Allowance, aged 18-59/64 Claimants of Incapacity Benefit, aged 18-59/64 Claimants of Severe Disablement Allowance, aged 18-59/64 Claimants of Carer's Allowance, aged 18-59/64 Claimants of Universal Credit in the 'Searching for work' and 'No work requirements' conditionality groups ++
Education, Skills & Training Deprivation 13.5%	Key Stage 2 attainment: scaled scores Key Stage 4 attainment: average capped points score Secondary school absence Staying on in education post 16 Entry to higher education Adults with no or low qualifications, aged 25-59/64 Adults who cannot speak English or cannot speak English well, aged 25-59/64 <div style="margin-left: 200px;"> } Children & Young People } Adult Skills </div>
Health Deprivation & Disability 13.5%	Years of potential life lost Comparative illness and disability ratio ** Acute morbidity Mood and anxiety disorders **
Crime 9.3%	Recorded crime rates for: <ul style="list-style-type: none"> • Violence • Burglary • Theft • Criminal damage
Barriers to Housing & Services 9.3%	Road distance to a: <ul style="list-style-type: none"> • Post office • Primary school • General store or supermarket • GP surgery Household overcrowding Homelessness Housing affordability <div style="margin-left: 100px;"> } Geographical Barriers } Wider Barriers </div>
Living Environment Deprivation 9.3%	Houses without central heating Housing in poor condition Air quality Road traffic accidents <div style="margin-left: 100px;"> } Indoors Living Environment } Outdoors Living Environment </div>
++ New indicators	
** Modified indicators	
% illustrates the weight of each domain in the Indices of Deprivation	

The percentages reported in each domain box show the weight that the domain receives in the Index of Multiple Deprivation 2019. See Section 3.7 and Appendix G for description of the domain weights.

Data time point

- 3.3.8 As far as possible, each indicator was based on data from the most recent time point available. Using the latest available data in this way means there is not a single consistent time point for all indicators. Details on the data time points used for each indicator are provided in Chapter 4.
- 3.3.9 As with previous Indices, the Indices of Deprivation 2019 use Census data only when alternative data from administrative sources is not available. Four such indicators were derived from the 2011 Census: adult skill levels and English language proficiency in the Education, Skills and Training Deprivation Domain; household overcrowding in the Barriers

to Housing and Services Domain; and houses without central heating in the Living Environment Deprivation Domain.

- 3.3.10 As a result of the time points for which data was available, the indicators do not take into account changes to policy since the time point of the data used. For example, the 2015/16 benefits data used in the Income Deprivation Domain predate the full rollout of Universal Credit, which only began replacing certain income and health related benefits from May 2016.

Geography and spatial scale

- 3.3.11 The Indices of Deprivation 2019 have been produced at Lower-layer Super Output Area level, using the current (2011) Lower-layer Super Output Areas¹⁹.
- 3.3.12 Guidance is provided in Appendix A of the accompanying Research Report on how to aggregate the Lower-layer Super Output Area data to other geographies such as wards or bespoke local areas, as requested by a number of users.
- 3.3.13 Summary measures for the Index of Multiple Deprivation, domains and supplementary indices have been produced for the following higher-level geographies: Local Authority Districts, upper tier Local Authorities, Local Enterprise Partnerships and Clinical Commissioning Groups.

Denominators

- 3.3.14 Denominators are an integral and important component of almost all the indicators included in the Indices of Deprivation. For each indicator, the relevant denominator seeks to measure the number of people (or households etc.) that are 'at-risk' of being defined as deprived, in other words that are at-risk of being included in the numerator. The denominator for each indicator is expressed on the same geographical scale as the numerator (for example Lower-layer Super Output Areas or Local Authority Districts) and is usually measured for the same year as the numerator.
- 3.3.15 The majority of the indicators in the Indices of Deprivation are measured as proportions or rates of the population that are deprived, and therefore use denominators based on population. To give a more accurate measure of the population 'at-risk' of being defined as deprived, these population-based denominators are calculated by taking the small area mid-year population estimates from the Office for National Statistics and removing prison populations (as provided by the Ministry of Justice). This step is undertaken because prisoners are typically not at-risk of being included in the numerator counts for the indicators. For example, individuals who are in prison are not eligible to claim means-tested out-of-work benefits.
- 3.3.16 Some of the indicators use denominators other than the resident population. For example, some indicators draw denominators from within the same dataset as the numerator (such as pupil attainment datasets); some are expressed as the proportion of

¹⁹ Lower-layer Super Output Areas are homogenous small areas of relatively even size containing approximately 1,500 people. The Indices of Deprivation 2015 also used the current (2011) Lower-layer Super Out Area geography. The Indices of Deprivation 2010 and earlier versions used the 2001 Lower-layer Super Output Area geography.

households rather than people; and some incorporate special adjustments to better reflect the population at risk.

- 3.3.17 Details of the exact denominators that are used for each numerator are discussed in the indicator descriptions in Chapter 4, and a full list is given in Appendix A. A more detailed explanation of the denominators used can be found in Appendix B.
- 3.3.18 Population-based denominators as referred to in paragraph 3.3.15 are published, as they were for the Indices of Deprivation 2015.

3.4 Stage 3: ‘Shrinkage estimation’ is used to improve reliability of the small area data

- 3.4.1 Where a rate or other measure of deprivation for a small area is based on small numbers, the resulting estimate may be unreliable, with an unacceptably high standard error. The technique of shrinkage estimation is used to ‘borrow strength’ from larger areas to avoid creating unreliable small area data; the impact of shrinkage may be to move a Lower-layer Super Output Area’s score towards more deprivation or towards less deprivation.
- 3.4.2 Without shrinkage, some Lower-layer Super Output Areas would have scores which do not reliably describe the deprivation in the area due to chance fluctuations from year to year. Such scores occur most commonly where numbers are small at Lower-layer Super Output Area level and the event is thus relatively rare. This may be the case for the indicator as a whole or only for particular Lower-layer Super Output Areas. In shrinkage estimation the score for a small area is estimated as a weighted combination of that small area’s score and the mean value for a larger area from which the smaller areas within the larger area borrow strength.
- 3.4.3 As with previous Indices, the larger areas used for shrinkage in the Indices of Deprivation 2019 are Local Authority Districts. The Lower-layer Super Output Areas within a single district share issues relating to local governance and possibly to economic sub-climates. To a certain extent, they may also share issues relating to labour market sub-climates. During the development of the Indices of Deprivation 2015, the possibility of using other large areas as the areas from which to borrow strength was explored, but the conclusion was to continue to use Local Authority Districts as the larger areas for the shrinkage process.
- 3.4.4 In the Indices of Deprivation 2019 the shrinkage technique is applied to the majority of indicators. Those which are not subjected to shrinkage include the modelled indicators, the road distance indicators and the indicator supplied at Local Authority District level. Specific information about the indicators to which shrinkage is applied is given in the indicator descriptions in Chapter 4. Further details about the shrinkage technique are given in Appendix D.

3.5 Stage 4: Indicators are combined to form the domains, generating separate domain scores

- 3.5.1 For each domain of deprivation, the aim is to obtain a single measure which is straightforward to interpret in that it is, if possible, expressed in meaningful units (for example the proportion of people or of households experiencing that form of

deprivation). This was achieved in the Income and Employment Domains, but was not possible in the other five domains.

- 3.5.2 The Income Deprivation Domain and Employment Deprivation Domain are constructed as simple rates of the population at-risk. Separate indicators in these domains are constructed as non-overlapping counts and are simply summed together to identify the total at-risk population for the domain.
- 3.5.3 In the other domains the indicators are on different metrics and therefore it is not possible to calculate a simple rate. The indicators are standardised by ranking and transforming to a standard normal distribution based on their ranks, before combining with selected weights to form the domain score:
- In three domains – the Children and Young People sub-domain of the Education, Skills and Training Deprivation Domain, the Health Deprivation and Disability Domain, and the Crime Domain – maximum likelihood factor analysis is used to generate appropriate weights for combining the standardised indicators into a single score per domain, or sub-domain. Maximum Likelihood factor analysis is used to determine what weight to give each of these indicators when combining them. It does this by testing the extent to which each of the indicators measure the underlying aspect of deprivation²⁰. Factor analysis is described in Appendix E.
 - In the remaining two domains, equal weights have been applied²¹.
- 3.5.4 In domains where there are sub-domains, this stage involves first combining the indicators into sub-domain scores. The sub-domain scores are then ranked and transformed to an exponential distribution for the reasons given in Section 3.6 before being combined into their respective domain scores.
- 3.5.5 Details of the specific steps taken to arrive at the domain scores are given in the appropriate places in Chapter 4. This approach to combining the indicators into the domains replicates that taken in the Indices of Deprivation 2015 and earlier Indices.
- 3.5.6 The domain scores and ranked indices that are generated as a result of this stage, and the sub-domain scores *before* ranking and transforming to an exponential distribution, are published outputs (see Appendix M for details of the published data and spreadsheets). These domain indices can be used in their own right by users interested in particular dimensions of deprivation rather than the overall Index of Multiple Deprivation.

²⁰ The method of factor analysis used in the 2019 Indices and earlier versions is the Maximum Likelihood method. Unlike Principal Components Analysis, which is the main alternative, the Maximum Likelihood method does not require the assumptions that all indicators are perfectly reliable and measured without error. For further details about the factor analysis technique, please see Appendix E.

²¹ Factor analysis requires a minimum of three indicators to function, and so could not be used in the sub-domains of the Living Environment Deprivation Domain because each sub-domain consists of just two indicators. Furthermore, factor analysis is not suitable for use when a Local Authority District level indicator score is assigned to all constituent Lower-layer Super Output Areas in the Local Authority District, as is the case for the homelessness indicator in the Wider Barriers sub-domain of the Barriers to Housing and Services Domain. For these reasons, factor analysis was not used in the Living Environment Deprivation Domain or the Barriers to Housing and Services Domain, and so indicators were combined with equal weights.

3.6 Stage 5: Domain scores are ranked, and the domain ranks transformed to a specified exponential distribution

- 3.6.1 When combining the domains to form an overall index, it is important that the scores of each domain are comparable and that the weighting of domains is not distorted by the fact that the domains may have very different distributions. It is also important to select a method of combination that does not result in deprivation on one domain being cancelled out by lack of deprivation on another domain. It is fundamental to the model of deprivation employed in the Indices that deprivations are cumulative.
- 3.6.2 In order to combine the domains, a number of steps are necessary. First the domain scores must be standardised, that is converted in such a way that they are measured on the same metric. This is achieved by ranking the Lower-layer Super Output Areas from least deprived Lower-layer Super Output Area to most deprived Lower-layer Super Output Area, separately for each of the seven domains. Second, the set of seven resultant domain ranks must each be transformed to the same specified distribution. Without undertaking standardisation and transformation the different domain score distributions would distort the impact of the explicit weights used in the final stage to combine the domains into the overall Index of Multiple Deprivation.
- 3.6.3 There are a number of different statistical techniques that can be employed to standardise and transform the domain scores to prepare them for combination. The method which has been employed since the Indices of Deprivation 2000 – exponential transformation of the ranked domain score – was explicitly designed to reduce ‘cancellation effects’. So, for example, high levels of deprivation in one domain are not completely cancelled out by low levels of deprivation in a different domain. Also, the exponential transformation applied puts more emphasis on the deprived end of the distribution and so facilitates identification of the most deprived areas.
- 3.6.4 The property of the exponential distribution which effectively emphasises the most deprived part of the distribution means that the Indices are specifically constructed to identify deprivation and *not* affluence. Put another way, the Indices discriminate well between deprived neighbourhoods but not between those in the less deprived part of the distribution.
- 3.6.5 The Indices of Deprivation 2019 uses exponential transformation of the ranks, as in the previous Indices. A more extensive account of the exponential transformation procedure is given in Appendix F.
- 3.6.6 In order to allow users to combine domains using alternative weights for specific purposes, the exponentially transformed scores are made available in file 9 (see Appendix M for details of the published data and spreadsheets).

3.7 Stage 6: The exponentially transformed domain scores are combined using appropriate domain weights to form an overall Index of Multiple Deprivation

- 3.7.1 Combining the different domains into an overall index always involves weighting the domains, whether the weights are set explicitly or not. Greater weight on a specific

domain gives greater importance to that domain in the overall index. Weights may be set explicitly, as they were in the Indices of Deprivation 2000 and subsequent updates. If domain scores were simply added together (after standardisation), this would give each domain an equal weight. Conversely, if domains are not standardised to lie on the same scale or distribution, weights are set implicitly by the domain distributions.

- 3.7.2 The weights used for the Indices of Deprivation 2000 were derived from consideration of the academic literature on poverty and deprivation, as well as consideration of the levels of robustness of the indicators. This resulted in a decision to give the greatest weight to the Income Deprivation Domain and Employment Deprivation Domain. A fuller account of this is given in Appendix G.
- 3.7.3 The weights employed in the construction of the Index of Multiple Deprivation 2019 are shown in the table below. These weights are unchanged since the construction of the Index of Multiple Deprivation 2004 when the Crime Domain was introduced, and the seven current domains established.

Domain	Domain weight (%)
Income Deprivation Domain	22.5
Employment Deprivation Domain	22.5
Health Deprivation and Disability Domain	13.5
Education, Skills and Training Deprivation Domain	13.5
Barriers to Housing and Services Domain	9.3
Crime Domain	9.3
Living Environment Deprivation Domain	9.3

- 3.7.4 While applying different weights would affect the Index of Multiple Deprivation, the impact may not be large. Research into the issue of weighting was carried out by the University of St Andrews (Dibben et al., 2007)²². Sensitivity testing on three different approaches to weighting showed that although a small adjustment could be made to the weights (in effect swapping the weights for the Employment Deprivation Domain and the Health Deprivation and Disability Domain) it did not have a large impact on the final Index of Multiple Deprivation ranks. This work is described in greater detail in Appendix G.
- 3.7.5 With reference to these research findings, the use of these weights was revisited in the consultations preceding the release of the Indices of Deprivation 2007²³, Indices of Deprivation 2010²⁴ and Indices of Deprivation 2015²⁵. Those consultations found the vast

²² Dibben, C., Atherton, I., Cox, M., Watson, V., Ryan, M. and Sutton, M. (2007) Investigating the Impact of Changing the Weights that Underpin the Index of Multiple Deprivation 2004, <http://webarchive.nationalarchives.gov.uk/20100410180038/http://www.communities.gov.uk/publications/communities/investigatingimpact>

²³ Ministry of Housing, Communities and Local Government (2007) Updating the English Indices of Deprivation 2004: Stage Two 'Blueprint' Consultation Report – Summary of Responses, <http://webarchive.nationalarchives.gov.uk/20120919132719/http://www.communities.gov.uk/publications/communities/indicesdeprivationresponses>

²⁴ Ministry of Housing, Communities and Local Government (2011) English Indices of Deprivation consultation: summary of responses, <https://www.gov.uk/government/consultations/english-indices-of-deprivation>

²⁵ <https://www.gov.uk/government/consultations/updating-the-english-indices-of-deprivation>

majority of respondents were in favour of keeping the weights the same. In light of the very high level of user support, the weights used in the Indices of Deprivation 2019 remain as used in the Indices of Deprivation 2015.

- 3.7.6 Based on these weights, the Index of Multiple Deprivation will suit the purposes of most users. But it is recognised that some users may wish to analyse deprivation using only a subset of the deprivation domains or to apply different weights. For example, analysts working in public health may wish to create a combined index that excludes the Health Deprivation and Disability Domain, allowing them to explore other forms of deprivation as a determinant of health outcomes. To facilitate users in applying alternative weights, the exponentially transformed domain scores (from stage 5) are published along with the appropriate population sizes; guidance on how to combine the domains together using different weights is provided in Appendix B of the Research Report.

3.8 Stage 7: The overall Index of Multiple Deprivation and domains are summarised for larger areas such as Local Authority Districts

- 3.8.1 The previous stages produce the small area (Lower-layer Super Output Area) data for the Indices of Deprivation 2019. In this final stage, the small area statistics are summarised for larger areas such as Local Authority Districts.
- 3.8.2 For larger areas, a single deprivation score (or rank) may not be adequate to accurately describe levels of deprivation across the area. Local Authority Districts can vary enormously in both geographic and population size and may have very different patterns of deprivation. Some areas are deprived but contain relatively little variation in deprivation across their neighbourhoods; in other places deprivation may be concentrated in pockets of severe deprivation rather than being more evenly spread.
- 3.8.3 To summarise the level of deprivation in larger areas, a range of summary measures of the Index of Multiple Deprivation 2019, the domains and the two supplementary indices (Income Deprivation Affecting Children Index and Income Deprivation Affecting Older People Index) have been created²⁶, as listed in Table 3.2 below. No single summary measure is the 'best' measure. Each measure highlights different aspects of deprivation, and comparison of the different measures is needed to give a fuller description of deprivation in a large area. All the summary measures should be considered, as no single measure is more important or more 'true' than another in describing the distribution of deprivation at this level. In addition, it is important to remember that the higher-area measures are *summaries*; the Lower-layer Super Output Area level data provides more detail than is available through the summaries.

²⁶ For the Indices of Deprivation 2010 and previous versions, the majority of summary measures published were for the Index of Multiple Deprivation only. In response to demand from users, additional summary measures for the domains and supplementary indices were published as part of the Indices of Deprivation 2015, and these are also published for the Indices of Deprivation 2019.

- 3.8.4 The accompanying Research Report provides details of how change over time can be assessed using the higher-level summaries. Users are reminded that when undertaking analyses of change of time using the higher-level summaries it is important to ensure that the same higher-level summary is used for each relevant time point²⁷.
- 3.8.5 The origins of the higher-level summaries produced for the Indices of Deprivation 2019 pre-date even the Indices of Deprivation 2000: early versions of higher-level summaries were derived for the Department of Environment's ward-based '1998 Local Index of Deprivation', and were further refined, developed and expanded upon for the Indices of Deprivation 2000. For example, the 1998 Local Index of Deprivation contained a 'degree' measure which summarised average ward ranks at Local Authority District level. A modified version of this 'degree' measure was included in the Indices of Deprivation 2000 as the 'Average Rank' higher-level summary measure. The 1998 Local Index of Deprivation also contained early versions of the higher-level summary measures that were termed 'Extent' and 'Local Concentration' in the Indices of Deprivation 2000. The 'Average Score' higher-level measure was introduced as a new measure in the Indices of Deprivation 2000 following responses to the consultation process. The aim in including the 'Average Score' measure was to provide an additional summary measure of deprivation that took into account all small areas within the Local Authority District, but which placed greater emphasis on those Local Authority Districts that contained small areas with the very highest levels of deprivation. The 'Income Scale' and 'Employment Scale' higher-level summaries were also introduced for the first time in the Indices of Deprivation 2000. In each iteration of the Indices from 2000 onwards, the guidance to users has consistently stressed the importance of considering all higher-level summary measures in order to obtain a comprehensive overview of the levels and patterns of deprivation within the higher-level area. The guidance has also consistently emphasised that no one higher-level summary measure is better than the others.

²⁷ For instance, it is not appropriate to compare an area's rank on the Extent measure of the IMD 2015 with the area's rank on the Local Concentration measure of the IMD 2019.

Table 3.2. The higher-area summary measures

Summary measure	Description
Average rank	<p>The ‘average rank’ measure summarises the average level of deprivation across the higher-level area, based on the ranks of the Lower-layer Super Output Areas in the area.</p> <p>As all Lower-layer Super Output Areas in the higher-level area are used to create the ‘average rank’, this gives a measure of the whole area covering both deprived and less-deprived areas. The measure is population-weighted, to take account of the fact that Lower-layer Super Output Area population sizes can vary. A detailed description of the methodological steps underpinning the calculation of the ‘average rank’ measure is provided in Appendix N, along with a worked example. A simplified schematic of the process is as follows:</p> <div data-bbox="501 763 1390 869" data-label="Diagram"> <pre> graph LR A[LSOA score] --> B[LSOA rank] B --> C[Population weighted LSOA rank] C --> D[Sum of population weighted LSOA ranks] </pre> </div> <p>The nature of this measure – using all areas and using ranks rather than scores – means that a highly polarised local authority or other higher-level area would not tend to score particularly highly, because extremely deprived and less deprived Lower-layer Super Output Areas will ‘average out’. Conversely, a higher-level area that is more uniform in being highly deprived will tend to score highly on the ‘average rank’ measure. Once the ‘average rank’ measure has been calculated as described, the higher-level areas are ranked from most deprived to least deprived on this measure, producing the ‘rank of average rank’ summary measure.</p>

Table 3.2. The higher-area summary measures

Summary measure	Description
<p>Average score</p>	<p>The ‘average score’ measure summarises the average level of deprivation across the higher-level area, based on the scores of the Lower-layer Super Output Areas in the area.</p> <p>As all Lower-layer Super Output Areas in the higher-level area are used to create the ‘average score’, this gives a measure of the whole area covering both deprived and less-deprived areas. The measure is population-weighted, to take account of the fact that Lower-layer Super Output Area population sizes can vary. A detailed description of the methodological steps underpinning the calculation of the ‘average score’ measure is provided in Appendix N, along with a worked example. A simplified schematic of the process is as follows:</p> <div data-bbox="512 779 1385 880" data-label="Diagram"> <pre> graph LR A[LSOA score] --> B[] B --> C[] C --> D[] D --> E[Population weighted LSOA score] E --> F[Sum of population weighted LSOA scores] </pre> </div> <p>The main difference with the ‘average rank’ measure described above is that more deprived Lower-layer Super Output Areas tend to have more ‘extreme’ scores than ranks. So highly deprived areas will not tend to average out to the same degree as when using ranks; highly polarised areas will therefore tend to score relatively higher on the ‘average score’ measure than on the ‘average rank’ measure.</p> <p>Once the ‘average score’ measure has been calculated as described, the higher-level areas are ranked from most deprived to least deprived on this measure, producing the ‘rank of average score’ summary measure.</p>
<p>Proportion of Lower-layer Super Output Areas in most deprived 10 per cent nationally</p>	<p>This measure is the ‘proportion of Lower-layer Super Output Areas that are in the most deprived 10 per cent nationally’. A detailed description of the methodological steps underpinning the calculation of this measure is provide in Appendix N, along with a worked example.</p> <p>By contrast to the ‘average rank’ and ‘average score’ measures, which are based on all Lower-layer Super Output Areas in the higher-level area, this measure focuses only on the most deprived Lower-layer Super Output Areas. Higher-level areas which have no Lower-layer Super Output Areas in the most deprived 10 per cent of all such areas in England have a score of zero for this summary measure.</p> <p>Once the ‘proportion of Lower-layer Super Output Areas that are in the most deprived 10 per cent nationally’ measure has been calculated as described, the higher-level areas are ranked from most deprived to least deprived on this measure, producing the ‘rank of proportion of LSOAs in most deprived 10% nationally’ summary measure.</p>

Table 3.2. The higher-area summary measures	
Summary measure	Description
Extent	<p>The ‘extent’ measure is a summary of the proportion of the local population that live in areas classified as among the most deprived in the country. The ‘extent’ measure uses a weighted measure of the population in the most deprived 30 per cent of all areas:</p> <ul style="list-style-type: none"> • The population living in the most deprived 10 per cent of Lower-layer Super Output Areas in England receive a ‘weight’ of 1.0 • The population living in the most deprived 11 to 30 per cent of Lower-layer Super Output Areas receive a sliding weight, ranging from 0.95 for those in the most deprived eleventh percentile, to 0.05 for those in the most deprived thirtieth percentile. <p>A detailed description of the methodological steps underpinning the calculation of this measure is provide in Appendix N, along with a worked example.</p> <p>Once the ‘extent’ measure has been calculated as described, the higher-level areas are ranked from most deprived to least deprived on this measure, producing the ‘rank of extent’ summary measure.</p>
Local concentration	<p>The ‘local concentration’ measure is a summary of how the most deprived Lower-layer Super Output Areas in the higher-level area compare to those in other areas across the country. This measures the population-weighted average rank for the Lower-layer Super Output Areas that are ranked as most deprived in the higher-area, and that contain exactly 10 per cent of the higher-area population.</p> <p>A detailed description of the methodological steps underpinning the calculation of this measure is provide in Appendix N, along with a worked example.</p> <p>Once the ‘local concentration’ measure has been calculated as described, the higher-level areas are ranked from most deprived to least deprived on this measure, producing the ‘rank of local concentration’ summary measure.</p>
Income scale and employment scale (two measures)	<p>The two ‘scale’ measures summarise the number of people in the higher-level area who are income deprived (the ‘income scale’) or employment deprived (the ‘employment scale’).</p> <p>Detailed descriptions of the methodological steps underpinning the calculation of these two measures are provide in Appendix N, along with worked examples.</p> <p>Once the ‘income scale’ and ‘employment scale’ measures have been calculated as described, the higher-level areas are ranked from most deprived to least deprived on each of these measures, producing the ‘rank of income scale’ and ‘rank of employment scale’ summary measures.</p>

3.8.6 Further guidance is provided on how to use and interpret these measures in the Research Report, Section 3.3.

3.8.7 The table below sets out which summary measures have been published for the Index of Multiple Deprivation, the domains and supplementary indices.

Table 3.3. The summary measures published for the Index of Multiple Deprivation, the domains and supplementary indices

	Average rank	Average score	Proportion of Lower-layer Super Output Areas in most deprived 10 per cent nationally	Extent	Local concentration	Scale
Index of Multiple Deprivation	x	x	x	x	x	
Income	x	x	x			x
Employment	x	x	x			x
Education	x	x	x			
Health	x	x	x			
Crime	x	x	x			
Living	x	x	x			
Barriers	x	x	x			
IDACI	x	x	x			
IDAOP1	x	x	x			

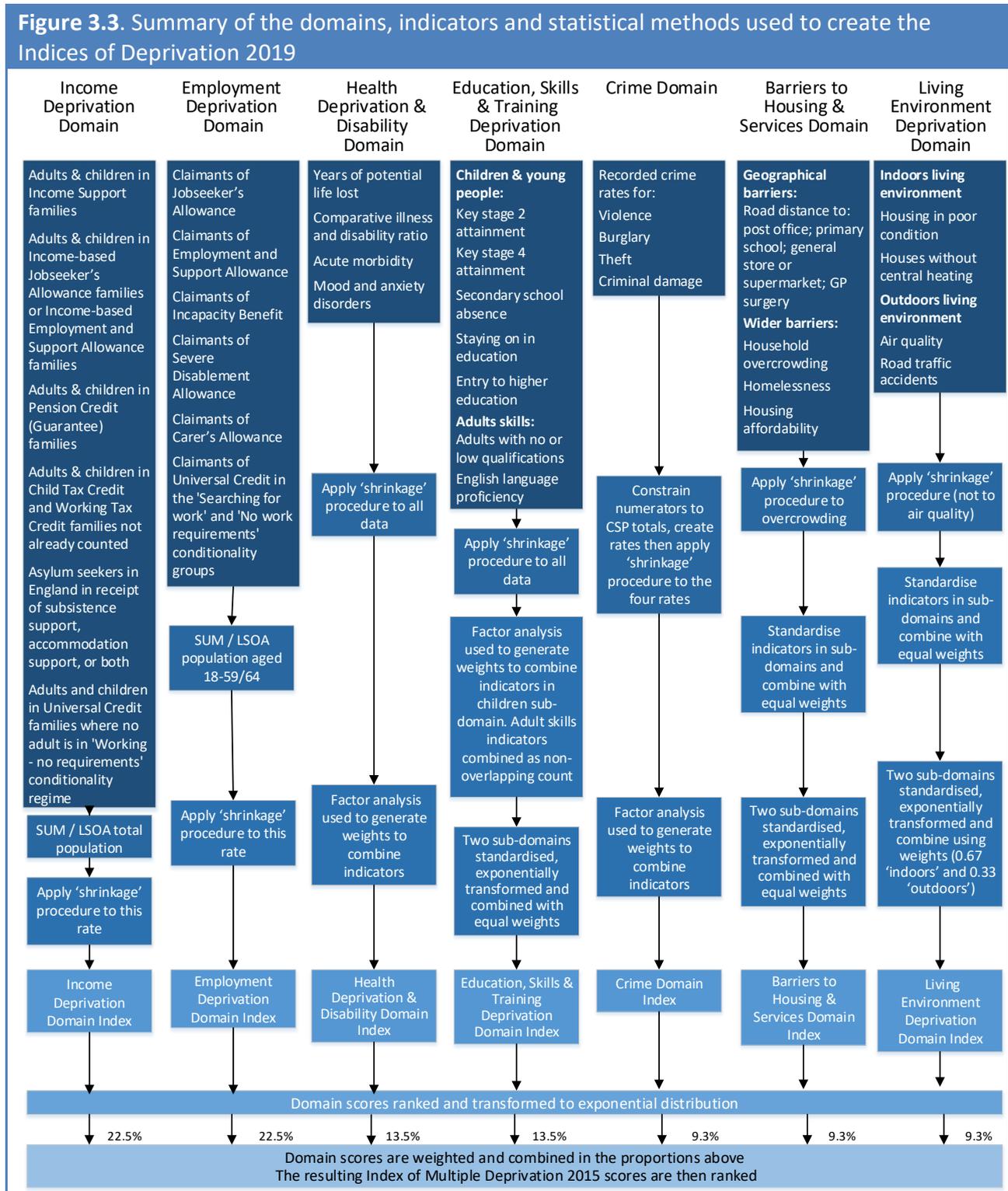
3.8.8 The higher-level geographical areas at which the Indices have been summarised are as follows: Local Authority Districts, upper tier Local Authorities, Local Enterprise Partnerships and Clinical Commissioning Groups. These are published in accompanying data files 10 - 13 (see Appendix M for details of the data and spreadsheets that have been published).

3.8.9 The population denominators used for the construction of the higher-level summaries for the Index of Multiple Deprivation and all domains other than the Employment Deprivation Domain are the mid-2015 Lower-layer Super Output Area population estimates, minus any prison populations. For the Employment Deprivation Domain, the working-age population aged 18 to 59/64 for mid-2015 and mid-2016 was used, minus any prison populations for that age group. For the supplementary indices the appropriate age group population estimate for mid-2015 was used, minus any prison populations for those age groups. These are published in accompanying data file 6; see Appendix M for details of the published data and spreadsheets.

3.8.10 In order to construct these high-level geographical summaries, look-up tables were constructed to indicate which Lower-layer Super Output Areas nest within each of the high-level geographies. This nesting was precise except in the case of the Local Enterprise Partnerships, where a "best fit" Lower-layer Super Output Area lookup was provided by the Office for National Statistics.

3.9 Summary of the domains, indicators and methods used to construct the Indices of Deprivation 2019

3.9.1 Figure 3.3 summarises the domains, indicators and methods used to construct the Lower-layer Super Output Area level Indices of Deprivation 2019.



Chapter 4. The domains and indicators

4.1 Introduction

- 4.1.1 This chapter describes the 39 component indicators in the Indices of Deprivation 2019 and how these were combined to create each domain. Appendix A lists the data sources used for each indicator and Appendix B describes how denominators for indicators were selected.
- 4.1.2 In this chapter, a section at the end of each domain summarises changes made to indicators since the Indices of Deprivation 2015. This summary covers new or modified indicators (and briefly describes the modifications); more detail is presented in Appendix C which contains a full description of any changes. Where benefits have been replaced or there have been eligibility changes since the Indices of Deprivation 2015, this is discussed in the main text. Appendix I also deals in detail with changes to the benefit system since the construction of the Indices of Deprivation 2015.

4.2 Domains

- 4.2.1 The Indices of Deprivation 2019 are a relative measure of deprivation for small areas (Lower-layer Super Output Areas) across England. The overall Index of Multiple Deprivation 2019 combines together indicators under seven different domains of deprivation, detailed in the following sections:
- Income Deprivation
 - Employment Deprivation
 - Education, Skills and Training Deprivation
 - Health Deprivation and Disability
 - Crime
 - Barriers to Housing and Services
 - Living Environment Deprivation
- 4.2.2 In addition, there are two supplementary indices: the Income Deprivation Affecting Children Index and the Income Deprivation Affecting Older People Index. These are described under the Income Deprivation Domain, since they are subsets of this domain.

4.3 Income Deprivation Domain

- 4.3.1 The Income Deprivation Domain measures the proportion of the population in an area experiencing deprivation relating to low income. The definition of low income used includes both those people that are out-of-work, and those that are in work but who have low earnings (and who satisfy the respective means tests).

The indicators

- Adults and children in Income Support families²⁸
- Adults and children in income-based Jobseeker's Allowance families
- Adults and children in income-based Employment and Support Allowance families
- Adults and children in Pension Credit (Guarantee) families
- Adults and children in Universal Credit families where no adult is classed within the 'Working - no requirements' conditionality group
- Adults and children in Working Tax Credit and Child Tax Credit families not already counted, that is those who are not in receipt of Income Support, income-based Jobseeker's Allowance, income-based Employment and Support Allowance, Pension Credit (Guarantee), and whose equivalised income (excluding housing benefit) is below 60 per cent of the median before housing costs²⁹
- Asylum seekers in England in receipt of subsistence support, accommodation support, or both.

Indicator details

Adults and children in Income Support families

Adults and children in income-based Jobseeker's Allowance families

Adults and children in income-based Employment and Support Allowance families

Adults and children in Pension Credit (Guarantee) families

Adults and children in Universal Credit households in the 'Searching for work', 'No work requirements', 'Planning for work', 'Working – with requirements' and 'Preparing for work' conditionality groups

- 4.3.2 These five indicators comprise a non-overlapping count of the number of adults and children in a Lower-layer Super Output Area living in families claiming Income Support, income-based Jobseeker's Allowance, income-based Employment and Support Allowance, Universal Credit ('Searching for work', 'No work requirements', 'Planning for work' 'Working – with requirements' and 'Preparing for work' conditionality groups) or Pension Credit (Guarantee). Data for August 2015 was sourced from databases held by the Department for Work and Pensions and HM Revenue & Customs.
- 4.3.3 Income Support, income-based Jobseeker's Allowance, income-based Employment and Support Allowance, Universal Credit ('Searching for work', 'No work requirements', 'Planning for work', 'Working – with requirements' and 'Preparing for work' conditionality groups) and Pension Credit (Guarantee) are means-tested social security benefits. The benefits are mutually exclusive so there is no double counting involved. To be eligible for these benefits, claimants must be able to demonstrate that their income and savings are below specified thresholds.

²⁸ The word 'family' is used to designate a 'benefit unit', that is the claimant, any partner and any dependent children (those for whom Child Benefit is received).

²⁹ Note that it is not possible to claim Universal Credit as well as Working Tax Credit or Child Tax Credit.

4.3.4 The Lower-layer Super Output Area level count was constructed by selecting relevant claimants from the Department for Work and Pensions' databases, matching in information on dependent partners (conducted within the Department for Work and Pensions) and dependent children (conducted within HM Revenue & Customs), then aggregating to Lower-layer Super Output Area level. The administrative records used to construct the indicators are the same as those used to produce published National Statistics.

Adults and children in Working Tax Credit and Child Tax Credit families

Child Tax Credit component

4.3.5 The Child Tax Credit component of this indicator was constructed as the number of adults and children in a Lower-layer Super Output Area living in Child Tax Credit families, who are not claiming Income Support, income-based Jobseeker's Allowance, income-based Employment and Support Allowance or Pension Credit (Guarantee)³⁰, and whose equivalised income³¹ (excluding housing benefits) is below 60 per cent of the national median before housing costs³². Data for August 2015 was sourced from a database held by HM Revenue & Customs.

4.3.6 Child Tax Credit is payable to families with children who are either:

- Claiming out-of-work benefits
- In work and claiming Working Tax Credit
- Not claiming out-of-work benefits, Universal Credit or Working Tax Credit but whose household income does not exceed the Child Tax Credit income threshold.

Working Tax Credit component

4.3.7 The Working Tax Credit component of this indicator was constructed as the number of adults in a Lower-layer Super Output Area in receipt of Working Tax Credit (who are not claiming Income Support, income-based Jobseeker's Allowance, income-based Employment and Support Allowance or Pension Credit (Guarantee)³³ and are not counted already under the Child Tax Credit component above) and whose equivalised income (excluding housing benefits) is below 60 per cent of the national median before housing costs. Data for August 2015 was sourced from a database held by HM Revenue & Customs.

4.3.8 Working Tax Credit is payable to people who:

- are aged from 16 to 24 and have a child or a qualifying disability, or are aged 25 or over (with or without children); and

³⁰ Note that it is not possible to claim Universal Credit as well as Working Tax Credit or Child Tax Credit.

³¹ Income equivalisation is a way of taking into account variations in household size and/or composition when making income comparisons between households. The Organisation for Economic Co-operation and Development's modified equivalence scale is used to equalise household income in this indicator.

³²The official low income threshold is 60 per cent of median household equivalised income. The Department for Work and Pensions' Households Below Average Income team provided a special version of the 60 per cent of median threshold which is at assessment unit level (claimant, partner and dependent children) and which takes into account only income that is required for the Working Tax Credit/Child Tax Credit calculation.

³³ Note that it is not possible to claim Universal Credit as well as Working Tax Credit or Child Tax Credit.

- work at least the specified number of hours
- have an income below the means tested level
- are not in receipt of Universal Credit.

Asylum seekers in England in receipt of subsistence support, accommodation support, or both

- 4.3.9 The indicator is the number of asylum seekers (adults and children) in a Lower-layer Super Output Area who were in receipt of subsistence support, accommodation support or both. Data for August 2015 was supplied by the Home Office.
- 4.3.10 Asylum is protection given to someone fleeing persecution in their own country under the 1951 United Nations Convention Relating to the Status of Refugees. In the UK, asylum seekers who are homeless or without money to buy food and other essentials ('destitute') can apply for subsistence and accommodation support while their application is being considered³⁴.

Combining the indicators to create the domain

- 4.3.11 The counts for each of these indicators at Lower-layer Super Output Area level were summed to produce a non-overlapping overall count of income deprived individuals. This overall count was then expressed as a proportion of the total population of the Lower-layer Super Output Area for mid-2015 (from the Office for National Statistics) less the prison population (from the Ministry of Justice). Shrinkage was applied to construct the overall domain score³⁵.

Changes since the Indices of Deprivation 2015

- 4.3.12 Changes to the Income Deprivation Domain have been informed by the introduction of Universal Credit. The roll-out of Universal Credit is still ongoing, meaning that substantial numbers of working age claimants are still receiving the legacy benefits that Universal Credit was designed to replace. As such, a combination of legacy benefits and Universal Credit has to be used (see paragraph 4.3.3 for details). There are a number of challenges with incorporating Universal Credit alongside legacy benefits which are outlined in detail in Appendix I.
- 4.3.13 In summary, from May 2016 onwards it becomes increasingly difficult to maintain a consistent definition of income deprivation across England as a whole and with the Indices of Deprivation 2015. For this reason, and after seeking advice from the Department for Work and Pensions directly, the 2015/16 tax year was selected as the basis for the Income

³⁴ See www.gov.uk/browse/visas-immigration/asylum for further details on asylum support in the UK.

³⁵ Shrinkage is a statistical method used to 'borrow strength' from larger areas (the local authority district) to reduce the impact of unreliable small area data. This is described in Section 3.4 and Appendix D.

Deprivation Domain³⁶. Specifically, the August 2015 time point was used as this enabled use of the special annual extract of legacy benefits that allows differentiation between income-based Job Seekers Allowance and contributions-based Job Seekers Allowance, as is necessary for this domain.

Supplementary indices

- 4.3.14 In addition, two supplementary indices were created, which are subsets of the Income Deprivation Domain. These are the Income Deprivation Affecting Children Index and the Income Deprivation Affecting Older People Index.

The Income Deprivation Affecting Children Index is the proportion of all children aged 0 to 15 living in income deprived families, here defined as families that either receive Income Support or income-based Jobseekers Allowance or income-based Employment and Support Allowance or Pension Credit (Guarantee) or Universal Credit (in the 'Searching for work', 'No work requirements', 'Planning for work', 'Working – with requirements' and 'Preparing for work' conditionality groups) or families not in receipt of these benefits but in receipt of Working Tax Credit or Child Tax Credit with an equivalised income (excluding housing benefit) below 60 per cent of the national median before housing costs. Child asylum seekers are not included in the Income Deprivation Affecting Children Index. Shrinkage was applied to construct the Income Deprivation Affecting Children Index score.

The Income Deprivation Affecting Older People Index is the proportion of all those aged 60 or over who experience income deprivation, here defined as adults aged 60 or over receiving Income Support or income-based Jobseekers Allowance or income-based Employment and Support Allowance or Pension Credit (Guarantee) or Universal Credit (in the 'Searching for work', 'No work requirements', 'Planning for work', 'Working – with requirements' and 'Preparing for work' conditionality groups) or families not in receipt of these benefits but in receipt of Working Tax Credit or Child Tax Credit with an equivalised income (excluding housing benefit) below 60 per cent of the national median before housing costs. Asylum seekers aged 60 and over are not included in the Income Deprivation Affecting Older People Index. Shrinkage was applied to construct the Income Deprivation Affecting Older People Index score.

4.4 Employment Deprivation Domain

- 4.4.1 The Employment Deprivation Domain measures the proportion of the working-age population in an area involuntarily excluded from the labour market. This includes people who would like to work but are unable to do so due to unemployment, sickness or disability, or caring responsibilities.

³⁶ A small number of Universal Credit claimants have been excluded from the Income Deprivation Domain count - these are individuals whose circumstances changed from the original claim and are no longer identified as income deprived. Following discussions with the Department for Work and Pensions it was agreed that those benefit units with one or more adult in the 'Working – no requirements' conditionality group should be excluded from the Income Deprivation Domain as their household income is above the threshold at which conditionality applies. Note, because Universal Credit is administered at benefit unit level rather than individual level, all cases will be excluded where either the principle claimant, or their partner is in the 'Working – no requirements group'.

The indicators

- Claimants of Jobseeker's Allowance (both contribution-based and income-based), women aged 18 to 59 and men aged 18 to 64
- Claimants of Employment and Support Allowance (both contribution-based and income-based), women aged 18 to 59 and men aged 18 to 64
- Claimants of Incapacity Benefit, women aged 18 to 59 and men aged 18 to 64
- Claimants of Severe Disablement Allowance, women aged 18 to 59 and men aged 18 to 64
- Claimants of Carer's Allowance, women aged 18 to 59 and men aged 18 to 64
- Claimants of Universal Credit in the 'Searching for work' and 'No work requirements' conditionality groups.

Indicator details

- 4.4.2 Data for the six indicators was provided by the Department for Work and Pensions, constructed from administrative records of benefit claimants in such a way to create a non-overlapping count of claimants. To account for seasonal variations in employment deprivation, four quarterly cuts were taken for each indicator and the average number of claimants across the four quarterly cuts calculated for each of the six indicators.

Claimants of Jobseeker's Allowance

- 4.4.3 Jobseeker's Allowance is paid to individuals who are out of work, available for work and actively seeking work. It was the primary measure of unemployment levels for small areas as of 2015/16.

Claimants of Employment and Support Allowance

Claimants of Incapacity Benefit

Claimants of Severe Disablement Allowance

- 4.4.4 Employment and Support Allowance, Incapacity Benefit and Severe Disablement Allowance are paid to individuals who are unable to work due to limiting illness or disability. Incapacity Benefit and Severe Disablement Allowance are no longer available for new claimants: Incapacity Benefit replaced Severe Disablement Allowance for new claimants in April 2001 and Employment and Support Allowance replaced Incapacity Benefit and Income Support paid because of an illness or disability for new claimants from October 2008. However, there still are a number of long-term sickness benefit claimants receiving Severe Disablement Allowance and Incapacity Benefit³⁷.

Claimants of Carer's Allowance

- 4.4.5 The Carers Allowance indicator measures those adults who are involuntarily excluded from the labour market due to caring responsibilities. Carer's Allowance is payable to

³⁷ As of February 2016, there were approximately 16,510 Severe Disablement Allowance claimants across England as a whole (an average of just over 0.5 claimants per Lower-layer Super Output Area) and 26,370 Incapacity Benefit claimants (just under 1 claimant per Lower-layer Super Output Area).

people aged 16 or over who provide unpaid care for at least 35 hours a week to someone who is in receipt of disability or social care benefits, who are not in full-time education or studying, and earn less than £102 a week³⁸.

Claimants of Universal Credit in the 'Searching for work' and 'No work requirements' conditionality groups

- 4.4.6 Claimants of Universal Credit in the 'Searching for work' and 'No work requirements' conditionality groups who are of working age (18-59 for females and 18-64 for males).
- 4.4.7 People in the 'Searching for work' conditionality group are not working or have very low earnings, and are required to take action to secure work, or more / better paid work. This category has strong overlap in terms of eligibility criteria and conditionality arrangements with income-based Jobseekers Allowance.
- 4.4.8 People in the 'No work requirements' conditionality group are not expected to work at present and are likely to have health or caring responsibilities that prevent them from working or preparing for work. This category has strong overlap in terms of eligibility criteria and conditionality arrangements with a subset of income-based Employment and Support and Carers Allowance.

Combining the indicators to create the domain

- 4.4.9 A non-overlapping count of claimants of each of the benefits was created for the following four time points to account for seasonal variations in employment deprivation: May 2015, August 2015, November 2015 and February 2016³⁹. The counts of Jobseeker's Allowance, Employment and Support Allowance, Universal Credit (in the 'Searching for work' and 'No work requirements' conditionality groups), Incapacity Benefit and Severe Disablement Allowance are non-overlapping because the benefits system does not permit an individual to claim more than one of these benefits at the same time. To account for the Claimants of Carer's Allowance indicator, a count of such claimants *not* receiving Jobseeker's Allowance, Employment and Support Allowance, Incapacity Benefit and Severe Disablement Allowance was added to the domain numerator to provide a non-overlapping count. This was achieved by the Department for Work and Pensions through the use of a unique person identifier.
- 4.4.10 A quarterly averaged count of claimants/participants was calculated for each of the indicators to create the Employment Deprivation Domain numerator, calculated as the seasonally-adjusted count of employment deprived people per Lower-layer Super Output Area.

³⁸ The eligible disability or social care benefits are: Personal Independence Payment daily living component, Disability Living Allowance middle or highest care rate, Attendance Allowance, Constant Attendance Allowance at or above the normal maximum rate with an Industrial Injuries Disablement Benefit, or basic (full day) rate with a War Disablement Pension or Armed Forces Independence Payment. Full-time studying is more than 21 hours per week. The earnings threshold is after the deduction of taxes, care costs while at work and 50 per cent of pension contributions.

³⁹ These time points are consistent with the Income Deprivation Domain. Also, using later time points would mean that a larger subset of claimants would have migrated on to different types of Universal Credit, which have different eligibility criteria to the existing Employment Deprivation Domain benefits.

- 4.4.11 The denominator was the working-age population (women aged 18 to 59 and men aged 18 to 64), derived from mid-year population estimates (from the Office for National Statistics), with the prison population (from the Ministry of Justice) subtracted. In order to provide a time point which closely matches the numerator, 2015 and 2016 mid-year population estimates were used, with a weight of 0.75 applied to the 2015 count and a weight of 0.25 applied to the 2016 count⁴⁰.
- 4.4.12 The Employment Deprivation Domain numerator was expressed as a proportion of the Employment Deprivation Domain denominator to form the Employment Deprivation Domain score. The score represents the proportion of the working-age population experiencing employment deprivation. Shrinkage was applied to construct the final domain score.

Changes since the Indices of Deprivation 2015

- 4.4.13 In order to provide a measure of Employment deprivation which is consistent with the measure used in Indices of Deprivation 2015, a subset of Universal Credit claimants has been included in the domain.
- 4.4.14 The key challenges with incorporating Universal Credit into the Indices of Deprivation 2019 are outlined in Appendix I. With regard to the Employment Deprivation Domain, a key challenge is that there are difficulties in identifying people who are employment deprived using the conditionality categories in Universal Credit. This has been mitigated by adopting the 2015/16 tax year time point, as during this period only single jobseekers were able to make a claim for Universal Credit. Single jobseekers can be straightforwardly incorporated into the Employment Deprivation Domain as they are subject to the same eligibility and conditionality criteria as income-based Jobseeker's Allowance claimants (already included in the domain).
- 4.4.15 However, there are a small number of Universal Credit claimants who, while initially claiming as single jobseekers, have since had a change in circumstances (e.g. moved into employment or become a lone parent) and have now moved into a new conditionality regime. It is necessary therefore to exclude those Universal Credit claimants who no longer meet the eligibility criteria of the Employment Deprivation Domain. The Universal Credit conditionality categories have been used to exclude certain claimants from the Employment Deprivation Domain, for example those who are in the conditionality category 'Working - no requirements' (who should be excluded from the domain because they are in employment and not required to seek additional work). However, two other conditionality categories may potentially contain people who would meet the criteria for inclusion in the domain. These are people in the 'Preparing for work' and the 'Working - with requirements' categories.
- 4.4.16 The 'Preparing for work' conditionality regime includes both those who are long-term sick, who would previously have been eligible for the legacy benefits included in the Employment Deprivation Domain, together with lone parents with children aged 3 to 4, who would previously have been excluded from the Employment Deprivation Domain.

⁴⁰ A ratio of 3:1 between 2015 and 2016 has been adopted for the denominator to match the numerator which uses three time points from 2015 and one from 2016.

Engagement with the Department for Work and Pensions revealed that it is not possible to distinguish these two groups at the relevant time point as the family information was not collected at that time, and based on this engagement, it was agreed that this group should be excluded from the Employment Deprivation Domain. However, for context – as of August 2015 only nine Lower-layer Super Output Areas (out of 32,844) in England were recorded as having any claimants in the preparing for work category in the published Universal Credit count⁴¹ and in no Lower-layer Super Output Areas were more than 0.6% of the working age population in this group. In other words, the exclusion of this group does not have a significant impact on the level of employment deprivation during the 2015/16 time period in any single Lower-layer Super Output Area.

- 4.4.17 The 'Working - with requirements' group are those in work but who could earn more, or those not working but who have a partner with low earnings. This group may potentially include those working less than 16 hours per week who could have been entitled to Job Seekers Allowance under the previous regime and who would have been eligible for inclusion in this domain. However, following engagement with the Department for Work and Pensions it was agreed that this group should be excluded from the Employment Deprivation Domain. Universal Credit data does not include any information on hours of work, so it is not possible to identify whether a sub-set of this group would be employment deprived based on the definition above. Analysis of Department for Work and Pensions official statistics⁴² indicated that approximately 98% of Lower-layer Super Output Areas had no or a negligible level of Universal Credit claimants in the working with requirements conditionality regime as of August 2018, and only 10 Lower-layer Super Output Areas had more than 1% of their working age population in this conditionality group (with no Lower-layer Super Output Areas exceeding 1.7%). In other words, the exclusion of this group does not have a significant impact on the level of employment deprivation during the 2015/16 time period in any single Lower-layer Super Output Area.
- 4.4.18 Universal Credit claimants in the 'Searching for work' and 'No work requirements' have been included as these categories overlap with the legacy benefits already included in the domain. Other conditionality categories have been excluded.

4.5 Education, Skills and Training Deprivation Domain

- 4.5.1 The Education, Skills and Training Domain measures the lack of attainment and skills in the local population. The indicators fall into two sub-domains: one relating to children and young people and one relating to adult skills. These two sub-domains are designed to reflect the 'flow' and 'stock' of educational disadvantage within an area respectively. That is, the 'children and young people' sub-domain measures the attainment of qualifications and associated measures ('flow'), while the 'skills' sub-domain measures the lack of qualifications in the resident working-age adult population ('stock').

⁴¹ <https://stat-xplore.dwp.gov.uk> extracted on 3rd of July 2018

⁴² <https://stat-xplore.dwp.gov.uk> extracted on 3rd of July 2018

The indicators

Children and Young People sub-domain

- Key Stage 2 attainment: The scaled score of pupils taking Mathematics, English reading and English grammar, punctuation and spelling Key Stage 2 exams⁴³
- Key Stage 4 attainment: The average capped points score of pupils taking Key Stage 4 (GCSE or equivalent) exams
- Secondary school absence: The proportion of authorised and unauthorised absences from secondary school
- Staying on in education post 16: The proportion of young people not staying on in school or non-advanced education above age 16
- Entry to higher education: A measure of young people aged under 21 not entering higher education

Adult Skills sub-domain

- Adult skills: The proportion of working-age adults with no or low qualifications, women aged 25 to 59 and men aged 25 to 64
- English language proficiency: The proportion of working-age adults who cannot speak English or cannot speak English well, women aged 25 to 59 and men aged 25 to 64

Indicator details

Key Stage 2 attainment

- 4.5.2 Prior to 2015/16 an average point score was calculated for pupils taking reading, writing and mathematics. From 2015/16 onwards this was replaced by a scaled score for pupils taking Mathematics, English reading and English grammar, punctuation and spelling Key Stage 2 examinations. The numerator is the total score of pupils taking Reading, Writing and Mathematics in 2014/15, and scaled scores in Mathematics, English reading and English grammar, punctuation and spelling in 2015/16 and 2016/17 in a Lower-layer Super Output Area. The denominator is the total number of subjects (exams) taken by pupils for the same years as the numerator. Because the scores are calculated differently in 2014/15 than 2015/16 and 2016/17, standardisation and shrinkage is applied separately to each year of data before combining into a single indicator using factor analysis.
- 4.5.3 The data is for pupils in state-funded schools⁴⁴ and was supplied by the Department for Education from the National Pupil Database, based on the Lower-layer Super Output Area of pupil residence. Three years of data were used to reduce issues due to fluctuations between year-groups.
- 4.5.4 During the 2014/15 to 2016/17 period for which data was used, changes to the grading scheme and teacher assessment framework resulted in changes to the way that the

⁴³ In 2014/15 the scaled score was not available so, instead, the average point score of pupils taking English and mathematics Key Stage 2 exams was used.

⁴⁴ The state-funded schools comprise: academies, free schools and City Technology Colleges, and schools maintained by a local authority (Community, Foundation, Voluntary Aided, Voluntary Controlled, Community Special and Foundation Special).

average points scores are constructed⁴⁵. Therefore, standardisation and shrinkage were applied separately to each year of data before combining into a single indicator using factor analysis.

Key Stage 4 attainment

- 4.5.5 The indicator is the average capped points score for pupils at Key Stage 4 (GCSE or equivalent)⁴⁶. The numerator is the total capped score of pupils taking Key Stage 4 in 2014/15, 2015/16 and 2016/17 in a Lower-layer Super Output Area. The denominator is the total number of pupils in the area who took Key Stage 4 exams, for the same years as the numerator.
- 4.5.6 The data is for pupils in state-funded schools and was supplied by the Department for Education from the National Pupil Database, based on the Lower-layer Super Output Area of pupil residence. Three years of data were used to reduce issues due to fluctuations between year-groups. As each year's results are separately moderated (and thus score thresholds change), standardisation and shrinkage were applied separately to each year of data before combining into a single indicator using factor analysis.

Secondary school absence

- 4.5.7 The indicator is the proportion of authorised and unauthorised absences from secondary school. The numerator is the number of half days missed by pupils living in a Lower-layer Super Output Area due to authorised and unauthorised absences for 2014/15, 2015/16 and 2016/17. The denominator is the total number of possible half-day sessions for 2014/15, 2015/16 and 2016/17.
- 4.5.8 The data is for pupils in state-funded schools and was supplied by the Department for Education from the National Pupil Database, based on the Lower-layer Super Output Area of pupil residence. Three years of data were used to reduce issues due to fluctuations between year-groups. Shrinkage was applied to the indicator.

Staying on in education post 16

- 4.5.9 *The Education and Skills Act 2008* introduced changes to the minimum age at which young people in England can leave education and learning. The Act stipulated that young people must continue in education or training to the age of 17 from 2013 and to 18 from 2014⁴⁷. Young people are able to choose whether to stay in full-time education, undertake work-based learning such as an apprenticeship, or part-time education or training if they are

⁴⁵ A change in the revised teacher assessment framework permits teachers to now 'use their discretion' in assessing KS2 writing. While this represents a change from previous Key Stage Assessments, it is still the case that assessments are externally moderated in 2017/18. Every year, 25 per cent of schools are subject to statutory external moderation by local authorities on a sample of their outcomes in English writing. This validates judgements to ensure that they are consistent with national standards and guards against systematic differences between geographical areas as a result of the changes.

⁴⁶ The average capped points score caps the total number of courses that can be included at the equivalent of eight full GCSEs. This places higher weight on the grades within the core of eight subjects than on the quantity of courses taken.

⁴⁷ <https://www.gov.uk/government/publications/2010-to-2015-government-policy-young-people/2010-to-2015-government-policy-young-people>

employed, self-employed or volunteering for more than 20 hours per week. As a result of these changes to the compulsory school leaving age, it has not been possible to update this indicator. The indicator is therefore retained from the Indices of Deprivation 2015.

- 4.5.10 The indicator measures the proportion of young people not staying on in school or non-advanced education above age 16, based on receipt of Child Benefit. Child Benefit is a tax-free payment that most parents can claim for their child(ren). To qualify for Child Benefit in the years used for this indicator, a child had to be under 16, or between 16 and 19 and be in relevant education or training, or registered for work, education or training with an approved body.
- 4.5.11 The numerator for the indicator is the number of people aged 17 receiving Child Benefit (who were only eligible if they were in relevant education or training), at Lower-layer Super Output Area level for the period 2010 to 2012. The denominator is the number of people in the area aged 15 receiving Child Benefit in the period 2008 to 2010.
- 4.5.12 The indicator definition is based on the assumption that the group of young people aged 17 in a Lower-layer Super Output Area in a given year is comparable to the group aged 15 two years previously. For indicator reliability, the value of deriving the numerator and the denominator from the same (Child Benefit) source is seen to outweigh the impact of in-migration and out-migration of young people in this age cohort between the two time points.
- 4.5.13 The data was supplied by HM Revenue & Customs for the purpose of the Indices of Deprivation 2015 and is retained in the same form for the Indices of Deprivation 2019. The indicator was first calculated in a positive form as the proportion of children staying on in school or non-advanced education. This figure was then subtracted from 1 to produce the proportion *not* staying on in education after the age of 16. Shrinkage was applied to the indicator.

Entry to higher education

- 4.5.14 The indicator is a measure of young people aged under 21 not entering higher education. The numerator is the number of successful entrants aged under 21 to higher education in a Lower-layer Super Output Area. Data from the Higher Education Statistics Agency was used for the numerator, with five years of data – 2012/13 to 2016/17 – used to reduce the problems of small numbers and year-on-year fluctuation. The denominator was the population aged 14-17 in the Lower-layer Super Output Area for the five years, 2012 to 2016 less the prison population.
- 4.5.15 The indicator includes those aged under 21 who successfully applied from a domestic postcode in England to a higher education institution anywhere in the UK⁴⁸. The data was restricted to first degree, first year, full-time students, and age was as at 31 August each year.
- 4.5.16 As detailed above, the numerator and denominator for this indicator were constructed from five years of data, now possible due to the availability of annually updated data. The

⁴⁸ For the purpose of the Higher Education Statistics Agency's data collection, 'higher education' refers to courses for which the level of instruction is above that of level 3 of the Qualifications and Curriculum Authority National Qualifications Framework (for example courses at the level of Certificate of Higher Education and above).

indicator was first calculated in a positive form as a measure of those aged 21 entering higher education. This figure was then subtracted from 1 to produce the measure of young people *not* entering higher education. Shrinkage was applied to the indicator.

Adult skills and English language proficiency

- 4.5.17 The adult skills indicator is the proportion of working-age adults (women aged 25 to 59 and men aged 25 to 64) with no or low qualifications.
- 4.5.18 The English language proficiency indicator is the proportion of the working-age population (women aged 25 to 59 and men aged 25 to 64) who cannot speak English or cannot speak English ‘well’. This indicator was introduced into the Adult Skills sub-domain in the Indices of Deprivation 2015 in order to include those adults who experience barriers to learning and disadvantage in the labour market as a result of lack of proficiency in English.
- 4.5.19 A non-overlapping count of those adults with no or low qualifications, and/or who cannot speak English or cannot speak English ‘well’ was provided by the Office for National Statistics from Census 2011 data. The denominator was the number of working-age adults (women aged 25 to 59 and men aged 25 to 64) in the same area, again taken from the 2011 Census. Shrinkage was applied to the indicator.

Combining the indicators to create the domain

- 4.5.20 The indicators within the Children and Young People sub-domain were standardised by ranking and transforming to a normal distribution. The maximum likelihood factor analysis technique was used to generate the weights to combine the indicators into the sub-domain score see Table 4.1.

Table 4.1. Indicator weights generated by factor analysis for the Children and Young People sub-domain

Indicator	Indicator weight
Key Stage 2 attainment	0.210
Key Stage 4 attainment	0.251
Secondary school absence	0.205
Staying on in education post 16	0.126
Entry to higher education	0.208

- 4.5.21 The indicators within the Adult Skills sub-domain were the proportion of adults with no or low qualifications and/or lack of English language proficiency. As these were already combined into a non-overlapping indicator, no further combination was needed within the sub-domain.
- 4.5.22 The two sub-domains were standardised by ranking and transforming to an exponential distribution and combined with equal weights to create the overall domain score.

Changes since the Indices of Deprivation 2015

- 4.5.23 The indicators in the domain remain the same as in the Indices of Deprivation 2015, except for minor changes to the grading scheme and teacher assessment frameworks for the Key Stage 2 indicator and the addition of one extra year of data (from four years of data to five years of data) in the entry to higher education indicator. Appendix C gives more details.

4.6 Health Deprivation and Disability Domain

4.6.1 The Health Deprivation and Disability Domain measures the risk of premature death and the impairment of quality of life through poor physical or mental health. The domain measures morbidity, disability and premature mortality but not aspects of behaviour or environment that may be predictive of future health deprivation.

The indicators

- Years of potential life lost: An age and sex standardised measure of premature death
- Comparative illness and disability ratio: An age and sex standardised morbidity/disability ratio
- Acute morbidity: An age and sex standardised rate of emergency admission to hospital
- Mood and anxiety disorders: A composite based on the rate of adults suffering from mood and anxiety disorders, derived from hospital episodes data, prescribing data and suicide mortality data.

Indicator details

Years of potential life lost

4.6.2 The years of potential life lost indicator measures 'premature death', defined as death before the age of 75 from any cause (the commonly used measure of premature death). This includes death due to disease as well as external causes such as accidents, unlawful killing and deaths in combat.

4.6.3 The indicator was based on mortality data covering the period 2013 to 2017, provided by the Office for National Statistics. The denominator was the 2013 to 2017 mid-year population estimates (minus the prison population) in five-year age-sex bands. The level of unexpected mortality was weighted by the age of the individual who has died. The unexpected death of a younger person therefore has a greater impact on the overall score than someone who is older, even if their death is also unexpected.

4.6.4 The indicator was directly age and sex standardised in five-year age-sex bands: comparing the actual number of deaths in an area to what would be expected given the area's age and sex profile. Shrinkage was applied to the indicator.

Comparative illness and disability ratio

4.6.5 The comparative illness and disability ratio is an indicator of work limiting morbidity and disability, based on those receiving benefits due to inability to work through ill health.

4.6.6 The legacy benefits paid to people in ill health are Disability Living Allowance, Employment and Support Allowance, Attendance Allowance, the disability premium of Income Support, Incapacity Benefit, and Severe Disablement Allowance.

4.6.7 In addition, since 2013, two new benefits have been introduced: Personal Independence Payment (PIP) and Universal Credit (UC). Personal Independence Payment is a benefit providing support to meet the extra costs associated with a long-term health condition or disability. Like the benefit it replaces – Disability Living Allowance – it is non-means tested, non-taxable and is paid to people who are in or out of work. Personal Independence Payment has replaced Disability Living Allowance for all new disability benefit claims and

all Personal Independence Payment claimants are included in the numerator for this indicator. Additionally, this indicator includes a subset of Universal Credit claimants who are receiving benefits due to poor health. The following categories of Universal Credit claimants have been included in the indicator numerator: Universal Credit claimants in the 'Preparing for work' conditionality category whose 'Family type' classification is 'not single, with child dependant(s)' and Universal Credit claimants with no 'Carer Entitlement' in the 'No work requirements' conditionality category.

- 4.6.8 The indicator was based on data from March 2016 (in order to precede the rollout of Universal Credit to people with work limiting illness or disability) provided by the Department of Work and Pensions. The denominator was the 2016 mid-year population estimate (minus the prison population) in five-year age-sex bands. The indicator was directly age and sex standardised in five-year age-sex bands; comparing the actual number of benefit recipients in an area to what would be expected given the area's age and sex structure. Shrinkage was applied to the indicator.

Acute morbidity

- 4.6.9 The acute morbidity indicator measures the level of emergency admissions to hospital, based on administrative records of in-patient admissions.
- 4.6.10 Emergency admissions are defined as cases where 'admission is unpredictable and at short notice because of clinical need'. This includes admission via the Accident and Emergency department, admission directly onto a ward or into theatre and the emergency transfer of patients between hospitals. All emergency admissions greater than one day in length (where discharge is not on the same date as admission) are included as an indication of acute health problems. Only admissions to NHS hospitals are included in the data.
- 4.6.11 The numerator used the number of hospital spells starting with admission in an emergency and lasting more than one calendar day and was based on data from the period 2015/16 to 2016/17 provided by the Health and Social Care Information Centre from the Hospital Episode Statistics database. The denominator was the 2016 and 2017 mid-year population estimates (minus the prison population) in five-year age-sex bands.
- 4.6.12 Two years of data were used to reduce the problems of small numbers. The indicator was directly age and sex standardised in five-year age-sex bands, and shrinkage applied.

Mood and anxiety disorders

- 4.6.13 The mood and anxiety disorders indicator is a broad measure of levels of mental ill health in the local population. The definition used for this indicator includes mood (affective), neurotic, stress-related and somatoform disorders.
- 4.6.14 The indicator is an estimate based on three separate sources outlined in the sections below: prescribing data; hospital episodes data; and suicide mortality data. Although none of the three sources on their own provide a comprehensive measure of mood and anxiety disorders, used in combination they represent a large proportion of all those suffering mental ill health.
- 4.6.15 In the Indices of Deprivation 2015 (and earlier) this indicator also included a fourth component which was derived from health benefits data from the Department for Work

and Pensions. The health benefits data component has been dropped from this indicator for the Indices of Deprivation 2019 due to concerns about the quality of the data on health conditions within the health benefits dataset.

- 4.6.16 In March 2018, the Department for Work and Pensions, as part of their quality assurance process, noticed discrepancies regarding the published figures for some disability benefit claimants by medical condition. The releases affected were Employment and Support Allowance and Incapacity Benefit/Severe Disablement Allowance, Employment and Support Allowance Work Capability Assessment and Employment and Support Allowance sanctions. Personal Independence Payments and Disability Living Allowance were not impacted. Whilst the issues were investigated, all the information relating to medical conditions was removed from online sources of this data and a note was attached asking users to exercise caution whilst using these statistics.
- 4.6.17 The issues stemmed from the mapping of medical conditions on the Department for Work and Pensions administrative system from IRG (Incapacity Reference Guide) to ICD (International Classification of Diseases), the form in which the statistics are published. In some cases, the IRG framework had been changed without the relevant mapping having been updated to reflect this, whilst in others the mapping was found not to have been suitable from the outset. As such, certain medical conditions were being assigned to IRG codes which were then being mapped to ICD codes that did not correspond to the original conditions. The new mapping includes two new codes: external causes of morbidity and mortality and codes for special purposes. Because of these concerns with data quality, the Department of Work and Pensions health benefit component has been removed from the Mood and anxiety disorder indicator.

Prescribing data

- 4.6.18 The number of patients within a particular GP practice with mental health problems was estimated using information on the conditions for which particular drugs are prescribed and their typical dosages⁴⁹. Prescription data is published at GP practice level⁵⁰, and a two-stage process used to estimate area rates.
1. The number of people was estimated based on the assumption that those with mental ill health take the national 'average daily quantity' of a specific drug on every day of the year⁵¹. Two years of prescription data (for 2016/17 and 2017/18) were used to reduce problems of small numbers.

⁴⁹ Based on prescription medication use for anxiolytics (British National Formulary Section 4.1.2) and anti-depressants (British National Formulary Section 4.3), <https://digital.nhs.uk/data-and-information/publications/statistical/national-dementia-and-antipsychotic-prescribing-audit/national-dementia-and-antipsychotic-prescribing-audit-national-summary-report>

⁵⁰ GP practice level prescription data was sourced from the Health and Social Care Information Centre (HSCIC) at <https://digital.nhs.uk/data-and-information/publications/statistical/practice-level-prescribing-data>

⁵¹ While this assumption may not fit very well in individual cases, it is more likely to hold across the 'average' for the practice population. For information on average daily quantities, see the Prescribing Support Unit information at www.hscic.gov.uk/prescribing. The average daily quantities were used to produce an estimate of the numbers of patients required to account for the GP Practice level prescription volumes for the different prescription drugs based on 'typical' dosages.

2. The estimate for each GP practice was then distributed indirectly to Lower-layer Super Output Area level using data on GP practice patients place of residence by Lower-layer Super Output Area level⁵².

4.6.19 The denominator for the indicator was based on the same practice population distribution used to distribute the GP Practice estimates to local areas.

Hospital episode data

4.6.20 Hospital episode data made available by the Health and Social Care Information Centre was used to estimate the proportion of the population suffering severe mental health problems relating to depression and anxiety, based on all those who have had an inpatient spell for reason of mental ill health.

4.6.21 The indicator is an annual count of those suffering at least one severe mental health inpatient spell during the year, an 'annual incidence of hospitalisation'. A count was made of all those who have had at least one in-patient spell in any one year coded within International Classification of Diseases 10 chapter 'F' (the coding for mental ill health)⁵³. Two years of data (for 2015/16 and 2016/17) were used to reduce problems of small numbers.

4.6.22 The denominator was the 2016 and 2017 mid-year population estimates (minus the prison population). A simple (not standardised) rate was calculated, and shrinkage applied.

Suicide mortality data

4.6.23 Although suicide is not a direct measure of mental ill health, it is highly associated with depression where it is implicated in a majority of cases⁵⁴. The actual measure used was deaths that occurred between 2013 and 2017 which had International Classification of Diseases 10 codes X60-X84 and Y10-Y34 excluding Y33.9 where the coroner's verdict was pending. Five years of data were used to reduce problems of small numbers.

4.6.24 The denominator was the 2013 to 2017 mid-year population estimates (minus the prison population). A simple (not standardised) rate was calculated, and shrinkage applied.

Combining the components to create a composite indicator

4.6.25 The three independent administrative data sources were combined to reduce the influence of under- or over-recording on any one source using weights generated by factor analysis, see Table 4.1.

⁵² The GP Attribution Dataset contains information about populations registered with GP practices, and is maintained by the Health and Social Care Information Centre. Data is published for individual GP practice patients at Lower-layer Super Output Area level, for <https://digital.nhs.uk/data-and-information/publications/statistical/patients-registered-at-a-gp-practice>. For earlier time points, data was made available by the Health and Social Care Information Centre.

⁵³ The International Classification of Diseases 10 mental health codes used were: F30-F39 (Mood (affective) disorders) and F40-F48 (Neurotic, stress-related and somatoform disorders).

⁵⁴ See for example Inskip, H., Harris, E. and Barraclough, B. (1998), Lifetime risk of suicide for affective disorder, alcoholism and schizophrenia, *The British Journal of Psychiatry*, 172, p.35-37, <http://bjp.rcpsych.org/content/172/1/35.abstract>

Table 4.2. Indicator weights generated by factor analysis for the mood and anxiety disorders indicator

Indicator	Indicator weight
Prescribing data	0.415
Hospital episode data	0.381
Suicide mortality data	0.205

- 4.6.26 Using the three components minimises the impact of any variation in the organisation and practice of local services, where individuals with identical mental health needs may receive different types of treatment; the combined indicator should therefore be a more precise measure of the underlying ‘true’ rate of mental health than any single indicator on its own.
- 4.6.27 Unlike the other indicators in this domain, the mood and anxiety disorders indicator is not age and sex standardised. Although there are particular ages when a person is at higher risk of suffering from these mental health disorders, and females are at greater risk than males, the distribution of mood and anxiety disorders does not follow a clear distribution over the lifespan, so age and sex have not been controlled for.

Combining the indicators to create the domain

- 4.6.28 The indicators within the domain were standardised by ranking and transforming to a normal distribution. Factor analysis was used to generate the weights to combine the indicators into the final domain score, see Table 4.3.

Table 4.3. Indicator weights generated by factor analysis for the Health Deprivation and Disability Domain

Indicator	Indicator weight
Years of potential life lost	0.271
Comparative illness and disability ratio	0.300
Acute morbidity	0.256
Mood and anxiety disorders	0.172

Changes since the Indices of Deprivation 2015

Comparative illness and disability ratio (CIDR)

- 4.6.29 As with the Income Deprivation and Employment Deprivation Domains, the Health Deprivation and Disability Domain has also been affected by social security reform, specifically the introduction of new benefits, Universal Credit and Personal Independence Payments for working age claimants (See Appendix I). These new benefits are in the process of replacing some of the benefits previously used in two of the Health Deprivation and Disability Domain indicators: income-based Employment and Support Allowance and Disability Living Allowance for working age adults for the Comparative Illness and Disability Ratio indicator, and income-based Employment and Support Allowance for people with mental health conditions for the health benefits component of the mood and anxiety disorder indicator (although as was noted in paragraphs 4.6.15 to 4.6.17, this health benefits component has now been dropped from the mood and anxiety disorder indicator).

- 4.6.30 As explored in Appendix I, the roll-out of Universal Credit presents a key challenge to producing a consistent measure of the Comparative Illness and Disability Ratio, as Employment and Support Allowance is being slowly replaced by Universal Credit for new claimants. Using a March 2016 timepoint for Comparative Illness and Disability Ratio mitigates the impact of these changes as only a very small number of those eligible for health-related benefits (grouped in the 'No work requirements' or 'Preparing for work' conditionality categories) were receiving Universal Credit by March 2016⁵⁵.
- 4.6.31 The introduction of Personal Independence Payments to replace Disability Living Allowance for those aged 16-64 presents further challenges to producing a consistent measure of the Disability Living Allowance component of Comparative Illness and Disability Ratio. The principle challenge to producing a consistent measure is that there are different conditionality arrangements governing eligibility for Personal Independence Payments compared with the Disability Living Allowance legacy benefit it replaces⁵⁶.
- 4.6.32 However, despite the differences in conditionalities to Disability Living Allowance, the roll out of Personal Independence Payments is still not complete and there are still large numbers of Disability Living Allowance claimants who haven't migrated to Personal Independence Payments. In March 2016 the migration to Personal Independence Payments was less than at present, and on the recommendation of the Department for Work and Pensions, all Personal Independence Payments claimants have been included in the Comparative Illness and Disability Ratio measure.

Acute morbidity data

- 4.6.33 Since 2014, patients can opt-out from having their data used 'for research or planning purposes' other than if they are used:
- To meet a mandatory legal requirement
 - Under the public interest test (such as to support the investigation of serious crime and/or to prevent abuse or serious harm to others).
- 4.6.34 These opt-out cases have been excluded from the numerator for the Acute Morbidity Indicator. In July 2018, NHS Digital reported 1,602,910 opt-outs (2.7% of all cases)⁵⁷.

⁵⁵ Taking the quarterly average of benefit claimant statistics across the 2015/16 statistical year (i.e. taking the average of the May 2015, August 2015, November 2015 and February 2016 time points), produces a quarterly average of 1,860 claimants of Universal Credit (in the 'No work requirements' or 'Preparing for work' conditionality categories). As noted above, for the Comparative Illness and Disability Indicator, only subsets of these two conditionality groups are included, so the actual number of Universal Credit claimants included in this indicator will be much less than 1,860. In contrast, there is an equivalent quarterly average of 1,940,000 claimants of Employment and Support Allowance, which are included in this indicator. As such, the Universal Credit component of this indicator will consist of less than 0.1% of the total number of people classed as deprived on this indicator.

⁵⁶ The principle differences in eligibility criteria relate to the length of time a person experiences a long-term condition and a shift of emphasis away from determining eligibility based on category of condition towards the way in which the condition affects an individual's ability to perform activities of daily living and mobility, see: <https://www.gov.uk/government/publications/disability-living-allowance-and-personal-independence-payment-main-differences>

⁵⁷ <https://digital.nhs.uk/data-and-information/publications/statistical/national-data-opt-out/july-2018/ndop-jul18>

Mood and anxiety disorders: health benefits indicator

- 4.6.35 The health benefits component of the mood and anxiety disorders indicator has been removed due to concerns over the reliability of the ICD-10 coding for health conditions within the source data collected by the Department for Work and Pensions (see paragraphs 4.6.15 to 4.6.17 above for further details).

Mood and anxiety disorders: Suicide mortality data

- 4.6.36 The numerator for this indicator now includes children aged 10-14.
- 4.6.37 Further details of this change are given in Appendix C.
- 4.6.38 All other indicators in the domain remain the same as in the Indices of Deprivation 2015.

4.7 Crime Domain

- 4.7.1 Crime is an important feature of deprivation that has major effects on individuals and communities. The Crime Domain measures the risk of personal and material victimisation at local level.

The indicators

- Violence: The rate of violence per 1,000 at-risk population
- Burglary: The rate of burglary per 1,000 at-risk properties
- Theft: The rate of theft per 1,000 at-risk population
- Criminal Damage: The rate of criminal damage per 1,000 at-risk population.

Indicator details

Violence: The rate of violence per 1,000 at-risk population

Burglary: The rate of burglary per 1,000 at-risk properties

Theft: The rate of theft per 1,000 at-risk population

Criminal Damage: The rate of criminal damage per 1,000 at-risk population

- 4.7.2 Recorded crime data for 2016/17 and 2017/18 was made available via the National Police Chiefs Council and the Home Office. The Appendix on quality assurance outlines the work undertaken to check the both input data and data processing steps performed (Appendix J).
- 4.7.3 The methodology used in the Indices of Deprivation 2019 is identical to that developed for and used in the Indices of Deprivation 2015, 2010, 2007 and 2004, except that two years of crime data are used in the Indices of Deprivation 2019, whereas only one year of data was used in each of the earlier indices:
1. A list of notifiable offence codes that were active during the 2016/17 and 2017/18 statistical years was identified, which best replicated the definitions of the four Crime Domain indicators 'violence', 'burglary', 'theft' and 'criminal damage'. See Appendix H for this list of offences by indicator.

2. Individual level geocoded crime records for this list of notifiable offences were extracted from the recorded crime data made available and assigned to one of the four indicators.
 3. Lower-layer Super Output Area level counts were constructed for each indicator by aggregating the individual event-level geocoded crime data using a bespoke mapping application. Where a crime occurred within 100 metres of a Lower-layer Super Output Area boundary, the crime was apportioned equally to the areas either side of the boundary. A series of rules were imposed to maximise data quality, such as ensuring that crimes that were geocoded to locations well outside of the respective force boundary were not mapped at this stage.
- 4.7.4 The Lower-layer Super Output Area level counts for each indicator were constrained to aggregate counts of crime (for an equivalent set of notifiable offence categories) published at Community Safety Partnership level which are available as open data⁵⁸. All recorded crimes are allocated a Community Safety Partnership identifier code, whilst a minority of recorded crimes are not allocated a detailed geocode. Any discrepancies between the Community Safety Partnership level data and the aggregated geocoded data are therefore dealt with in this constraining step, so that the constrained Lower-layer Super Output Area level aggregations from geocoded data sum up to match the Community Safety Partnership level open data exactly.
- 4.7.5 For the violence, theft and criminal damage indicators, the constrained Lower-layer Super Output Area counts for 2016/17 and 2017/18 were summed and divided by two in order to produce average annual crime counts over the two-year period. The resultant crime counts were then expressed as crime rates per 1,000 'at-risk' population, using a special population-based denominator. This denominator was constructed by calculating the 'at-risk' population in mid-2016 and the 'at-risk' population in mid-2017 and then taking the average of the two. For each of the two years, the 'at-risk' population consisted of the total Lower-layer Super Output Area mid-year population estimate for that year (minus the prison population) plus the non-resident workplace population from the 2011 Census.
- 4.7.6 For the burglary indicator, counts for Lower-layer Super Output Areas for 2016/17 and 2017/18 were summed and divided by two in order to produce average annual crime counts over the two-year period. The resultant crime counts were then expressed as a crime rate per 1,000 'at-risk' properties, using a special property-based denominator. This denominator consisted of residential dwellings at Lower-layer Super Output Area level from the 2011 Census plus non-domestic properties at the same level from the March 2018 version of Ordnance Survey's Address Base.
- 4.7.7 Finally, shrinkage was applied to the Lower-layer Super Output Area level rates for each indicator, to produce the four indicator scores.

⁵⁸ Although the Community Safety Partnership level open data statistics do relate to the same underlying occurrence of crime, they are semi-independent of the geocoded crime data because the Community Safety Partnership identifier in the crime record is not dependent upon the detailed geocode variable(s) (i.e. the grid reference or postcode).

Combining the indicators to create the domain

- 4.7.8 The four composite shrunk indicators were standardised by ranking and transforming to a normal distribution. Factor analysis was used to generate the weights to combine the indicators into the domain score, see Table 4.4.

Indicator	Indicator weight
Violence	0.338
Burglary	0.166
Theft	0.189
Criminal Damage	0.307

Changes since the Indices of Deprivation 2015

- 4.7.9 The main change to this domain since the Indices of Deprivation 2015 is the shift to base the domain on two years of crime data rather than one year as has been the case in previous indices. The indicators in the domain remain the same as in the Indices of Deprivation 2015. Minor changes made to accommodate updated Home Office counting rules are described in Appendix C.

4.8 Barriers to Housing and Services Domain

- 4.8.1 The Barriers to Housing and Services Domain measures the physical and financial accessibility of housing and local services. The indicators fall into two sub-domains: 'geographical barriers', which relate to the physical proximity of local services, and 'wider barriers' which includes issues relating to access to housing, such as affordability.

The indicators

Geographical Barriers sub-domain

- Road distance to a post office: A measure of the mean road distance to the closest post office for people living in the Lower-layer Super Output Area
- Road distance to a primary school: A measure of the mean road distance to the closest primary school for people living in the Lower-layer Super Output Area
- Road distance to a general store or supermarket: A measure of the mean road distance to the closest supermarket or general store for people living in the Lower-layer Super Output Area
- Road distance to a GP surgery: A measure of the mean road distance to the closest GP surgery for people living in the Lower-layer Super Output Area.

Wider Barriers sub-domain

- Household overcrowding: The proportion of all households in a Lower-layer Super Output Area which are judged to have insufficient space to meet the household's needs
- Homelessness: Local Authority District level rate of acceptances for housing assistance under the homelessness provisions of the 1996 Housing Act, assigned to the constituent Lower-layer Super Output Areas

- Housing affordability: Difficulty of access to owner-occupation or the private rental market, expressed as the inability to afford to enter owner-occupation or the private rental market.

Indicator details

Road distance to a post office

Road distance to a primary school

Road distance to a general store or supermarket

Road distance to a GP surgery

- 4.8.2 The four road distance indicators were chosen for the Indices of Deprivation 2000 and retained in each subsequent update as they relate to key services that are important for people's day-to-day life and to which people need to have good geographical access. All road distance indicators are constructed in the same way.
- 4.8.3 The indicators are defined as an average road distance measured in kilometres and calculated initially at Output Area level⁵⁹.
- 4.8.4 The grid referenced locations of Post Offices were supplied by Post Office Ltd (for March 2018). All Post Office branches were included.
- 4.8.5 The locations of primary schools were obtained from the Department for Education's 'Get Information About Schools' system (February 2019). The data included grid references and postcodes. All schools classified as 'open' or 'open but proposed to close' that are also 'primary', 'middle deemed primary' or 'all through' were included. In terms of the type of establishment, schools were included that are classified as local authority maintained schools, academies or free schools.
- 4.8.6 The grid referenced locations of food shops were obtained from the Ordnance Survey MISO dataset (for May 2018). The definition of food shop includes supermarket chains, convenience stores and independent supermarkets. This includes concessions such as food shops within petrol stations, but administrative offices are removed.
- 4.8.7 The grid referenced locations of GP premises were obtained from NHS Digital. The dataset consists of all active GP practices and branch surgeries. NHS Digital provided a dedicated extract of data for inclusion in the Indices of Deprivation 2019. It does not capture the size of a practice, which varies from that of a single practitioner to a large surgery with many GPs and additional health care professionals.
- 4.8.8 Because healthcare and education are a responsibility for the devolved administrations, only GPs and primary schools located in England have been taken into account when constructing the English Indices of Deprivation. However, food shops and Post Offices in mainland UK were included, so that account can be taken of services just within the Scottish or Welsh borders.

⁵⁹ For more information about Output Areas see:

<https://www.ons.gov.uk/methodology/geography/ukgeographies/censusgeography#output-area-oa>

4.8.9 A bespoke geographic information system application was used to calculate the road distance to the closest service from the population weighted centroid of each Output Area. To create an average road distance for the Lower-layer Super Output Area, a population-weighted mean of the Output Area road distances was used. Each Output Area score was weighted according to the proportion of the Lower-layer Super Output Area population that is within the Output Area, and the weighted scores summed. The Output Area level population estimates used for population-weighting were taken from mid-2017 small area population estimates at Output Area level published by the Office for National Statistics⁶⁰.

Household overcrowding

4.8.10 The indicator is the proportion of households in a Lower-layer Super Output Area that are classed as overcrowded according to the definition below. The numerator is the number of overcrowded households in the Lower-layer Super Output Area, while the denominator is the number of households in the same area. Both were taken from the 2011 Census. Shrinkage was applied to the indicator.

4.8.11 The Census 2011 'occupancy rating' provides a measure of whether a household's accommodation is overcrowded or under-occupied. There are two measures of occupancy rating, one based on the total number of rooms in a household's accommodation, and one based only on the number of bedrooms. The household overcrowding indicator uses the occupancy rating based on rooms. This relates the actual number of rooms in a dwelling to the number of rooms required by the household, taking account of the ages of, and relationships between, household members.

4.8.12 The room requirement⁶¹ used in the occupancy rating states that every household needs a minimum of two common rooms, excluding bathrooms, with bedroom requirements that reflect the composition of the household. The occupancy rating of a dwelling is expressed as a positive or negative figure, reflecting the number of rooms in a dwelling that exceed the household's requirements, or by which the home falls short of its occupants' needs.

4.8.13 All statistics derived from the 2011 Census and published by the Office for National Statistics are classified as National Statistics and comply fully with the National Statistics Code of Practice.

Homelessness

4.8.14 This Local Authority District level indicator is expressed as the rate of acceptances for housing assistance under the homelessness provisions of housing legislation (as defined below). The numerator data are drawn from the statutory homelessness statistics published on a quarterly basis by the Ministry of Housing, Communities and Local

⁶⁰ Each road distance indicator uses the total population for population-weighting, with the exception of the road distance to a primary school where the population of children aged 4 to 11 was used.

⁶¹ For worked examples of how the room requirement is calculated, see: <http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/2011-census-user-guide/quality-and-methods/quality/quality-notes-and-clarifications/index.html>

Government. The numerator data cover the three-year period from 2015/16 to 2017/18⁶². There are some instances where the Ministry of Housing, Communities and Local Government has had to impute the statutory homelessness statistics for one or more Local Authority Districts in one or more quarterly time periods. Any imputed statistics are excluded from the numerator of this indicator. The denominator is the number of households in the Local Authority District based upon the projections produced by the Office for National Statistics⁶³. The denominator data is included for the same number of time points as there are valid (i.e. non-imputed) numerator data to ensure consistency between numerator and denominator.

- 4.8.15 Homelessness is defined as applications made to local housing authorities under the homelessness provisions of housing legislation where a decision was made and the applicant was found to be eligible for assistance (acceptances). It therefore excludes any households found to be ineligible.
- 4.8.16 The raw data used to construct the indicator was the same as those used to produce published National Statistics. Local Authority District rates were assigned to the constituent Lower-layer Super Output Areas, with each such area in a district given the same rate. As this data is available at Local Authority District level, shrinkage was not applied to this indicator.

Housing affordability

- 4.8.1 The housing affordability indicator is a measure of the inability to afford to enter owner-occupation or the private rental market. The indicator is made up of two components relating to housing affordability: one component which measures difficulty of access to owner-occupation, and one component which measures difficulty of access to the private rental market. The private rental component considers whether people can afford to rent in the market without assistance from Housing Benefit. The two components were constructed separately.
- 4.8.2 The indicator is a modelled estimate based on house prices and rents in the relevant Housing Market Area⁶⁴ and modelled incomes at Lower-layer Super Output Area level with a 2016 time point.
- 4.8.3 Housing Market Areas are a geography which were developed to identify the optimal areas within which planning for housing should be carried out, since housing market dynamics and population changes do not respect administrative boundaries such as for local authorities. The Housing Market Area geography takes into account commuting and migration patterns using 2001 Census data, and the extent to which areas were 'self-

⁶² For details of the statutory homelessness statistics used here, please see:

<https://www.gov.uk/government/collections/homelessness-statistics>

⁶³ For details of the household projections used here, please see: <https://www.gov.uk/government/statistics/2014-based-household-projections-in-england-2014-to-2039>

⁶⁴ Jones, Coombes and Wong (2010) The Geography of Housing Market Areas in England, undertaken for the former National Housing and Planning Advice Unit and published by the Department for Local Government and Communities www.gov.uk/government/publications/housing-market-areas. For further details see: www.ncl.ac.uk/curds/research/defining/NHPAU.htm

contained' (that is, the extent to which people live and work in the same area, or the extent to which people move to a new house within the same area)⁶⁵.

- 4.8.4 The main data sources are the Family Resources Survey for household incomes and composition, the Land Registry for house prices, and the Valuation Office Agency for market rents. Other sources include a range of Census and other published data at Lower-layer Super Output Area level, and indicators at Local Authority District level including the Annual Population Survey and the Annual Survey of Hours and Earnings.
- 4.8.5 The target group is households where the head is aged under 40⁶⁶. This aims to capture the cohort of households entering the housing market based on the recognition that most first-time buyers and renters are in the younger adult age group.
- 4.8.6 Households (that is the first benefit units in the household) are assigned to dwelling size groups based on their bedroom requirements as under the standard UK 'bedroom standard'⁶⁷. Affordability criteria are broadly the same as for the Indices of Deprivation 2015. The threshold house prices and rents were based on the lower quartile of all sale prices/rents within size groups (0, 1, 2, 3 and 4 or more bedrooms) at Housing Market Area level.⁶⁸ The lower tier of Housing Market Areas was used, with Lower-layer Super Output Area level price and local authority level rent data apportioned to Housing Market Areas (lower-tier Housing Market Areas are described in Jones et al (2010), see footnote 64).
- 4.8.7 Income is defined as the income of the 'first benefit unit' in the household, excluding income from means-tested benefits⁶⁹. Income levels were estimated in stages, following similar lines to a study by Bramley and Watkins⁷⁰ for the Improvement Service for Scottish

⁶⁵ For more information about Housing Market Areas please refer to English indices of deprivation 2015: technical report – Appendix I <https://www.gov.uk/government/publications/english-indices-of-deprivation-2015-technical-report>

⁶⁶ Technically, the head of household is known as the "Household Reference Person", defined as the highest income householder without regard to gender.

⁶⁷ The standard is defined in the Housing (Overcrowding) Bill 2003 and in summary allocates a bedroom for each couple and for each additional adult, and for each child or pair of children, provided that children over 10 do not have to share with the opposite sex. For the renting component, a single person household aged under 35 is deemed to need only a bedroom in a shared dwelling (using threshold rents available for a '0-bedroom' unit).

⁶⁸ The primary criterion for buying is based on lending multipliers, assuming a 95% mortgage and ignoring deposit constraints. For renting, the primary criterion is a ratio of rent to gross income of 25%. The secondary criterion for both buying and renting is that net income after housing cost should exceed 1.2 times the Housing Benefit Applicable Amount (HBAA) for the relevant household unit (DWP *Housing Benefit and Council Tax Benefit Circular HB/CTB A1/2012*, Appendix A, Annexe 2).

⁶⁹ The first benefit unit is defined as the main householder and any partner and dependent children, where the household reference person is aged under 40. Other adults present in any 'complex' households are separate benefit units, and their income is not included because these would not be considered reckonable income for the purposes of obtaining a mortgage and because it is assumed that it is the core benefit unit that would be seeking to buy or rent an appropriate housing unit. For the same reason, the room requirements of other adults in a 'complex' household are not included when constructing the indicator.

⁷⁰ Bramley, G. and Watkins, D. (2013) Local Incomes and Poverty in Scotland: developing local and small area estimates and exploring patterns of income distribution, poverty and deprivation, Report of Research for the Improvement Service on behalf of four Local Authorities (Edinburgh, Falkirk, Fife and Highland) and the Scottish Government. <http://www.improvementservice.org.uk/library/download-document/3838-local-incomes-and-poverty-in-scotland/>

local government, which estimated income and poverty measures for Scottish Data Zones. Individual-level predictive regression models were developed based on income levels for individuals and households in the Family Resources Survey, applied to small areas using equivalent variables from Census and other sources at Lower-layer Super Output Area level; and constrained using the Office for National Statistics' 'groups' of similar Lower-layer Super Output Areas in stronger or weaker housing markets⁷¹.

- 4.8.8 In order to combine the two components into a single indicator of housing affordability, each component was standardised by ranking and transforming to a normal distribution. The two components were then combined with equal weights to create the housing affordability indicator.

Combining the indicators to create the domain

- 4.8.9 The relevant indicators within each of the sub-domains were then standardised by ranking and transforming to a normal distribution and combined using equal weights. The sub-domains were then standardised by ranking and transforming to an exponential distribution and combined with equal weights to create the overall domain score.

Changes since the Indices of Deprivation 2015

- 4.8.10 The indicators in the domain remain the same as in the Indices of Deprivation 2015.
- 4.8.11 There were some minor changes to data and modelling approaches used in the housing affordability indicator, and details of these changes are given in Appendix C.

4.9 Living Environment Deprivation Domain

- 4.9.1 The Living Environment Deprivation Domain measures the quality of the local environment. The indicators fall into two sub-domains. The 'indoors' living environment measures the quality of housing; while the 'outdoors' living environment contains measures of air quality and road traffic accidents.

The indicators

Indoors sub-domain

- Houses without central heating: The proportion of houses that do not have central heating.
- Housing in poor condition: The proportion of social and private homes that fail to meet the Decent Homes standard.

Outdoors sub-domain

- Air quality: A measure of air quality based on emissions rates for four pollutants.
- Road traffic accidents involving injury to pedestrians and cyclists.

⁷¹ Lower-layer Super Output Areas were classified according to whether the Housing Market Area to which they belong has relatively lower or higher house prices. This classification was then combined with the Office for National Statistics Census 2001-based classification of Lower-layer Super Output Areas at 'Group' level to produce the groups of similar Lower-layer Super Output Areas in stronger or weaker markets.

Indicator details

Houses without central heating

- 4.9.2 The houses without central heating indicator is used as a measure of housing which is expensive to heat. The numerator is the number of houses without central heating in the Lower-layer Super Output Area while the denominator is the number of households in the area.
- 4.9.3 The data was taken from the Census 2011 and identifies the proportion of houses in each Lower-layer Super Output Area that do not have central heating in any room⁷². Shrinkage was applied to the indicator.

Housing in poor condition

- 4.9.4 The housing in poor condition indicator is a modelled estimate of the proportion of social and private homes that fail to meet the Decent Homes standard.
- 4.9.5 A property fails the Decent Homes Standard if it fails to meet any one of the four separate components shown in the table below⁷³. Each of these components was modelled separately, using data from the 2015 English Housing Survey at national level, in combination with a commercial dataset that provides information on the age, type, tenure and occupant characteristics of the housing stock at individual dwelling level. Failure likelihood factors for individual dwellings were generated by segmentation analysis and logistic regression models. These were then aggregated to Lower-layer Super Output Area.

⁷² The Census 2011 definition of central heating used includes gas, oil or solid fuel central heating, night storage heaters, warm air heating and underfloor heating.

⁷³ See 'A Decent Home: Definition and guidance for implementation' published in June 2006 for details of the Decent Homes standard, see: <https://www.gov.uk/government/publications/a-decent-home-definition-and-guidance>

Table 4.5. The four components of the Decent Homes Standard

Component	Description
Housing Health and Safety Rating System	Dwellings which fail to meet this criterion are those containing one or more hazards assessed as serious ('Category 1'). The system includes 29 hazards in the home, grouped into three themes: 1) excess cold; 2) falls; and 3) other.
Disrepair	A dwelling is said to be in disrepair if: at least one of the key building components is old and needs replacing or major repair due to its condition; or more than one of the other building components are old and need replacing or major repair due to their condition.
Modernisation	A dwelling is said to fail this criterion if it lacks three or more of the following: a reasonably modern kitchen (20 years old or less); a kitchen with adequate space and layout; a reasonably modern bathroom (30 years old or less); an appropriately located bathroom and WC; adequate insulation against external noise (where such noise is a problem); or adequate size and layout of common areas for blocks of flats.
Thermal comfort	A dwelling fails this criterion if it does not have effective insulation and efficient heating.

Air quality

- 4.9.6 The indicator is an estimate of the concentration of the four pollutants nitrogen dioxide, benzene, sulphur dioxide and particulates. Values for each of the pollutants were based on 2016 air quality data published by the UK Air Information Resource for 1km grid-squares⁷⁴, which was modelled to Lower-layer Super Output Area level using the point-in-polygon method. For Lower-layer Super Output Areas that did not have grid points falling within them, data from the nearest point of the air quality grid was assigned.
- 4.9.7 For each pollutant the atmospheric concentration was compared to a national standard value⁷⁵, with the concentrations in each Lower-layer Super Output Area divided by the appropriate national standard, before summing to produce a single indicator.
- 4.9.8 In theory, values for the combined indicator range from zero to infinity. However, in practice, values are unlikely to exceed 4, the equivalent of a site where concentrations of all four pollutants are at their respective national standard thresholds.

⁷⁴ UK-AIR: Air Information Resource, <http://uk-air.defra.gov.uk/>

⁷⁵ The annual mean standards of nitrogen dioxide, benzene and particulates are defined by the UK's National Air Quality Strategy while the safe guideline for sulphur dioxide is set by the World Health Organisation.

Road traffic accidents involving injury to pedestrians and cyclists

- 4.9.9 The indicator is based on reported accidents that involve death or personal injury to a pedestrian or cyclist⁷⁶. The indicator uses data for 2015 to 2017 published by the Department for Transport, with three years of data used to reduce the problem of small numbers.
- 4.9.10 The numerator for this indicator is the number of reported accidents (weighted for severity) in a Lower-layer Super Output Area that involve death or personal injury to a pedestrian or cyclist, averaged across the three years 2015 to 2017. To take into account the number of people in the local area during the day, the denominator uses the non-resident workplace population (from Census 2011) as well as the average of the mid-year population estimates for 2015 to 2017 (from the Office for National Statistics) with the prison population (from the Ministry of Justice) subtracted.
- 4.9.11 Weights were applied to the total counts of the three severity types: a weight of 1 was applied for slight severity, 2 for serious and 3 for fatal. Each incident was plotted according to its grid reference, which gives its location accurate to the nearest metre. Where an incident occurred within 100 metres of a Lower-layer Super Output Area boundary, the incident was apportioned equally to the areas either side of the boundary. Shrinkage was applied to the indicator.

Combining the indicators to create the domain

- 4.9.12 The indicators within each of the sub-domains was standardised by ranking and transforming to a normal distribution then combined using equal weights to create the sub-domains. The sub-domains were standardised by ranking and transforming to an exponential distribution.
- 4.9.13 The domain was created by summing the two sub-domains, weighted according to patterns of 'indoors' and 'outdoors' time use⁷⁷. As with the Indices of Deprivation 2015, the Indoors Living Environment sub-domain was given two thirds of the domain's weight, and the Outdoors Living Environment sub-domain, one-third.

Chance since Indices of Deprivation 2015

The indicators in the domain remain the same as in the Indices of Deprivation 2015.

⁷⁶ Only accidents that involve at least one 'mechanically propelled' vehicle are included in the dataset. Accidents involving personal injury are counted, including deliberate acts of violence but not confirmed cases of suicide. Accidents involving pedal cycles are included. Where many casualties were associated with one accident, all pedestrian and cyclist casualties were counted. Injuries sustained on private roads and in car parks are not included. See: www.gov.uk/government/collections/road-accidents-and-safety-statistics for details.

⁷⁷ UK 2000 Time Use Survey, <http://discover.ukdataservice.ac.uk/catalogue?sn=4504>

Chapter 5. Ensuring reliability of the Indices of Deprivation

5.1 Overview of quality assurance

- 5.1.1 The Indices of Deprivation 2019 have been carefully designed and developed to ensure the robustness and reliability of the output datasets and reports. The quality assurance process for the methods, input data sources, data processing steps and outputs builds on the research team's experience of previous developments of the Indices of Deprivation since 2000 and involves a number of different processes outlined in this section.
- 5.1.2 The quality assurance process also draws on the quality assurance and audit arrangements practice models developed by the UK Statistics Authority to ensure that the assessment of data sources and methodology carried out is proportionate to both the level of public interest in the Indices, and the scale of risk over the quality of the data⁷⁸.
- 5.1.3 Further detail on the quality assurance is provided in Appendices J and K, including our assessment against the UK Statistics Authority criteria for National Statistics status and additional validation carried out for certain indicators (Appendix J), and quality assurance documents for the input data sources (Appendix K).

Our assessment of the quality of the Indices of Deprivation

- 5.1.4 Based on the design and development of the Indices of Deprivation, and the quality assurance processes and actions, we have assessed that the Indices of Deprivation outputs are fit for purpose. This is based on our assessment of the level of risk of quality concerns and public interest in the Indices, which use the risk and profile matrix set out in the UK Statistics Authority toolkit.
- 5.1.5 In the following sections we outline how our quality management meets the criteria required for the basic and enhanced levels of assurance. Our quality assurance draws on the four practice areas associated with data quality set out by the UK Statistics Authority toolkit: operational context and data collection; communication with data suppliers; quality assurance principles, standards and checks; and quality assurance investigations carried out for enhanced assurance.

5.2 Designing the Indices to ensure quality

- 5.2.1 The starting point for the quality assurance work is that the Indices themselves have been designed to ensure the high quality of the output data. The design of the Indices of Deprivation 2019 is based on a set of principles and practices that help to ensure data quality (more detail on the methods, domains and indicators is given in Chapters 3 and 4):

⁷⁸ UK Statistics Authority (2019) Administrative Data Quality Assurance Toolkit, https://www.statisticsauthority.gov.uk/wp-content/uploads/2019/02/qualityassurancetoolkit_updated_Feb19_2.pdf

- The domains and Index of Multiple Deprivation bring together 39 indicators of deprivation, from a wide range of data sources. This sheer diversity of inputs also leads to more reliable overall data outputs; to be highly deprived on the Index of Multiple Deprivation, an area is likely to be highly deprived on many of the domains⁷⁹. Due to the variety of data inputs, there is little chance that an area is identified as highly deprived due to a bias in one of the component indicators; the use of multiple independent indicators increases robustness of the final outputs.
- Shrinkage estimation is used to improve reliability of the small area data, by ‘borrowing strength’ from larger Local Authority Districts. This tends to result in unreliable values (those having larger standard errors) being shifted or ‘shrunk’ towards the average of the larger area. During the development of the Indices (see below), all indicators were compared before- and after-shrinking, to examine the extent of movement of unreliable scores.
- The different domain scores are standardised (in order to combine them into the overall Index of Multiple Deprivation) by ranking across all areas. This has the effect of pulling-in any extreme area scores that lie at the top or bottom of the distribution. Exponential transformation is then used to ensure that deprivation on one domain is not completely cancelled out by lack of deprivation on another domain.
- The domains are weighted before combining into the overall Index of Multiple Deprivation (see paragraph 3.7.3 and Appendix G for further details).

5.3 How we have ensured quality of the Indices

Appropriate and robust indicators, based on well understood data sources

- 5.3.1 As outlined in Chapter 3, the development of the Indices of Deprivation 2019 identified a set of 39 indicators that can be used to measure relative deprivation within each of the domains. These indicators are based on data sources that can be used to derive appropriate measures covering England at small area level. Chapter 4 sets out the sources used for each of the indicators. The data sources used as inputs to the Indices of Deprivation 2019 can be grouped into three types as shown in the table below.
- 5.3.2 For each of the input data sources used, the research team assessed and documented its quality. Appendix K lists the quality documents for each data source. Close communication with the data suppliers ensured that the strengths and weaknesses of the underlying sources and indicators were well understood.

⁷⁹ To a lesser extent, this also applies to individual domains of deprivation; to be highly deprived on a domain, an area is likely to be highly deprived on the individual indicators from which the domain is constructed.

Table 5.1. Types of data sources used as inputs to the Indices of Deprivation 2019		
Data source	Notes	Documentation assessed
<i>Published i.e. open data</i>	The preference was to directly use, wherever possible, existing high-quality open data sources that have themselves been validated as being of National Statistics quality. In some cases, small variations on open data sources were obtained from the same source through special request; for example, Census 2011 data on qualifications and English language proficiency was obtained from the Office for National Statistics.	Quality assurance report(s) supplied with the open data
<i>Administrative data sources made available to the research team</i>	In the absence of appropriate published open data sources, the second preference was for the Indices of Deprivation 2019 to derive indicators from established and well-understood administrative data sources. These data sources, or indicators derived from them, were made available to the research team by data suppliers. In many cases, these data sources are also used by data suppliers to derive published statistical data outputs; for example, the Income Deprivation and Employment Deprivation Domains are in-part derived from the Department for Work and Pensions benefits database, which is a source for Department for Work and Pensions Official Statistics (many of which have themselves been assessed as being of National Statistics quality). In practice, the majority of indicators in the Indices were built directly from well-understood administrative sources in this way.	Quality assurance report(s) on the underlying administrative data sources
<i>Modelled estimates derived for the Indices of Deprivation 2019</i>	In the small number of cases where there was an absence of appropriate open data or established and well-understood administrative data sources, the Indices of Deprivation 2019 used specially modelled estimates for the deprivation indicator at hand. In practice, this was the case for only three indicators: housing affordability, housing in poor condition and air quality. These were developed and quality assured by leading experts in the appropriate fields (see Chapter 4 for further details on these indicators).	Quality assurance report(s) on any underlying data sources, and technical summaries of the methodology used to construct the indicator

5.3.3 In practice, the majority of the datasets used in the Indices of Deprivation 2019 were derived from administrative records, which have close to 100 per cent coverage. In many instances the raw administrative records are the same as those used to produce published National Statistics.

- 5.3.4 The research team conducted additional exploration of issues that could affect the quality of the sources, such as the impact of any changes since the Indices of Deprivation 2015, and considered actions to minimise risks to quality. These are set out in Appendix J.
- 5.3.5 The following sections outline the quality assurance steps undertaken during the development of the data outputs. Appendix J provides further detail of the quality assurance process, under the framework outlined by the UK Statistics Authority.

Minimise the impact of potential bias and error in the input data sources

- 5.3.6 As set out in Section 5.2, the Indices of Deprivation have been carefully designed to minimise the impact of possible bias and error in the input data sources. The different processing stages, and range of different indicators used, mean that the resulting output datasets provide a robust identification of deprived areas.
- 5.3.7 An example of this comes from the Mood and Anxiety Disorders indicator of the Health and Disability Deprivation Domain. This indicator is constructed from three independent administrative data sources (see Section 4.6). Although none of the three sources on their own provide a comprehensive measure of mood and anxiety disorders, used in combination they represent a large proportion of all those suffering mental ill health. In addition, using the three component indicators in this way reduces the influence of under- or over-recording from any one source, and minimises the impact of any variation in the organisation and practice of local services, where individuals with identical mental health needs may receive different types of treatment. The combined indicator should therefore be a more precise measure of the underlying ‘true’ rate of mental health than any single indicator on its own.

Views of data users

- 5.3.8 This update of the Indices of Deprivation was restricted to updating the data sources used in the Indices of Deprivation 2015, and therefore did not involve consideration of potential new indicators. The decision to restrict the scope of this update to a data update only was based on user feedback gathered during the production of the Indices of Deprivation 2015. The views of users were sought through a survey carried out in July 2014, a consultation in November 2014, and workshops in November and December 2014. There was considerable support for maintaining the present methodology, domains and indicators.
- 5.3.9 The Ministry of Housing, Communities and Local Government Project Board and its Advisory Group also provided feedback on the methodology, data sources and quality assurance process during the production of the Indices of Deprivation 2015.

Audited, replicable and validated processing steps are used to construct the indicators, domains and Index of Multiple Deprivation 2019

- 5.3.10 All processing of the data was carried out using syntax, providing a complete audit of the processing steps from input data sources through to data outputs⁸⁰. Using syntax avoids the risks associated with carrying out calculations and processing using spreadsheets.

⁸⁰ All processing was carried out using Stata 15 statistical software.

5.3.11 The syntax also enabled clearer validation and audit of the work done, both internally within the teams responsible for the domains and other members of the research team, and externally by the independent assessor (see paragraph 5.3.19). The checks included external replication and validation of the complete set of processing steps. The syntax was checked to confirm the processing steps were being implemented accurately and produced data outputs as expected.

Real world validation of the data inputs and outputs

- 5.3.12 An important part of the checking process was to compare the Indices of Deprivation 2019 data against the data used to construct the previous Indices (the Indices of Deprivation 2015) at all stages in the process. A range of methods were used, including plotting histograms and box plots to examine the range and distribution of data, and scatter plots and correlations to determine the overall association of data between years. The final domains and Index of Multiple Deprivation were tabulated for the 2019 and 2015 versions, and areas that had changed significantly between the versions were examined.
- 5.3.13 The administrative datasets used in the Indices of Deprivation are liable to change between years as eligibility criteria, definitions and methodology are modified over time. To ensure that reliable data was used, the input data sources were compared thoroughly with the sources used in producing the previous Indices where available. This quality check was carried out before any data processing, in order to check for large differences that might indicate a methodological change in the administrative datasets being used.
- 5.3.14 Examining the input data sources also helped contextualise differences seen at a later stage of data processing. For example, trends in benefit claimant numbers were used in the quality checks once data processing had been carried out, helping judge whether any change between years identified by the Indices data is realistic.
- 5.3.15 Where possible, the Indices of Deprivation 2019 data was compared to equivalent published data to check that they were broadly similar. Small differences between the Indices of Deprivation 2019 data and published data are inevitable due to methodological differences, but significant differences could indicate a processing error. Published data was not always available at Lower-layer Super Output Area level, so comparisons were made at a spatial scale that was possible, most commonly at Local Authority District level. Ideally this validation would have used data from independent sources to compare to those used in constructing the Indices, however in practice this was not always possible as no such separate source existed.
- 5.3.16 The deprivation deciles of each indicator, sub-domain and domain were mapped and the geographical pattern of deprivation examined. Checks of the overall distribution of deprivation across England were accompanied by more detailed checks of small areas known to the research team.
- 5.3.17 In addition, ‘reality checks’ were undertaken to consider whether the Indices of Deprivation 2019 data corresponded with the expected pattern of deprivation. For example, overcrowding is expected to be more severe in urban areas than rural locations because cities are more densely populated. Reality checking provides an additional check that the data processing has been correctly carried out, and that the indicators, domains and overall Index of Multiple Deprivation have been correctly ranked.

Internal and external quality assurance checks

- 5.3.18 *Internal audit.* The data processing steps and data outputs were subject to a series of internal quality assurance checks by the project team. Indicators and domains were reviewed by the team responsible for constructing the domain, and internally audited by a team member who was not involved in constructing the domain. The Index of Multiple Deprivation and higher-level summaries were reviewed and audited by two team members.
- 5.3.19 *External scrutiny of the complete process.* On completion of the Indices, an external independent assessor carried out external validation and assurance of the data processing steps for construction of the indicators, domains and Index of Multiple Deprivation from start to finish. This external scrutiny included assessment of the data processing methods and syntax, and real-world analysis of the Indices of Deprivation 2019 output datasets against the Indices 2015 data outputs and comparable open data sources.

Additional enhanced assurance of specific data sources

- 5.3.20 A small number of data sources were identified as requiring additional quality assurance. These were related to the homelessness indicator and road distance to GP indicator in the Barriers to Housing and Services Domain, and the indicators in the Crime Domain. The additional assurance work for these indicators is outlined in Appendix J.

Roles and responsibilities of the research team and data suppliers

- 5.3.21 The development and construction of the Indices of Deprivation was a complex project, involving multiple data suppliers and processing steps carried out by the research team. The composition of the research team carrying out the update of the Indices of Deprivation has been carefully considered to ensure quality of the data outputs.
- 5.3.22 In addition, clear communication and coordination between the different teams involved was an important part of ensuring the quality of the final outputs. Regular contact with each of the data suppliers helped understand the strengths and weaknesses of the different input data sources and modelling techniques used.

Appendix A. Indicator details and data sources

- A.1.1. This Appendix provides numerator and denominator details for each of the 39 indicators included in the Indices of Deprivation 2019.
- A.1.2. As far as is possible, each indicator has been based on data from the most recent time point available. Using the latest available data in this way means that there is not a single consistent time point for all indicators.
- A.1.3. Where the denominator is detailed as residential population, this includes the communal establishment population, but excludes any prison population.

A.2. Income Deprivation Domain

- **Adults and children in Income Support families**
Numerator: As described, 2015 (Department for Work and Pensions)
Denominator (for summed Income Domain indicators): Total resident population mid-2015 (Office for National Statistics) less the prison population (Ministry of Justice).
- **Adults and children in income-based Jobseeker's Allowance families**
Numerator: As described, 2015 (Department for Work and Pensions)
Denominator (for summed Income Domain indicators): Total resident population mid-2015 (Office for National Statistics) less the prison population (Ministry of Justice).
- **Adults and children in income-based Employment and Support Allowance families**
Numerator: As described, 2015 (Department for Work and Pensions)
Denominator (for summed Income Domain indicators): Total resident population mid-2015 (Office for National Statistics) less the prison population (Ministry of Justice).
- **Adults and children in Pension Credit (Guarantee) families**
Numerator: As described, 2015 (Department for Work and Pensions)
Denominator (for summed Income Domain indicators): Total resident population mid-2015 (Office for National Statistics) less the prison population (Ministry of Justice).
- **Adults and children in Universal Credit families where no adult is in 'Working - no requirements' conditionality regime**
Numerator: Adults and children in Universal Credit households in the 'Searching for work', 'No work requirements', 'Planning for work', 'Working – with requirements' and 'Preparing for work' conditionality groups, 2015 (Department for Work and Pensions)
Denominator (for summed Income Domain indicators): Total resident population mid-2015 (Office for National Statistics) less the prison population (Ministry of Justice).
- **Adults and children in Working Tax Credit and Child Tax Credit families not already counted, that is those who are not in receipt of Income Support, income-based Jobseeker's Allowance, income-based Employment and Support Allowance, Pension Credit (Guarantee) or relevant Universal Credit conditionality groups⁸¹, and whose equivalised income (excluding housing benefit) is below 60 per cent of the median before housing costs**
Numerator: As described, 2015 (HM Revenue and Customs)

⁸¹ Specifically, in the 'Searching for work', 'No work requirements', 'Planning for work', 'Working – with requirements' and 'Preparing for work' conditionality groups.

Denominator (for summed Income Domain indicators): Total resident population mid-2015 (Office for National Statistics) less the prison population (Ministry of Justice).

- **Asylum seekers in England in receipt of subsistence support, accommodation support, or both**

Numerator: As described, 2015 (Home Office)

Denominator (for summed Income Domain indicators): Total resident population mid-2015 (Office for National Statistics) less the prison population (Ministry of Justice).

A.3. Employment Deprivation Domain

- **Claimants of Jobseeker's Allowance (both contribution-based and income-based), women aged 18-59 and men aged 18-64**

Numerator: As described, four quarters from May 2015 to February 2016 (Department for Work and Pensions)

Denominator (for summed Employment Domain indicators): Working-age population, women aged 18 to 59 and men aged 18 to 64 (Office for National Statistics population estimates 2015 and 2016) less the prison population (Ministry of Justice).

- **Claimants of Employment and Support Allowance (both contribution-based and income-based), women aged 18-59 and men aged 18-64**

Numerator: As described, four quarters from May 2015 to February 2016 (Department for Work and Pensions)

Denominator (for summed Employment Domain indicators): Working-age population, women aged 18 to 59 and men aged 18 to 64 (Office for National Statistics population estimates 2015 and 2016) less the prison population (Ministry of Justice).

- **Claimants of Incapacity Benefit, women aged 18-59 and men aged 18-64**

Numerator: As described, four quarters from May 2015 to February 2016 (Department for Work and Pensions)

Denominator (for summed Employment Domain indicators): Working-age population, women aged 18 to 59 and men aged 18 to 64 (Office for National Statistics population estimates 2015 and 2016) less the prison population (Ministry of Justice).

- **Claimants of Severe Disablement Allowance, women aged 18-59 and men aged 18-64**

Numerator: As described, four quarters from May 2015 to February 2016 (Department for Work and Pensions)

Denominator (for summed Employment Domain indicators): Working-age population, women aged 18 to 59 and men aged 18 to 64 (Office for National Statistics population estimates 2015 and 2016) less the prison population (Ministry of Justice).

- **Claimants of Carer's Allowance, women aged 18-59 and men aged 18-64**

Numerator: As described, four quarters from May 2015 to February 2016 (Department for Work and Pensions)

Denominator (for summed Employment Domain indicators): Working-age population, women aged 18 to 59 and men aged 18 to 64 (Office for National Statistics population estimates 2015 and 2016) less the prison population (Ministry of Justice).

- **Claimants of Universal Credit in the 'Searching for work' and 'No work requirements' conditionality groups, women aged 18-59 and men aged 18-64**

Numerator: As described, four quarters from May 2015 to February 2016 (Department for Work and Pensions)

Denominator (for summed Employment Domain indicators): Working-age population, women aged 18 to 59 and men aged 18 to 64 (Office for National Statistics population estimates 2015 and 2016) less the prison population (Ministry of Justice).

A.4. Education Skills and Training Deprivation Domain

- **Key Stage 2 attainment**
Numerator: Total score of pupils taking reading, writing and mathematics Key Stage 2 exams in maintained schools, 2014/15, and the scaled score of pupils taking Mathematics, English reading and English grammar, punctuation and spelling Key Stage 2 exams, 2015/16 and 2016/17 (Department for Education)
Denominator: Total number of Key Stage 2 subjects taken by pupils in maintained schools, 2014/15, 2015/16 and 2016/17 (Department for Education).
- **Key Stage 4 attainment**
Numerator: Total capped (best 8) score of pupils taking Key Stage 4 in maintained schools, 2014/15, 2015/16 and 2016/17 (Department for Education)
Denominator: All pupils in maintained schools who took Key Stage 4 exams, 2014/15, 2015/16 and 2016/17 (Department for Education).
- **Secondary school absence**
Numerator: Number of authorised and unauthorised absences from secondary school, 2014/15, 2015/16 and 2016/17 (Department for Education)
Denominator: Total number of possible sessions for 2014/15, 2015/16 and 2016/17 (Department for Education).
- **Staying on in education post 16**
Numerator: Young people not staying on in school or non-advanced education above age 16, 2010, 2011 and 2012 (HM Revenue and Customs)
Denominator: Young people aged 15 receiving Child Benefit in 2008, 2009 and 2010 (HM Revenue and Customs).
- **Entry to higher education**
Numerator: Young people aged under 21 not entering higher education, 2012/13, 2013/14, 2014/15, 2015/16 and 2016/17 (Higher Education Statistics Agency)
Denominator: Population aged 14-17, 2012, 2013, 2014, 2015 and 2016 (Office for National Statistics population estimates) less the prison population (Ministry of Justice).
- **Adult skills**
Numerator: Working-age adults with no or low qualifications, non-overlapping count with English language proficiency indicator, women aged 25 to 59 and men aged 25 to 64, 2011 (Office for National Statistics, from Census 2011)
Denominator: Working-age adults, women aged 25 to 59 and men aged 25 to 64, 2011 (Census).
- **English language proficiency**
Numerator: Working-age adults who cannot speak English or cannot speak English well, non-overlapping count with Adult skills indicator, women aged 25 to 59 and men aged 25 to 64, 2011 (Office for National Statistics, from Census 2011)
Denominator: Working-age adults, women aged 25 to 59 and men aged 25 to 64, 2011 (Census).

A.5. Health Deprivation and Disability Domain

- **Years of potential life lost**
Numerator: Mortality data in five-year age-sex bands, for 2013, 2014, 2015, 2016 and 2017 (Office for National Statistics)
Denominator: Total resident population in five-year age-sex bands, for 2013, 2014, 2015, 2016 and 2017 (Office for National Statistics population estimates) less the prison population (Ministry of Justice).
- **Comparative illness and disability ratio**
Numerator: Non-overlapping counts of people in receipt of Income Support, Disability Premium, Attendance Allowance, Disability Living Allowance, Severe Disablement Allowance, Incapacity Benefit and selected conditionality regimes from Universal Credit in five-year age-sex bands, March 2016 (Department for Work and Pensions)
Denominator: Total resident population in five-year age-sex bands, 2016 (Office for National Statistics population estimates) less the prison population (Ministry of Justice).
- **Acute morbidity**
Numerator: Hospital spells starting with admission in an emergency in five-year age-sex bands, 2015/16 and 2016/17 (Health and Social Care Information Centre, Hospital Episode Statistics)
Denominator: Total resident population in five-year age-sex bands, 2016 and 2017 (Office for National Statistics population estimates) less the prison population (Ministry of Justice).
- **Mood and anxiety disorders**
A composite based on the rate of adults suffering from mood and anxiety disorders (source: Health and Social Care Information Centre, 2018; Health and Social Care Information Centre, Hospital Episode Statistics, 2015/16 and 2016/17; and Office of National Statistics suicide mortality data, 2013, 2014, 2015, 2016 and 2017).

A.6. Crime Domain

- **Violence**
Numerator: 18 recorded crime offence types, 2016/17, and 20 recorded crime types, 2017/18 (National Police Chiefs' Council, provided by the Home Office)
Denominator: Total resident population, 2016 (Office for National Statistics) less the prison population (Ministry of Justice) plus the non-resident workplace population, 2011 (Census). Total resident population, 2017 (Office for National Statistics) less the prison population (Ministry of Justice) plus the non-resident workplace population, 2011 (Census).
- **Burglary**
Numerator: 4 recorded crime offence types, 2016/17 and 2017/18 (National Police Chiefs' Council, provided by the Home Office)
Denominator: Total residential dwellings, 2011 (Census), plus non-domestic addresses, 2018 (Ordnance Survey's Address Base).

- **Theft**
 Numerator: 5 recorded crime offence types, 2016/17 and 2017/18 (National Police Chiefs' Council, provided by the Home Office)
 Denominator: Total resident population, 2016 (Office for National Statistics) less the prison population (Ministry of Justice) plus the non-resident workplace population, 2011 (Census). Total resident population, 2017 (Office for National Statistics) less the prison population (Ministry of Justice) plus the non-resident workplace population, 2011 (Census).
- **Criminal damage**
 Numerator: 8 recorded crime offence types, 2016/17 and 2017/18 (National Police Chiefs' Council, provided by the Home Office)
 Denominator: Total resident population, 2016 (Office for National Statistics) less the prison population (Ministry of Justice) plus the non-resident workplace population, 2011 (Census). Total resident population, 2017 (Office for National Statistics) less the prison population (Ministry of Justice) plus the non-resident workplace population, 2011 (Census).

A.7. Barriers to Housing and Services Domain

- **Road distance to a post office**
 Population weighted mean of Output Area road distance score (the road distance from the populated weighted Output Area centroid to nearest Post Office), March 2018 (Post Office Ltd).
- **Road distance to a primary school**
 Population weighted mean of Output Area road distance score (the road distance from the populated weighted Output Area centroid to nearest primary school), February 2019 (Department for Education 'Get Information About Schools').
- **Road distance to general store or supermarket**
 Population weighted mean of Output Area road distance score (the road distance from the populated weighted Output Area centroid to general store or supermarket), May 2018 (Ordnance Survey).
- **Road distance to a GP surgery**
 Population weighted mean of Output Area road distance score (the road distance from the population weighted Output Area centroid to nearest GP premises), May 2019 (NHS Digital).
- **Household overcrowding**
 Numerator: Overcrowded households, 2011 (Census)
 Denominator: Total number of households, 2011 (Census).
- **Homelessness**
 Numerator: Number of accepted decisions for assistance under the homelessness provisions of housing legislation, average of 2015/16, 2016/17 and 2017/18 (Ministry of Housing, Communities and Local Government)
 Denominator: Total number of households (Local Authority District level projections), 2015, 2016 and 2017 (Office for National Statistics).
- **Housing affordability**
 Modelled estimate of households unable to afford to enter owner-occupation or the private rental market on the basis of their income, estimated primarily from the Family

Resources Survey, Land Registry house prices, and Valuation Office Agency market rents, 2016.

A.8. Living Environment Deprivation Domain

- **Housing in poor condition**
Modelled estimate of the probability that any given dwelling in the Output Area (aggregated to Lower-layer Super Output Area level) fails to meet the Decent Homes standard, estimated from the English Housing Survey, 2015.
- **Houses without central heating**
Numerator: As described, 2011 (Census)
Denominator: Total number of households, 2011 (Census).
- **Air quality**
Modelled estimates of air quality based on the concentration of four pollutants (nitrogen dioxide, benzene, sulphur dioxide and particulates), estimated from UK Air Information Resource air quality, 2016.
- **Road traffic accidents**
Numerator: Injuries to pedestrians and cyclists caused by road traffic accidents, 2015, 2016 and 2017 (Department for Transport)
Denominator: Total resident population, averaged over 2015 to 2017 (Office for National Statistics) less the prison population (Ministry of Justice) plus non-resident workplace population, 2011 (Census).

Appendix B. Denominators

B.1.1. The majority of the 39 indicators used in the Indices of Deprivation 2019 are expressed as rates or proportions, and thus require a numerator (for example the number of people experiencing a particular form of deprivation in an area) and a suitable denominator (for example the total number of people 'at-risk' of the deprivation in the same area). This Appendix details the issues involved and the data and methodology employed in the construction of estimates of the at-risk population for the various indicators.

B.2. Choosing suitable denominators

B.2.1. A denominator should represent the population at-risk of experiencing a given type of deprivation and therefore it is important to choose a denominator that relates to the numerator with which it will be combined. Certain indicators use numerators and denominators derived from the same data source, while other indicators require their numerators and denominators to be constructed from different sources. Whichever is required, it is important to try to ensure that each denominator includes only those individuals (or households, properties etc.) that are at-risk of experiencing the particular form of deprivation being measured by that indicator.

B.2.2. So, for example, in the Education, Skills and Training Deprivation Domain, the Key Stage 2 attainment indicator is constructed by deriving both the numerator (the points achieved in Key Stage 2 examinations by pupils living in a Lower-layer Super Output Area) and the denominator (the sum of the number of subjects taken by pupils living in a Lower-layer Super Output Area) from the National Pupil Database dataset. Similarly, for the indicators where numerators were derived from the 2011 Census, the denominators were also drawn from the Census. Deriving both numerator and denominator using a single data source rules out any systematic error that arises from datasets of different coverage or representativeness.

B.2.3. For a considerable number of indicators, however, estimates of the at-risk population need to be constructed using external data sources. This is discussed below.

B.3. Data for the denominators

B.3.1. 'Mid-year' population estimates at Lower-layer Super Output Area level are published by the Office for National Statistics' Population Estimation Unit. These are single year of age and sex mid-year estimates that are published in the years between censuses. These estimates are derived by 'aging' the previous Census estimates by adding in births, subtracting deaths and adjusting for migration. The most recent mid-year estimates were published in October 2018 and relate to the mid-point of 2017.

B.3.2. Output Area level population denominators were used to create the four road distance indicators in the Barriers to Housing and Services Domain. These denominators use mid-2017 data.

B.3.3. Data was also obtained from the Home Office on the number of prisoners per single year of age and sex for each Lower-layer Super Output Area containing a prison. It is not possible to obtain this data at Output Area level.

B.4. Defining the at-risk population

- B.4.1. The population estimates used as denominators for many of the indicators included resident population and communal establishment population but excluded the prison population. Prisoners were not included as they are not at-risk of many forms of deprivation captured in the Indices of Deprivation. Other types of communal establishment population (for example students; persons in care establishments; children in local authority homes) *are* at-risk of experiencing these forms of deprivation (age/sex restrictions allowing), and so were included in the denominator. This is the same definition of at-risk populations that was adopted for previous Indices.

B.5. Age and sex profile

- B.5.1. Some indicators required estimates of the total population for the denominator while others required estimates of the population of a specific age and sex. Population estimates by five-year age band and sex, and by non-standard age/sex groupings as required by particular indicators, were created by the research team from the population estimates published by the Office for National Statistics and prisoner counts provided by the Ministry of Justice. For example, the Employment Deprivation Domain required a denominator of males aged 18 to 64 and females aged 18 to 59, while the standardised health indicators required a population denominator for each five-year age-band and sex group.

Appendix C. Changes since the Indices of Deprivation 2015

C.1. Domains and indicators

C.1.1. It has been possible to update almost all of the indicators in the Indices of Deprivation 2015 with little or, at most, minor changes. Figure C.1 summarises the updated and modified indicators for each of the domains:

- two new indicators have been added due to the introduction of Universal Credit into the benefits system
- two indicators have been modified due to changes to the benefit system.

C.1.2. There have been minor changes to a further ten indicators, for example where it has been possible to base an indicator on a longer time series of data in order to increase the robustness of the results

C.1.3. Any changes to the indicators are described in the text in the following sections.

Figure C.1. Domains and indicators for the Indices of Deprivation 2019, showing changes since the Indices of Deprivation 2010

Income Deprivation 22.5%	Adults and children in Income Support families Adults and children in income-based Jobseeker's Allowance families Adults and children in income-based Employment and Support Allowance families Adults and children in Pension Credit (Guarantee) families Adults and children in Working Tax Credit and Child Tax Credit families, below 60% median income not already counted Asylum seekers in England in receipt of subsistence support, accommodation support, or both Adults and children in Universal Credit families where no adult is in 'Working - no requirements' conditionality regime ++			
Employment Deprivation 22.5%	Claimants of Jobseeker's Allowance, aged 18-59/64 Claimants of Employment and Support Allowance, aged 18-59/64 Claimants of Incapacity Benefit, aged 18-59/64 Claimants of Severe Disablement Allowance, aged 18-59/64 Claimants of Carer's Allowance, aged 18-59/64 Claimants of Universal Credit in the 'Searching for work' and 'No work requirements' conditionality groups ++			
Education, Skills & Training Deprivation 13.5%	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top;"> Key Stage 2 attainment: scaled scores Key Stage 4 attainment: average capped points score Secondary school absence Staying on in education post 16 Entry to higher education Adults with no or low qualifications, aged 25-59/64 Adults who cannot speak English or cannot speak English well, aged 25-59/64 </td> <td style="width: 5%; vertical-align: middle; text-align: center;"> } } } } } } } </td> <td style="width: 45%; vertical-align: middle;"> Children & Young People Adult Skills </td> </tr> </table>	Key Stage 2 attainment: scaled scores Key Stage 4 attainment: average capped points score Secondary school absence Staying on in education post 16 Entry to higher education Adults with no or low qualifications, aged 25-59/64 Adults who cannot speak English or cannot speak English well, aged 25-59/64	} } } } } } }	Children & Young People Adult Skills
Key Stage 2 attainment: scaled scores Key Stage 4 attainment: average capped points score Secondary school absence Staying on in education post 16 Entry to higher education Adults with no or low qualifications, aged 25-59/64 Adults who cannot speak English or cannot speak English well, aged 25-59/64	} } } } } } }	Children & Young People Adult Skills		
Health Deprivation & Disability 13.5%	Years of potential life lost Comparative illness and disability ratio ** Acute morbidity Mood and anxiety disorders **			
Crime 9.3%	Recorded crime rates for: <ul style="list-style-type: none"> • Violence • Burglary • Theft • Criminal damage 			
Barriers to Housing & Services 9.3%	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%; vertical-align: top;"> Road distance to a: <ul style="list-style-type: none"> • Post office • Primary school • General store or supermarket • GP surgery Household overcrowding Homelessness Housing affordability </td> <td style="width: 5%; vertical-align: middle; text-align: center;"> } } } } } } </td> <td style="width: 55%; vertical-align: middle;"> Geographical Barriers Wider Barriers </td> </tr> </table>	Road distance to a: <ul style="list-style-type: none"> • Post office • Primary school • General store or supermarket • GP surgery Household overcrowding Homelessness Housing affordability	} } } } } }	Geographical Barriers Wider Barriers
Road distance to a: <ul style="list-style-type: none"> • Post office • Primary school • General store or supermarket • GP surgery Household overcrowding Homelessness Housing affordability	} } } } } }	Geographical Barriers Wider Barriers		
Living Environment Deprivation 9.3%	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%; vertical-align: top;"> Houses without central heating Housing in poor condition Air quality Road traffic accidents </td> <td style="width: 5%; vertical-align: middle; text-align: center;"> } } } } </td> <td style="width: 55%; vertical-align: middle;"> Indoors Living Environment Outdoors Living Environment </td> </tr> </table>	Houses without central heating Housing in poor condition Air quality Road traffic accidents	} } } }	Indoors Living Environment Outdoors Living Environment
Houses without central heating Housing in poor condition Air quality Road traffic accidents	} } } }	Indoors Living Environment Outdoors Living Environment		
++ New indicators				
** Modified indicators				
% illustrates the weight of each domain in the Indices of Deprivation				

Changes to the Income Deprivation Domain

New indicator	<p>Adults and children in Universal Credit families where no adult is in 'Working - no requirements' conditionality regime</p> <p>Universal Credit has started to replace existing component indicators of the Income Deprivation Domain. Universal Credit replaces income-based Jobseekers Allowance, income-based Employment and Support Allowance, and some categories of Income Support and Tax Credit claimants. The majority of Universal Credit claimants as of August 2015 can be included in the Income Deprivation Domain – with five of the six conditionality categories falling below the income threshold to be categorised as income deprived. However, those in the ‘Working – no requirements’ conditionality regime have been excluded as people in this category had earnings above the income deprivation threshold (this conditionally regime accounted for 17.1% of the total caseload across England in August 2015⁸²).</p>
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Changes to the Employment Deprivation Domain

New indicator	<p>Claimants of Universal Credit in the 'Searching for work' and 'No work requirements' conditionality groups</p> <p>This indicator captures those who previously received legacy workless benefits (Jobseekers Allowance, Employment and Support Allowance, Carers Allowance, Incapacity Benefit and Severe Disablement Allowance) who moved on to Universal Credit as it was rolled out across the country.</p> <p>People in the 'Searching for work' conditionality group are not working or have very low earnings and are required to take action to secure work, or more / better paid work. This category has strong overlap in terms of eligibility criteria and conditionality arrangements with income-based Jobseekers Allowance.</p> <p>People in the ‘No work requirements’ conditionality group are not expected to work at present and are likely to have health or caring responsibilities that prevent them from working or preparing for work. This category has strong overlap in terms of eligibility criteria and conditionality arrangements with a subset of income-based Employment and Support and Carers Allowance.</p>
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⁸² See Table I1 in Appendix I.

Changes to the Education, Skills and Training Deprivation Domain

Changes to data and definitions	<p>The Key Stage 2 examinations were changed for the 2015/16 school year. Prior to 2015/16 an average point score was calculated for pupils taking reading, writing and mathematics. From 2015/16 onwards this was replaced by a scaled score for pupils taking Mathematics, English reading and English grammar, punctuation and spelling Key Stage 2 examinations. A change in the revised teacher assessment framework permits teachers to now 'use their discretion' in assessing KS2 writing. While this represents a change from previous Key Stage Assessments, it is still the case that assessments are externally moderated in 2017/18⁸³.</p> <p>The numerator for the entry to higher education indicator is based on five years of data (four years was used previously). The denominator for this indicator has also been constructed from five years of data.</p>
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Changes to the Health Deprivation and Disability Domain

Modified indicators	<p>Data on claimants of Universal Credit (in the 'No work requirements' or the 'Preparing for work' conditionality categories) and Personal Independence Payments have been incorporated into the comparative illness and disability ratio indicator⁸⁴.</p> <p>The health benefits component of the mood and anxiety disorders indicator has been removed due to concerns over the reliability of the ICD-10 coding for health conditions within the source data collected by the Department for Work and Pensions.</p>
Changes to data and definitions	<p>The Hospital Episodes Statistics data used in the acute morbidity indicator have been subject to changes in policy on data protection. Since 2014, patients can opt-out from having their data used 'for research or planning purposes' other than if they are used:</p> <p>To meet a mandatory legal requirement Under the public interest test (such as to support the investigation of serious crime and/or to prevent abuse or serious harm to others)</p>

⁸³ Every year, 25 per cent of schools are subject to statutory external moderation by local authorities on a sample of their outcomes in English writing. This validates judgements to ensure that they are consistent with national standards and guards against systematic differences between geographical areas as a result of the changes.

⁸⁴ In 2015/16 there were on average 1,860 people claiming Universal Credit in the 'No work requirements' or the 'Preparing for work' conditionality categories across England as a whole, compared with 1,940,000 people claiming Employment and Support Allowance i.e. less than 0.1% of all work limiting illness benefits claimants. The Comparative Illness and Disability Ratio indicator requires a subset of Universal Credit claimants in the 'No work requirements' or the 'Preparing for work' conditionality categories. Lone parents and carers are also grouped in these categories and must be excluded. Given that the date of this indicator is March 2016, it was possible to exclude lone parents using the family group flag which is available for this time point.

	<p>These opt outs cases have been excluded from the numerator for the Acute Morbidity Indicator.</p> <p>There has been a slight change to the suicide mortality indicator with the numerator for this indicator now including children aged 10-14.</p>
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Changes to the Crime Domain

<p>Changes to data and definitions</p>	<p>The violence, burglary, theft and criminal damage indicators are now based on two years of data (2016/17 and 2017/18) whereas in previous indices these indicators have been restricted to a single year of data. Furthermore, the Home Office periodically updates the counting rules that define what constitutes crime and the specific type of crime. Some minor updates have been made to the rules since the Indices of Deprivation 2015, but it has still been possible to replicate the indicators using the same definitions for ‘violence’, ‘burglary’, ‘theft’ and ‘criminal damage’. The number of offence categories used for each crime indicator were revised for the Indices of Deprivation 2019, in order to maximise comparability with the Indices of Deprivation 2015:</p> <ul style="list-style-type: none"> • Violence - 18 notifiable offence categories in 2016/17 and 20 offence categories in 2017/18 (previously 18 categories in 2013/14) • Burglary – 4 notifiable offence categories. • Theft – 5 notifiable offence categories • Criminal damage – 8 notifiable offence categories <p>See Appendix H for details of the notifiable offence categories used in the Indices of Deprivation 2019.</p>
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Changes to the Barriers to Housing and Services Domain

<p>Changes to data and definitions</p>	<p>In the housing affordability indicator, the predictive formulae for affordability at individual and household level were derived through a combination of logistic regression and ordinary least squares regression (Linear Probability Model), whereas for the Indices of Deprivation 2015 only ordinary least squares regression was used. The resulting predictions had a more suitable distribution when combining the two models.</p>
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	<p>The homelessness indicator is now based on quarterly homelessness statistics rather than annual homelessness statistics. Consistent with the Indices of Deprivation 2015, this indicator excludes imputed data. The move to use quarterly rather than annual data means that only those quarters that are imputed are excluded, whereas when using annual data the entire year would be excluded if any one of the quarters was imputed. The use of quarterly data therefore results in a greater retention of valid data than the use of annual data.</p>
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Appendix D. The shrinkage technique

D.1. Improving the reliability of small area data values using shrinkage estimation

- D.1.1. The shrinkage technique is designed to deal with the problems associated with small numbers in a Lower-layer Super Output Area. In some areas – particularly where the at-risk population is small – data may be ‘unreliable’, that is more likely to be affected by sampling and other sources of error.
- D.1.2. The technique of shrinkage estimation (in other words empirical Bayesian estimation) is used to ‘borrow strength’ from larger areas to avoid creating unreliable small area data. Shrinkage estimation involves moving Lower-layer Super Output Area scores towards another more robust score, often relating to a higher geographical level. All Lower-layer Super Output Area scores will move somewhat through shrinkage, but those with large standard errors (in other words the most ‘unreliable’ scores) will tend to move the most. The Lower-layer Super Output Area score may be moved towards a ‘more deprived’ or ‘less deprived’ score through shrinkage estimation. Without shrinkage, some Lower-layer Super Output Areas would have scores which do not reliably describe the deprivation in the area due to chance fluctuations from year to year.
- D.1.3. It could be argued that shrinkage estimation is inappropriate for administrative data which are, in effect, a census. This is not correct. The problem exists not only where data are derived from samples but also where scans of administrative data effectively mean that an entire census of a particular group is being considered. This is because such censuses can be regarded as samples from ‘super-populations’, which one could consider to be samples in time. All the data from administrative sources and the 2011 Census are treated as samples from a super-population in this way, and the shrinkage technique was applied to indicators which use this data. The exceptions are the modelled indicators, road distance indicators and indicators supplied at Local Authority District level.

Selecting the larger areas from which unreliable small area data can borrow strength

- D.1.4. The principle for selecting the larger area should be that the Lower-layer Super Output Areas within them share characteristics. In the current shrinkage methodology, Local Authority Districts are used. The Lower-layer Super Output Areas within a single district share issues relating to local governance and possibly to economic sub-climates. To a certain extent, they may also share issues relating to labour market sub-climates.
- D.1.5. There are various other contenders for larger areas from which unreliable small area data could borrow strength. During the development of the Indices of Deprivation 2015, work was undertaken to explore the possibility of using the Office for National Statistics ‘Super Output Area Classification’ as a potential larger area from which small area data could borrow strength. Having considered the results of the investigation there was no clear evidence that shrinkage to Super Output Area Classification clusters would be preferable, and the conclusion was to continue with the approach of shrinking to Local Authority Districts. The approach taken in the Indices of Deprivation 2019 is the same as in the

Indices of Deprivation 2015, and so Local Authority Districts are used in the shrinkage calculation.

D.2. The shrinkage calculation

- D.2.1. The actual mechanism of the shrinkage procedure is to estimate deprivation in a particular Lower-layer Super Output Area using a weighted combination of (a) data from the Lower-layer Super Output Area, and (b) data from another more robust score (in the case of the Indices, this is the Local Authority District score). The weight attempts to increase the efficiency of the estimation, while not increasing its bias. All Lower-layer Super Output Area scores are adjusted to some degree through the shrinkage process, but the magnitude of the adjustment will be greatest for areas with the least reliable scores. The amount of movement depends on both the size of the standard error and the amount of heterogeneity amongst the Lower-layer Super Output Areas in a Local Authority District.
- D.2.2. The 'shrunk' estimate of a Lower-layer Super Output Area level proportion (or ratio) is a weighted average of the two 'raw' proportions for the Lower-layer Super Output Area and for the corresponding District. The weights used are determined by the relative magnitudes of within-Lower-layer Super Output Area and between-Lower-layer Super Output Area variability.

If the rate for a particular indicator in Lower-layer Super Output Area j is r_j events out of a population of n_j , the empirical logit for each Lower-layer Super Output Area is:

$$m_j = \log \left[\frac{(r_j + 0.5)}{(n_j - r_j + 0.5)} \right]$$

whose estimated standard error s_j is the square root of:

$$s_j^2 = \frac{(n_j + 1)(n_j + 2)}{n_j(r_j + 1)(n_j - r_j + 1)}$$

The corresponding counts r out of n for the district in which Lower-layer Super Output Area j lies gives the district-level logit:

$$M = \log \left[\frac{(r + 0.5)}{(n - r + 0.5)} \right]$$

The 'shrunk' Lower-layer Super Output Area level logit is then the weighted average:

$$m_j^* = w_j m_j + (1 - w_j) M$$

where w_j is the weight given to the 'raw' Lower-layer Super Output Area- j data and $(1 - w_j)$ the weight given to the overall rate for the district. The formula used to determine w_j is:

$$w_j = \frac{1/s_j^2}{1/s_j^2 + 1/t^2}$$

where t^2 is the inter-Lower-layer Super Output Area variance for the k Lower-layer Super Output Areas in the district, calculated as:

$$t^2 = \frac{1}{k-1} \sum_{j=1}^k (m_j - M)^2$$

D.2.3. Thus, large Lower-layer Super Output Areas, where precision $1/s_2^j$ is relatively large, have weight w_j close to 1 and so shrinkage has little effect. The shrinkage effect is greatest for small Lower-layer Super Output Areas in relatively homogeneous districts.

The final step is to back-transform the shrunk logit m_j^* using the 'anti-logit', to obtain the shrunk Lower-layer Super Output Area level proportion for each Lower-layer Super Output Area:

$$z_j = \frac{\exp(m_j^*)}{1 + \exp(m_j^*)}$$

Appendix E. Factor analysis

E.1. Combining different types of indicator using factor analysis

- E.1.1. In a number of the domains, factor analysis is used as a method for combining indicators, by finding appropriate weights for combining indicators into a single score based on the inter-correlations between all the indicators⁸⁵.
- E.1.2. Factor analysis is only used in domains where 'latent variables' are hypothesised to exist and where the indicator variables are 'effect indicators', i.e. indicators that are influenced by the latent variable. In practice, the technique is applied to three domains: the Children and Young People sub-domain of the Education, Skills and Training Deprivation Domain, the Health Deprivation and Disability Domain, and the Crime Domain.
- E.1.3. There are many candidates in terms of types of factor analysis. Two of the main contenders are maximum likelihood factor analysis (as used in the current and previous versions of the Indices of Deprivation) and Principal Components Analysis. The distinction between maximum likelihood factor analysis and Principal Components Analysis is a technical one. In brief, the assumptions underpinning Principal Components Analysis are that the indicators going into the analysis are perfectly reliable and measured without error. Maximum likelihood factor analysis requires no such assumption.
- E.1.4. It is not the aim of this analysis to reduce a large number of variables into a number of theoretically significant factors as is usual in much social science use of factor analysis. The indicators within a domain have been chosen because they are held to measure a single area-deprivation factor. The analysis therefore involves exploring a one-common factor model against the possibility of there being more than one meaningful factor. If a meaningful second common factor were found it would suggest the need for a new domain or the removal of variables in order to ensure coherence amongst indicators within each domain. This possibility can be examined through standard tests and criteria, such as examination of Eigen values. No meaningful second factors (in other words second factors that measured deprivation) emerged in any of the domains.

E.2. The process for combining indicators using factor analysis

- E.2.1. The process of combining indicators using factor analysis comprised three stages:
1. All indicators were converted to the standard normal distribution (following shrinkage, where appropriate).
 2. The standardised scores were factor analysed (using the Maximum Likelihood method), deriving a set of weights.
 3. The indicators were then combined using these weights.

⁸⁵ See Noble et al. 2004 Annex F for a full account of the Factor Analysis technique applied.

Appendix F. Exponential transformation

F.1. Using exponential transformation to prepare the domains for combination

F.1.1. In order to combine the domains into an overall Index of Multiple Deprivation, the domain scores first need to be standardised. Any standardisation and transformation should meet the following criteria:

- *Standard distribution*. It must ensure that each domain has a common distribution, so that domains can be combined, without one domain dominating due to a much larger distribution.
- *Cancellation*. It must have an appropriate degree of ‘cancellation’ built into it (discussed below).
- *Identify deprived areas*. It must facilitate the easy identification of the most deprived Lower-layer Super Output Areas.
- *Scale independent*. It must not be scale dependent (in other words, it must not equate the level of deprivation with the size of the population).

F.1.2. The standardisation and transformation used in the Indices of Deprivation 2019 involves each of the domain scores being ranked, and then the ranks are transformed to an exponential distribution. The exponential distribution has a number of properties that satisfy the criteria above, most importantly that it enables control over cancellation, and it helps identify the most deprived Lower-layer Super Output Areas.

Standard distribution

F.1.3. The exponential distribution transforms each domain so that they each have a common distribution, the same range and identical maximum / minimum values. The process starts by ranking the scores in each domain to standardise the domain scores (from 1 for the least deprived, to 32,844 for the most deprived), before applying the exponential transformation procedure to create a standardised domain score ranging from 0 (least deprived) to 100 (most deprived).

Cancellation

F.1.4. The exponential transformation procedure gives control over the extent to which a lack of deprivation in one domain cancels or compensates for deprivation in another domain. It allows precise regulation, although not elimination, of these cancellation effects. The scaling constant (23) was used in order to produce the objective of achieving roughly 10 per cent cancellation. This means that in the extreme case, a Lower-layer Super Output Area which was ranked most deprived on one domain but least deprived on another would overall be ranked at the 90th percentile in terms of deprivation (if the two domains were equally weighted). This compares to the 50th percentile if the untransformed ranks or a normal distribution had been used instead. For example, a Lower-layer Super Output Area that ranked most deprived in terms of the Income Deprivation Domain but was ranked least deprived on the Barriers to Housing and Services Domain would still be at the 90th percentile (top 10 per cent) if these two domains were combined with equal weights.

Identify deprived areas

- F.1.5. The exponential transformation effectively spreads out that part of the distribution in which there is most interest - that is the 'tail' which contains the most deprived Lower-layer Super Output Areas in each domain. The scaling constant ensures that the most deprived 10 per cent of Lower-layer Super Output Areas cover 50 per cent of the distribution of scores (in other words, scores between 50 and 100 after exponential transformation).

Scale independent

- F.1.6. The transformation is not affected by the size of the Lower-layer Super Output Area's population.

F.2. The exponential transformation calculation

- F.2.1. The transformation used is as follows:

For any Lower-layer Super Output Area, denote its rank on the domain R, scaled to the range [0,1]. $R=1/N$ for the least deprived and $R=N/N$ (in other words $R=1$) for the most deprived, where N =the number of Lower-layer Super Output Areas in England.

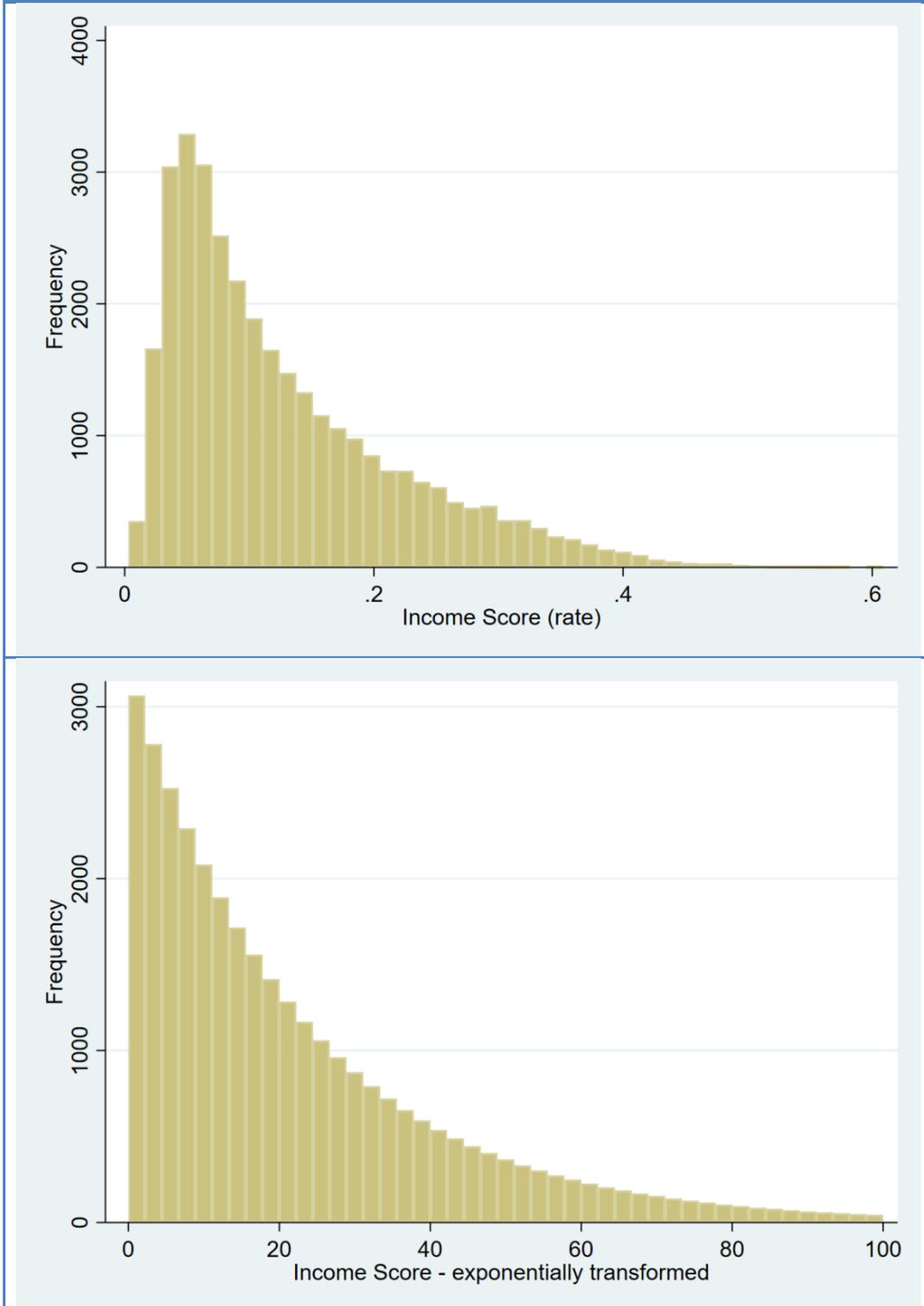
The transformed domain score X is given by:

$$X = -23 \ln(1 - R(1 - \exp^{-100/23}))$$

where 'ln' denotes natural logarithm and 'exp' the exponential or antilog transformation

- F.2.2. Figure F.1 illustrates the effect of the exponential distribution using the Income Deprivation Domain as an example. The first figure shows the distribution of the Income Deprivation scores, in other words the percentage of income-deprived people in each area. The second figure shows the exponentially transformed domain scores, which range from 0 to 100. The 10 per cent most deprived Lower-layer Super Output Areas (numbering 3,248) have an exponentially transformed score between 50 and 100. The remaining 90 per cent have an exponentially transformed domain score between 0 and 50.

Figure F.1. Distribution of Indices of Deprivation 2019 Income deprivation domain, before and after exponential transformation has been applied



Appendix G. Weighting the domains

G.1. Weighting the domains to create an overall Index of Multiple Deprivation

- G.1.1. Combining the different domains into an overall index always involves weighting the domains, whether the weights are set explicitly or not. Greater weight on a specific domain gives greater importance to that domain in the overall index. Weights may be set explicitly, as they were in the Indices of Deprivation 2000 and subsequent updates. If domain scores were simply added together (after standardisation), this would give each domain an equal weight. Conversely, if domains are not standardised to lie on the same scale or distribution, weights are set implicitly by the domain distributions.
- G.1.2. In the final analysis there is no ultimate method by which to measure multiple deprivation, as it is a combination of individual deprivations measured in the component domains. However, the choice of weights is not arbitrary; for the Indices of Deprivation 2000 and subsequent updates, the aim was that the weights should be explicit and based on clear criteria:
- The Income and Employment Deprivation Domains should carry more weight than the other domains. This is supported by research and the wider academic literature, for example the work of Townsend⁸⁶. Accordingly, the Income and Employment Deprivation Domains have been given the highest weights, accounting for 45 per cent between them of the final domain weights in Indices of Deprivation 2019.
 - Domains with the most robust indicators should be given the greater weights. Only those indicators which are sufficiently robust are included within the Indices. In addition, all the indicators meet specific criteria for being included: they are ‘domain specific’ and measure major features of deprivation in that domain, are up-to-date, are capable of being updated on a regular basis, and are available across England at a small area level. The relative robustness of the indicators was gauged by extensive and detailed quality assurance testing of the data which also drew on extensive experience of working with such data.
- G.1.3. During the consultation for the Indices of Deprivation 2000 and each of the subsequent English Indices of Deprivation, there has been a great deal of support for the weights chosen. Subsequent assessment of potential weights based on empirical methodologies (see below) also supports the weights used for Indices of Deprivation 2019.
- G.1.4. Assessment of potential weights based on empirical methods showed consistent results. Analysis commissioned from Dibben et al⁸⁷ explored three alternative empirical methods for setting domain weights, rather than the theoretical basis outlined above:
- Survey approach – How does living in the conditions measured by each domain affect an individual’s chance of being socially excluded? This used data from the Millennium

⁸⁶ Townsend (1987), *Deprivation*, p.125-126, our italics.

⁸⁷ Dibben, C., Atherton, I., Cox, M., Watson, V., Ryan, M. and Sutton, M. (2007) *Investigating the Impact of Changing the Weights that Underpin the Index of Multiple Deprivation 2004*, London: Communities and Local Government.

Poverty and Social Exclusion Survey to examine the contributions of different domains to a social well-being measure closely related to social exclusion.

- Revealed preference approach – How does the state divide up the ‘public purse’ between different policies aimed at reducing the proportion of the population affected by each of the domains of deprivation? This analysis allocated departmental and local government spend between each of the domains.
- Discrete Choice Experiment – Given a choice between individuals living in these different conditions, who is felt to be most in need of support from the government? The experiment surveyed 1,000 households, asking respondents to choose between supporting individuals with different types of deprivation; these responses were used to derive empirical weights for the domains.

G.1.5. There was close overall agreement between the three empirical methods for deriving domain weights, and the actual domain weights, with the research recommending a single change to the weights – switching the weights of the Employment Deprivation Domain (from 22.5 per cent to 13.5 per cent) and Health Deprivation and Disability Domain (from 13.5 per cent to 22.5 per cent) domains. This change makes little difference to the overall Index distribution, with a very high correlation between the original and revised indices.

G.1.6. With reference to these research findings, the use of these weights was revisited in the consultations preceding the release of the Indices of Deprivation 2007⁸⁸, Indices of Deprivation 2010⁸⁹ and Indices of Deprivation 2015⁹⁰. All three consultations found the vast majority of respondents were in favour of keeping the weights the same. In light of the very high level of user support, the weights used in the Indices of Deprivation 2019 remain as used in the Indices of Deprivation 2015.

⁸⁸ Ministry of Housing, Communities and Local Government (2007) Updating the English Indices of Deprivation 2004: Stage Two ‘Blueprint’ Consultation Report – Summary of Responses, <http://webarchive.nationalarchives.gov.uk/20120919132719/http://www.communities.gov.uk/publications/communities/indicesdeprivationresponses>

⁸⁹ Ministry of Housing, Communities and Local Government (2011) English Indices of Deprivation consultation: summary of responses, <https://www.gov.uk/government/consultations/english-indices-of-deprivation>

⁹⁰ Ministry of Housing, Communities and Local Government (2014) English Indices of Deprivation consultation: summary of responses, <https://www.gov.uk/government/consultations/updating-the-english-indices-of-deprivation>

Appendix H. Categories of recorded crime

H.1.1. This Appendix sets out the categories of recorded crime used for the Crime Domain indicators. See Chapter 4 for details of the domain and indicators.

Violence

Table H.1. Home Office offence codes used for the violence indicator		
Offence code 2016/17	Offence code 2017/18	Offence name
1	1	Murder
4.1	4.1	Manslaughter
4.2	4.2	Infanticide
2	2	Attempted murder
37/1	37/1	Causing Death by Aggravated Vehicle Taking
5D	5D	Assault with intent to cause serious harm
5E	5E	Endangering Life
8N	8N	Assault with injury
8P	8P	Racially or Religiously Aggravated Assault with Injury
8L	8L	Harassment
8M	8M	Racially or Religiously Aggravated Harassment
---	8R	Malicious communications (previously part of 8L)
---	8S	Assault with injury on a constable (previously part of 5D or 8N)
9A	9A	Public Fear Alarm or Distress
9B	9B	Racially or Religiously Aggravated Public Fear, Alarm or Distress
105A	105A	Assault without Injury
105B	105B	Racially or religiously Aggravated Assault without Injury
34A	34A	Robbery of Business Property
34B	34B	Robbery of Personal Property
62A	62A	Violent disorder

Burglary

Table H.2. Home Office offence codes used for the burglary indicator		
Offence code 2016/17	Offence code 2017/18	Offence name
28A/B/C/D	28E/F/G/H	2016/17: Burglary in a dwelling 2017/18: Burglary Residential / Attempted Burglary Residential / Distraction Burglary residential/Attempted Distraction Burglary Residential
29	29A	2016/17: Aggravated Burglary in a dwelling 2017/18: Aggravated Burglary Residential
30A/B	30C/D	2016/17: Burglary in a building other than a dwelling 2017/18: Burglary business and community / attempted burglary business and community
31	31A	2016/17: Aggravated Burglary in a building other than a dwelling 2017/18: Aggravated burglary business and community

Theft

Table H.3. Home Office offence codes used for the theft indicator	
Offence code 2016/17 and 2017/18	Offence name
37/2	Aggravated Vehicle Taking
39	Theft from the Person
45	Theft from a Motor Vehicle
48	Theft or Unauthorised Taking of Motor Vehicle
126	Interfering with a motor vehicle

Criminal damage

Table H.4. Home Office offence codes used for the criminal damage indicator	
Offence code 2016/17 and 2017/18	Offence name
56A	Arson endangering life
56B	Arson not endangering life
58A	Criminal Damage to a dwelling
58B	Criminal Damage to a building other than a dwelling
58C	Criminal Damage to a vehicle
58D	Other Criminal Damage
58J	Racially or Religiously Aggravated Criminal Damage
59	Threat or possession with intent to commit Criminal Damage

Appendix I. Universal Credit and Personal Independence Payments

I.1.1. The most significant changes imposed on the indices are a consequence of changes to the benefit system and, in particular, the rollout of Universal Credit (UC) and Personal Independence Payments (PIP). The Income Deprivation Domain and the Employment Deprivation Domain are most affected but there is also an impact on the Health Deprivation and Disability Domain. Different considerations apply to Universal Credit and Personal Independence Payments and so they are discussed in turn.

Universal Credit

I.1.2. Over the history of the indices, there have always been changes to the benefit landscape which have had to be incorporated into the Indices. However, what makes Universal Credit particularly challenging is threefold: first, that the rollout has been over a relatively long period; second, Universal Credit is substantively different from the legacy benefits it replaces, in that there are different conditionality regimes; and third, and most importantly, the rollout of Universal Credit has a geographical component. In other words, at any given point in time, only certain geographical areas and particular client groups have been affected.

I.1.3. As the Income Deprivation Domain and the Employment Deprivation Domain together account for 45% of the total weight of the final Index of Multiple Deprivation (with the other five domains accounting for the remaining 55% of the total weight), it is imperative that the impact of Universal Credit on data consistency is fully understood.

I.1.4. For an indicator to be incorporated into the indices, it has to meet certain criteria:

- be 'domain specific' and appropriate for the purpose (as far as possible, being direct measures of that form of deprivation)
- measure major features of that deprivation (not conditions just experienced by a small number of people or areas)
- be up-to-date and (as far as possible) updateable⁹¹
- be statistically robust at the small area level
- be available for the whole of England at a small area level in a consistent form.

I.1.5. Because Universal Credit is not simply a re-branding of an existing benefit (or group of benefits), it is the final bullet point in the list above which gives most cause for concern. The definition of deprivation must be consistent in all geographical areas and, as much as possible, the *measure* of deprivation in an area where Universal Credit has been rolled out must be comparable to the measure of deprivation in an area where there has been no rollout.

⁹¹ Wherever possible, indicators are used that can be regularly updated. However not all indicators can be regularly updated, for example those based on Census 2011. Census data is used only when alternative data from administrative sources is not available.

I.1.6. Universal Credit replaces income-based Jobseekers Allowance (JSA-IB), income-based Employment and Support Allowance (ESA-IB), and some categories of Income Support (IS). These are referred to as the ‘legacy benefits’ and are defined by claimants’ positions as regards the labour market. Universal Credit operates in a different way and defines claimants by reference to what are termed the ‘conditionality regimes’. The following table lists the six conditionality regimes (column A), outlines their meaning (column B), the equivalent legacy benefits (column C) and the proportion of Universal Credit claimants in 2015/2016 (column D and E) in each conditionality category:

Table I.1 Summary of Universal Credit conditionality categories				
Category A	Description B	Legacy benefit/s C	Proportion of UC claimants at August 2015 ⁹² n= 93,345 D	Proportion of UC claimants in total of 4 quarters in 2015/16 ⁹³ n= 452,519 E
1. Searching for work	Not working, or with very low earnings. Claimant is required to take action to secure work, or more / better paid work. The Work Coach supports them to plan their work search and preparation activity.	JSA-IB (and ESA-IB awaiting Work capability assessment), some Housing Benefit (HB) cases	69.5%	67%
2. Working - with requirements	In work but could earn more, or not working but has a partner with low earnings.	Tax Credits (plus small numbers of JSA-IB and IS claimants working less than 15 hours per week), some HB cases	9.3%	10.4%
3. No work requirements	Not expected to work at present. Health or caring responsibility prevents claimant from working or preparing for work.	ESA-IB, some HB cases	2.4%	2.5%

⁹² Figures extracted from the Department for Work and Pensions (DWP) StatXplore tool <http://www.stat-xplore.dwp.gov.uk/> for People receiving Universal Credit at August 2015. This is relevant for the Income Deprivation Domain.

⁹³ Figures extracted from the Department for Work and Pensions (DWP) StatXplore tool <http://www.stat-xplore.dwp.gov.uk/> for People receiving Universal Credit at May 2015, August 2015, November 2015 and February 2016. This is relevant for the Employment Deprivation Domain.

Table I.1 Summary of Universal Credit conditionality categories				
Category A	Description B	Legacy benefit/s C	Proportion of UC claimants at August 2015 ⁹² n= 93,345 D	Proportion of UC claimants in total of 4 quarters in 2015/16 ⁹³ n= 452,519 E
4. Working - no requirements	Individual or household earnings over the level at which conditionality applies. Required to inform the Department for Work and Pensions of changes of circumstances, particularly if at risk of decreasing earnings or losing job.	Small number of Tax Credit claimants (likely to be over the 60% median income threshold), some HB cases	17.1%	18%
5. Planning for work	Expected to work in the future. Lone parent / lead carer of child aged 1 - 2. Claimant required to attend periodic interviews to plan for their return to work.	IS, some HB cases	1%	1.4%
6. Preparing for work	Expected to start preparing for future work (even with limited capability for work at the present time or a child aged 3 – 4): the claimant is expected to take reasonable steps to prepare for work including Work Focused Interview.	IS/ESA-IB, some HB cases	0.6%	0.8%
Total			100%	100%

- I.1.7. The rollout of Universal Credit began in April 2013. It was restricted to a small number of geographical areas and was initially limited to new claims for single jobseekers only. From May 2016, rollout was intensified both as regards to area and the claimant group. Rollout for *new* claims across the country was completed on 12th December 2018 with migration of legacy claimants taking place by 2022 (Department for Work and Pensions current estimate).
- I.1.8. However, the gradual rollout for new claimants has meant that the impact of Universal Credit can be mitigated by selecting a time point that is before the introduction of Universal Credit has had major impact. Prior to the commencement of this update to the Indices of Deprivation, a research study was undertaken to investigate the impact of Universal Credit and involved extensive consultation with the Department for Work and Pensions. The conclusion of that study was that choosing a time point within the tax year 2015/2016 would minimise the impact of Universal Credit.

- I.1.9. Although during 2015/2016 rollout was restricted to new single jobseeker claimants (i.e. those in conditionality group 1 'Searching for work'), when any of these claimants changed their status (i.e. were no longer classed as single jobseekers) they moved to other Universal Credit conditionality groups. The table above indicates the proportion of Universal Credit claimants in the different conditionality categories as at August 2015 (the date of the Income Deprivation Domain – column D) and across four quarters in 2015/16 (the quarterly cuts for the Employment Deprivation Domain – column E). As can be seen, in both cases, the overwhelming majority of Universal Credit claimants were still within conditionality group 1 'Searching for work'.
- I.1.10. The approaches to dealing with Universal Credit in each domain have been addressed in the relevant parts of Chapter 4 above.

Personal Independence Payments

- I.1.11. Personal Independence Payments (PIP) were introduced in April 2013 to replace Disability Living Allowance for those aged 16-64 and presented further challenges to producing a consistent deprivation measure. However, the impact is limited to one component of one indicator of the Health Deprivation and Disability Domain – namely the Comparative Illness and Disability Ratio.
- I.1.12. The principle challenge to producing a consistent measure is that there are different conditionality arrangements governing eligibility for Personal Independence Payments compared with the Disability Living Allowance legacy benefit it replaces⁹⁴.
- I.1.13. Personal Independence Payments are assessed on different criteria to Disability Living Allowance - a score-based system is used that relates a recipient's needs with a list of daily living and mobility activities. Personal Independence Payments are not based on a recipient's diagnosed condition but on how it affects them. Therefore, the amount received depends on how their condition affects them, not the condition itself. Consequently, nearly all claims for Personal Independence Payments are assessed by a health professional - usually in face-to-face assessments. The differences in assessment criteria present a small risk that an individual could be identified as eligible or not eligible for disability related benefits depending on whether they were subject to the new (Personal Independence Payments) or legacy (Disability Living Allowance) benefits regime.
- I.1.14. This is further compounded by the benefit being rolled out on an area by area basis, resulting in people with disabilities being subject to different benefits regimes and their associated eligibility criteria depending on where in the country they are living. Another key difference between Personal Independence Payments and Disability Living Allowance is that with Personal Independence Payments, awards are subject to more systematic reviews and will normally be of fixed duration. There are no automatic entitlements for specific conditions within Personal Independence Payments or lifelong awards (even if a

⁹⁴ The principle differences in eligibility criteria relate to the length of time a person experiences a long-term condition and a shift of emphasis away from determining eligibility based on category of condition towards the way in which the condition affects an individual's ability to perform activities of daily living and mobility, see:

<https://www.gov.uk/government/publications/disability-living-allowance-and-personal-independence-payment-main-differences>

condition is permanent). When someone's award comes to an end, they must make a further claim to Personal Independence Payments if they still have needs arising from their health condition or disability⁹⁵. These differences could potentially have an impact on the caseload of disability benefit claimants. While those in the Disability Living Allowance regime who are subject to lifetime awards could not be moved off the benefit (and therefore could not drop out of the Comparative Illness and Disability Ratio count), those receiving Personal Independence Payments are subject to re-assessments, and could be potentially classified as no longer eligible for disability benefits and therefore removed from the Comparative Illness and Disability Ratio count.

- I.1.15. By June 2013 all new working age disability claimants in the UK were required to claim Personal Independence Payments. Existing Disability Living Allowance claimants have since been slowly migrated onto Personal Independence Payments, either voluntarily, when there was a change in disabling condition, when fixed term awards of Disability Living Allowance expired, or where the Department for Work and Pensions invited existing claimants to claim Personal Independence Payments (the latter was part of a geographical rollout)⁹⁶. Under the original rollout timetable all existing Disability Living Allowance claimants not on lifetime awards (aged 16 to 64 on 8 April 2013) should have been required to claim Personal Independence Payments by September 2017⁹⁷. However, as of August 2017, there were still approximately 734,000 Disability Living Allowance claimants aged 16-64 across England (over 37% of all working age disability benefit claimants). The ongoing reassessment of claimants means that the Comparative Illness and Disability Ratio measure needs to include both working age Disability Living Allowance and Personal Independence Payments claimants in order to produce a comprehensive measure of people of working age who need help with personal care or have walking difficulties because they are physically or mentally disabled.
- I.1.16. The conclusion of how the introduction of Personal Independence Payments has been treated in the Indices of Deprivation 2019 is presented in chapter 4 above.

⁹⁵ <https://www.gov.uk/government/publications/disability-living-allowance-and-personal-independence-payment-main-differences>

⁹⁶ <https://www.turn2us.org.uk/Benefit-guides/Benefit-Changes/Benefit-Changes-Timetable-2015>

⁹⁷ <https://www.benefitsandwork.co.uk/personal-independence-payment-pip/pip-timetable>

Appendix J. Quality assurance of the Indices of Deprivation 2019

J.1. Level of assurance

J.1.1. The quality assurance of the Indices of Deprivation 2019 used the risk and profile matrix set out in the latest UK Statistics Authority Administrative Data Quality Assurance Toolkit⁹⁸, summarised in the table below.

Table J.1. Risk and profile matrix for administrative data quality assurance

Level of risk of quality concerns	Public interest profile		
	Lower	Medium	Higher
Low	Statistics of lower quality concern and lower public interest [A1]	Statistics of low quality concern and medium public interest [A1/A2]	Statistics of low quality concern and higher public interest [A1/A2]
Medium	Statistics of medium quality concern and lower public interest [A1/A2]	Statistics of medium quality concern and medium public interest [A2]	Statistics of medium quality concern and higher public interest [A2/A3]
High	Statistics of higher quality concern and lower public interest [A1/A2/A3]	Statistics of higher quality concern and medium public interest [A3]	Statistics of higher quality concern and higher public interest [A3]

Level of risk of quality concerns

J.1.2. Our assessment for each indicator, domain and the overall Index of Multiple Deprivation is based on the criteria set out in the table below.

⁹⁸ UK Statistics Authority (2019) Administrative Data Quality Assurance Toolkit, https://www.statisticsauthority.gov.uk/wp-content/uploads/2019/02/qualityassurancetoolkit_updated_Feb19_2.pdf

Table J.2. Our criteria for assessing the level of risk of quality

Summary	<ul style="list-style-type: none"> • What weight does this indicator contribute to the overall Index of Multiple Deprivation? • Our assessment of level of risk of quality concerns: Low; Medium; High.
Operational context and data collection	<ul style="list-style-type: none"> • Is the indicator published (i.e. open data), in a form that could be used to recreate the indicator relatively straightforwardly? • If published as open data, is the indicator National Statistics? (i.e. of recognised quality, and with appropriate quality assurance documentation) • If the indicator is not published as open data, is it based on underlying datasets that are themselves used to generate National Statistics? • Is the underlying data used for payments (e.g. benefit systems)? (i.e. likely to high quality and regularly audited) • Is the underlying data used for performance targets (e.g. crime data)? (i.e. risk of performance pressure) • Is the underlying source data collated from separate sources? (i.e. risk of inconsistent processes across the difference sources) • Have any statistical disclosure control methods been applied to the data before being provided to us?
Communication with data suppliers	<ul style="list-style-type: none"> • Is there a single point of contact with the data supplier? • Have the data supplier and project team established appropriate contact points to discuss data supply and quality assurance? • Has sufficient quality assurance documentation been provided by the data supplier?
Quality assurance principles, standards and checks	<ul style="list-style-type: none"> • Have concerns been raised by suppliers, users or reviewers over the quality of the indicator or underlying data sources? • If any such concerns have been raised, have these been responded to in the Indices methodology and/ or documentation? • Do good proxy datasets exist for validating the indicator against real-world data sources? E.g. if the underlying datasets are not published, are any derivatives from the datasets available for our quality assurance validation such as data at Local Authority District level?

J.1.3. Based on our assessment of the Indices inputs and outputs, we have identified:

- The domains and overall Indices of Multiple Deprivation have a *low* Level of risk of quality concerns. These datasets might be seen to have a *high* risk of quality concerns due to the number of different data collection bodies, and complex data collection processes. However, these risks are mitigated by the design, data processing, and multiple independent indicators used, in developing the domains and the Index of Multiple Deprivation.
- The input indicators have a mixture of *low* and *medium* concerns over data quality. For each of the data sources used for the indicators, Appendix K sets out the main quality assurance documents available.

Public interest profile

J.1.4. Based on our assessment of the Indices inputs and outputs, we have identified the public interest in the Indices:

- *Medium* public interest in the overall Index of Multiple Deprivation and higher-level summary measures
- *Lower / medium* public interest for the domains
- *Lower* public interest for the underlying indicators used in the Indices.

Overall level of assurance

J.1.5. Based on our assessment of the Indices inputs and outputs, we have determined the level of assurance required to be as follows:

- *Enhanced assurance* is appropriate for the overall Index of Multiple Deprivation and higher-level summary measures, and a small number of specific datasets: the Crime Domain indicators, and then homelessness indicator and road distance to GP indicator in the Barriers to Housing and Services Domain. Additional assurance work for these indicators is outlined in Appendix J.3 below.
- *Basic assurance* is appropriate for the remaining indicators and domains.

J.2. Quality management actions

J.2.1. The work to produce the Indices of Deprivation has incorporated a number of actions to ensure quality, which are set out in Chapter 5. The table below lists the primary actions against the quality management actions framework set out in the latest UK Statistics Authority toolkit⁹⁹.

Table J.3. Quality management actions undertaken for quality assurance of the Indices of Deprivation	
Quality management area	Actions
Manage	<ul style="list-style-type: none"> • Design of the Indices, including quality of the input data sources; statistical techniques to improve the reliability of small area data; and communication with data suppliers and users. • Clear roles and responsibilities across the research team and data suppliers, and separate internal and external quality assurance checks.

⁹⁹ UK Statistics Authority (2019) Administrative Data Quality Assurance Toolkit, https://www.statisticsauthority.gov.uk/wp-content/uploads/2019/02/qualityassurancetoolkit_updated_Feb19_2.pdf

Table J.3. Quality management actions undertaken for quality assurance of the Indices of Deprivation	
Quality management area	Actions
Communicate	<ul style="list-style-type: none"> • Review of potential data sources with data suppliers, to identify strengths and weaknesses of the data sources and data processing considered for inclusion in the Indices. • Regular dialogue with data suppliers, project manager and the research team. • Documenting quality guidelines and quality assurance for all input data sources used in the Indices (see Appendix K) • Description of the indicators used in the Indices, including biases and assumptions. • During the production of the Indices of Deprivation 2015 there was an extensive programme of engagement with users of the outputs, including 250 responses to the survey on the draft proposals, 100 responses to the final consultation and 125 attendees at workshops.
Investigate	<ul style="list-style-type: none"> • Quality assurance of all data sources used as inputs in the Indices, including review of quality processes for administrative and survey data, and modelling methodologies used to develop specific indicators. • Quality assurance of the processing steps used to construct all indicators, sub-domains, domains, the overall Index of Multiple Deprivation, and the higher area level summaries. • Real world validation of the outputs against data from the previous Indices of Deprivation 2015, as well as appropriate open data sources. This included sense checking of geographic patterns and time series trends. Ideally this validation would have used data from independent sources to those used in constructing the Indices; however, in practice this was not always possible as no such separate source existed. • In addition to the quality assurance carried out when constructing the domains, internal audit and external scrutiny are carried out on the complete process. These include scrutiny of the methods, processing syntax, and the constructed datasets. The internal audit was carried out on a domain-by-domain basis by a team member not involved in the construction of the domain. The external scrutiny was carried out by an external academic, to provide independent verification.

J.3. Enhanced assurance

J.3.1. A small number of specific datasets were identified as requiring additional quality assurance: the homelessness indicator and road distance to GP surgery indicator in the Barriers to Housing and Services Domain, and the Crime Domain indicators. The additional assurance work for these indicators is outlined below.

Crime Domain

- J.3.2. The Crime Domain has been included since the 2004 Indices, consisting of indicators based on police recorded crime data. These data came under scrutiny in 2014 in efforts to improve their quality. The Public Administration Select Committee¹⁰⁰ and Her Majesty's Inspectorate of Constabulary¹⁰¹ undertook a review of the crime recording practices of police forces and identified concerns with crimes being under-recorded and/or miscategorised. The UK Statistics Authority removed the National Statistics designation from statistics based on recorded crime data in January 2014¹⁰².
- J.3.3. In its final report¹⁰³, Her Majesty's Inspectorate of Constabulary concluded that up to 20 percent of crimes may have been going unrecorded. The report acknowledged that there appeared to be some variation in the level of under-recording between police forces, but it was not possible to give a reliable statistical measure of this variation between forces.
- J.3.4. Since 2014 there has been a rolling programme of crime data integrity inspections carried out across forces in England and Wales. As of the end of July 2019, inspections had been carried out for 30 of the 39 English police forces¹⁰⁴, with eight of these forces also having been re-inspected over the period¹⁰⁵. As not all forces have yet been subjected to an inspection, it is not possible to draw upon the findings of the inspections to make adjustments to crime statistics to account for under-recording or mis-recording. Furthermore, the inspections that have been undertaken do not provide any results at sub-police force level, therefore it is not possible to infer how crime recording varies at lower geographical levels or between more or less deprived neighbourhoods. Therefore, as was the case for the Indices of Deprivation 2015, geographical adjustments cannot be made to the police recorded crime data used in the Indices of Deprivation 2019 to take under-recording into account.
- J.3.5. However, the Indices themselves are designed to help ensure the quality of the output datasets by minimising the impact of bias and error in the input data sources:
- The Crime Domain is based on a combination of multiple crime types, which have different geographical distributions, and potentially different under-recording distributions, and which are then used to rank areas. The distribution of the Crime

¹⁰⁰ Commons Select Committee, Crime statistics inquiry <http://www.parliament.uk/business/committees/committees-a-z/commons-select/public-administration-select-committee/inquiries/parliament-2010/crime-statistics/>

¹⁰¹ Her Majesty's Inspectorate of Constabulary (HMIC) crime data integrity information <https://www.justiceinspectors.gov.uk/hmic/our-work/crime-data-integrity/>

¹⁰² UK Statistics Authority register of de-designations, <http://www.statisticsauthority.gov.uk/assessment/assessment/register-of-de-designations/index.html>

¹⁰³ Her Majesty's Inspectorate of Constabulary (2014), Crime-recording: making the victim count, <https://www.justiceinspectors.gov.uk/hmic/publication/crime-recording-making-the-victim-count/>

¹⁰⁴ It is acknowledged that inspection process is intended to lead to improvements in crime recording in forces, and that data recording practices may therefore be modified following an inspection. As any such modification may lead to more (or less) crimes being recorded by a given police force, it is acknowledged that the staggered timing of the inspections may potentially lead to a systematic difference in recording levels between police forces, depending on when in the cycle their inspection occurs. However, as all forces are aware of the inspection process, it could be argued that even those forces that have not yet been inspected are likely to have made pre-emptive improvements to their recording practices following the publication of the HMIC (204) report referenced above.

¹⁰⁵ <https://www.justiceinspectors.gov.uk/hmicfrs/our-work/article/crime-data-integrity/reports-rolling-programme-crime-data-integrity/>

Domain ranks is therefore likely to be more reliable than the distribution of any one of the underlying offences.

- As the Crime Domain uses a large set of crime categories (see Appendix H), mis-categorisation of crimes will often not affect the domain. For example, ‘Assault with intent to cause serious harm’, ‘Assault with injury’ and ‘Assault without Injury’ are each included under the violence indicator; a mis-categorisation between these offences will therefore have no impact on the indicator.
- In addition, the team has carried out enhanced quality assurance checks and processes to ensure the quality of the crime data outputs, which are described in the section below.

J.3.6. Taking into account the findings of the final report from Her Majesty’s Inspectorate of Constabulary, the data exploration undertaken by the research team, and the support from users, the Indices of Deprivation 2019 continues to use police recorded crime data for the Crime Domain as the best available source of information on crime levels at small area level.

Additional quality checks and processes carried out on the police recorded crime datasets

J.3.7. The individual-level geocoded recorded crime data used to construct the Crime Domain of the Indices of Deprivation 2019 was drawn primarily from the routine monthly data extracts provided by the 39 regional police forces in England to the Home Office for the purpose of administering the [police.uk](https://www.police.uk) website. The National Police Chiefs’ Council granted members of the Indices of Deprivation 2019 research team access to the raw (i.e. non-anonymised) police data within a secure police setting for the purposes of updating the Indices.

J.3.8. In addition to the quality assurance checks already performed by the respective police forces and the Home Office in producing the [police.uk](https://www.police.uk) open data source, the research team performed an extensive series of checks on the geocoded police data to ensure the appropriate levels of accuracy and completeness prior to incorporation into the Crime Domain. As well as the quality checks carried out, various techniques were used to maximise the quality of the aggregate crime counts constructed from the raw geocoded crime data.

J.3.9. The most important checking process carried out was to compare the Indices of Deprivation 2019 crime counts generated from the raw individual-level geocoded data, against aggregate crime counts at the Police Force-level and Community Safety Partnership-level that are supplied separately by each police force to the Home Office and which are available as open data. These checks of geocoded data against the open data, aggregate statistics were performed at the end of each major data processing phase of the Crime Domain. Primarily, these checks enabled assessment of:

- the degree to which the raw geocoded data contained the correct number of crime records (per crime type, time period and Police Force) prior to any mapping being undertaken; and
- the degree to which the geocoded data could be successfully mapped to appropriate Lower-layer Super Output Areas using the grid reference and/or postcode of offence location.

- J.3.10. Where checks revealed discrepancies between the geocoded data and the open data, an enquiry was submitted to the relevant police force. Where necessary, a follow-up data request was submitted to the police force for a bespoke extract of geocoded data for the purpose of the Crime Domain. These bespoke data extracts were then incorporated into the processing phases of the Crime Domain, and the checks against open data performed again.
- J.3.11. The extensive checks performed on the final geocoded data demonstrated a high level of correspondence with the publicly available open data at Police Force-level and Community Safety Partnership-level.
- J.3.12. The research team has is satisfied that this data provides the best measure of crime levels at Lower-layer Super Output Area level and that the data is fit for purpose to use as an input source for the Indices of Deprivation 2019.

Homelessness indicator in the Barriers to Housing and Services Domain

- J.3.13. The homelessness indicator is produced at Lower-layer Super Output Area level by assigning the Local Authority District homelessness rate to all constituent Lower-layer Super Output Areas. The Local Authority District level homelessness rate is derived from the Statutory Homelessness Statistics published by the Ministry of Housing, Communities and Local Government¹⁰⁶.
- J.3.14. Local Authority Districts are required to provide statistical returns on Statutory Homelessness on a quarterly basis. Within the Statutory Homelessness Statistics, imputed values are used in cases where a Local Authority District has not provided a valid statistical return for a given quarter.
- J.3.15. For the Indices of Deprivation 2015, the statutory homelessness statistics on which the homelessness indicator was based related to statistical years, and within the source dataset there was a flag to indicate whether any of the four quarters within a given year had been imputed for each Local Authority District. For the Indices of Deprivation 2015, the numerator of the homelessness indicator consisted of the number of acceptances for homelessness in the given years, but excluded any year(s) in which one or more quarter had been imputed. The denominator of this indicator in the Indices of Deprivation 2015 was the number of households in the Local Authority District but excluded any year(s) for which numerator data had been excluded.
- J.3.16. For the Indices of Deprivation 2019, the homelessness indicator has been improved by deriving the Local Authority District homelessness rates from the quarterly statistics rather than the annual statistics. The implication of this is that imputed data is now excluded on a quarterly basis rather than a yearly basis. So, for example, if a Local Authority District does not provide a valid statistical return for one quarter within a year, but does provide

¹⁰⁶ Prior to April 2018, all Local Authority Districts were required to submit quarterly statistical returns on statutory homelessness using the P1E system. From April 2018 onwards, all Local Authority Districts are required to submit quarterly statistical returns on statutory homelessness using the Homelessness Case Level Information Collection (H-CLIC) system. As the data underpinning the homeslessness indicator for the Indices of Deprivation 2019 relates to statutory homelessness statistics for the years 2015/16, 2016,17 and 2017/18, these data were all submitted through the P1E system.

valid returns for the other three quarters, then only the imputed quarter will be excluded, whereas in the Indices of Deprivation 2015 the entire year would have been excluded.

- J.3.17. An extensive programme of data exploration and development work was undertaken for the homelessness indicator of the Indices of Deprivation 2019, in order to enable a fully informed appraisal of the impact of moving from yearly input data to quarterly input data. As part of this programme of work, detailed analysis was performed to ascertain the relative merits of continuing to exclude imputed data from the indicator, versus the potential merits of including imputed data. Analysis was also undertaken to explore the potential benefits of expanding the time-series from three years of data (as was used in the Indices of Deprivation 2015) to five years of data. Both these issues were regarded as small potential improvements facilitated by an improved data landscape (and so were not regarded as substantive methodological changes).
- J.3.18. Having carefully reviewed the quarterly time-series of statutory homelessness statistics for each Local Authority District that had one or more imputed quarters of data, the research team concluded that imputed data should continue to be excluded from the homelessness indicator. The primary reason for this was that, although the imputed statistics were plausible for many of the Local Authority Districts, this was not the case for all Local Authority Districts: in a small number of cases, the values for imputed quarters appeared to be out-of-line with the trends observed in the non-imputed quarters.
- J.3.19. Following a period of liaison with the homelessness team within the Ministry of Housing, Communities and Local Government, which included a review of the imputation methodology used within the statutory homelessness statistical release, it was agreed that imputed quarters should continue to be excluded from the homelessness indicator used in the Indices of Deprivation 2019. This is to ensure that the Lower-layer Super Output Area ranks on the homelessness indicator (which are themselves derived from the Local Authority District homelessness rates assigned to the constituent Lower-layer Super Output Areas) are not adversely affected by the inclusion of imputed data on which there are concerns about the plausibility of the imputed values.
- J.3.20. It was also concluded that the time series should continue to cover the three most recent years, rather than extend it to include two additional earlier years.

Road distance to GP practice indicator in the Barriers to Housing and Services Domain

- J.3.21. The road distance to nearest GP indicator in the Barriers to Housing and Services Domain is based upon a dataset of the geographical locations of GP practices. During the construction of this indicator it transpired that there are a number of publicly available data sets pertaining to provide comprehensive lists of the geographical locations of GP practices. An extensive programme of work was undertaken to review the contents of the various datasets in order to identify any differences between them and the reasons for this, and to help guide the decision on which data set (or which combination of data sets) provided the most comprehensive account.
- J.3.22. The first major issue identified with the respective datasets was the distinction between 'GP practices' and 'GP branch surgeries'. The NHS Prescription Service is responsible for maintaining up-to-date lists of 'GP practices', and these lists are routinely published by the

NHS Digital Organisation Data Service (ODS). In addition to this, the NHS Digital Organisation Data Service (ODS) is responsible for the upkeep of lists of 'GP branch surgeries'. The distinction between a 'GP practice' and a 'GP branch surgery' is largely an organisational one and relates to cases where multiple GP practices/surgeries operate as part of the same group. Organisationally on the NHS data systems, one practice/surgery from the group will be listed as the 'GP practice' and the other(s) will be listed as 'GP branch surgeries'. From the perspective of the patient, there may be no discernible difference between a 'GP practice' and 'GP branch surgery' as defined by the NHS. As such, it was concluded that all active 'GP practices' and all active 'GP branch surgeries' must be included in the GP location dataset that underpins the road distance to nearest GP indicator.

- J.3.23. The second major issue identified related to the geographical references associated with the records in the respective GP datasets. The review of the various datasets undertaken revealed that the postcodes contained within the 'GP practice' and 'GP branch surgery' datasets published by NHS Digital relate to the location stated in the GP contract cost centre, which can be different from the location where they provide treatment/consultation. It was therefore necessary to request a bespoke extract of data from NHS Digital to ensure that all 'GP practices' and 'GP branch surgeries' were associated with the postcode in which consultation/treatment was provided, rather than the postcode of the contract cost centre that is provided in the publicly available open data resources. NHS Digital undertook a process of data matching to link the GP codes held on the NHS Digital Organisation Data Service (ODS) database with postcodes held by NHS.UK, which relate to the treatment/consultation locations. For a minority of 'GP branch surgeries' that were listed in the NHS Digital database but not in the NHS.UK database, the default postcodes from the NHS Digital database were used.
- J.3.24. The process of exploring the various sources of data and testing the comprehensiveness and accuracy of the postcode fields involved considerable 'reality checking', which included consulting the 'Find my GP Services' website to check the details of individual GP locations, and phone calls to a number of GP practice/surgeries to verify the information contained with the databases.
- J.3.25. The final GP location dataset that was supplied by NHS Digital for this indicator consisted of a comprehensive list of GP practices and surgeries with postcodes relating to the location at which treatment/consultation was provided.

Appendix K. Quality assurance documents for input data sources

K.1.1. This Appendix lists the main quality assurance documents available for the input data sources used in the Indices of Deprivation, with web links where available¹⁰⁷. Table L.2 provides a look-up between the indicator identification code used in the table, and the proper name of the indicator.

Table K.1. Quality assurance documents available for the input data sources		
Indicator codes(s)	Document / resource name	Web link (if available)
ID1, ID2, ID3, ID4, ID5, ID6, ID8, ID9, ID10, ID11, ID12, ID13, ID21, ID23	DWP Statistics Quality Guidelines Statement	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/203643/dwp-statistics-Quality_Guidelines_statement_final.pdf
ID1, ID2, ID3, ID4, ID5, ID6, ID8, ID9, ID10, ID11, ID12, ID13, ID21, ID23	Statement of the administrative sources of DWP statistics	https://www.gov.uk/government/statistics/statement-of-the-administrative-sources-of-dwp-statistics
ID1, ID2, ID3, ID4, ID5, ID6, ID8, ID9, ID10, ID11, ID12, ID13, ID21, ID23	Confidentiality and access policy for DWP statistics	https://www.gov.uk/government/statistics/confidentiality-and-access-policy-for-dwp-statistics
ID1, ID2, ID3, ID4, ID5, ID6, ID8, ID9, ID10, ID11, ID12, ID13, ID21, ID23	Policies and statements related to DWP statistical summaries (including Quality statement and Methodology statement)	https://www.gov.uk/government/statistics/dwp-statistical-summary-policies-and-statements
ID1, ID2, ID3, ID4, ID5, ID6, ID8, ID9, ID10, ID11, ID12, ID13, ID21, ID23	Policies and statements related to DWP abstract of statistics	https://www.gov.uk/government/statistics/dwp-abstract-of-statistics-policies-and-statements
ID1, ID2, ID3, ID4, ID5, ID6, ID8, ID9, ID10, ID11, ID12, ID13, ID21, ID23	Fraud and error in benefits recent guidelines/QA/Tech annexe	https://www.gov.uk/government/publications/fraud-and-error-in-the-benefit-system-supporting-documents-for-statistical-reports
ID7	Home Office statistics statement of compliance with code of practice for official statistics	https://www.gov.uk/government/publications/statement-of-compliance-with-code-of-practice-for-official-statistics

¹⁰⁷ All web references were downloaded 21st August 2019.

Table K.1. Quality assurance documents available for the input data sources		
Indicator codes(s)	Document / resource name	Web link (if available)
ID7	Home Office statement of compliance – release practices	https://www.gov.uk/government/publications/home-office-statement-of-compliance-release-practices
ID7	Home Office use of administrative sources for statistical purposes	https://www.gov.uk/government/publications/home-office-use-of-administrative-sources-for-statistical-purposes
ID1, ID2, ID3, ID4, ID6, ID17	Quality reports for HMRC statistics	https://www.gov.uk/government/collections/hmrc-quality-reports-statistics
ID1, ID2, ID3, ID4, ID6, ID17	HMRC statement of administrative sources	https://www.gov.uk/government/statistics/hmrc-statistics-statement-of-administrative-sources
ID1, ID2, ID3, ID4, ID6, ID17	HMRC policy on revisions	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/251990/cop-revisions.pdf
ID18	Higher Education Statistics Agency (HESA) data quality report	https://www.hesa.ac.uk/about/regulation/official-statistics/quality-report
ID19, ID20, ID23, ID24, ID33, ID36	Census quality assurance by Local Authority	http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/2011-census-user-guide/quality-and-methods/quality/quality-assurance/local-authority-quality-assurance/index.html
ID19, ID20, ID23, ID24, ID33, ID36	Census response and imputation rates	http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/2011-census-user-guide/quality-and-methods/quality/quality-measures/response-and-imputation-rates/index.html
ID19, ID20, ID23, ID24, ID33, ID36	Census assessing accuracy of responses	http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/2011-census-user-guide/quality-and-methods/quality/quality-measures/assessing-accuracy-of-answers/index.html
ID19, ID20, ID23, ID24, ID33, ID36	Census data capture and cleaning	http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/2011-census-user-guide/quality-and-methods/quality/quality-measures/data-capture--coding-and-cleaning/index.html
ID19, ID20, ID23, ID24, ID33, ID36	Census confidence intervals	http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/2011-census-user-guide/quality-and-methods/quality/quality-measures/confidence-intervals/index.html

Table K.1. Quality assurance documents available for the input data sources		
Indicator codes(s)	Document / resource name	Web link (if available)
ID19, ID20, ID23, ID24, ID33, ID36	Census quality notes and clarifications	http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/2011-census-user-guide/quality-and-methods/quality/quality-notes-and-clarifications/index.html
Denominators	Quality and methodology information for population indicators	https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/topicspecificmethodology
Denominators	Quality measures for population estimates and uncertainty project for Local Authority Mid-Year Population Estimates	https://www.ons.gov.uk/methodology/methodologicalpublications/generalmethodology/onsworkingpaperseries/methodologyformeasuringuncertaintyinonlocalauthoritymidyearpopulationestimates2012to2015
ID19, ID20, ID23, ID24, ID33, ID36	2011 census issues and corrections	http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/census-products--issues-and-corrections/index.html
ID19, ID20, ID23, ID24, ID33, ID36	Census independent review of coverage assessment and quality assurance	http://www.ons.gov.uk/ons/guide-method/census/2011/how-our-census-works/how-we-planned-the-2011-census/independent-assessments/independent-review-of-coverage-assessment--adjustment-and-quality-assurance/index.html
ID22, ID23, ID23, ID32	The HES processing cycle and data quality	https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/hospital-episode-statistics/the-processing-cycle-and-hes-data-quality
ID22, ID23, ID23, ID32	Data quality and checks performed on SUS and HES data	https://digital.nhs.uk/binaries/content/assets/legacy/pdf/d/r/data_quality_checks_performed_on_sus_and_hes_data.pdf
ID22, ID23, ID23, ID32	HSCIC data quality	https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/data-quality
ID14, ID15, ID16, ID31	Standards for official statistics published by DfE	https://www.gov.uk/government/publications/standards-for-official-statistics-published-by-the-department-for-education
ID25, ID26, ID27, ID28	UK Statistics Authority 2014 report on assessment of compliance to code of practice for crime statistics	https://www.statisticsauthority.gov.uk/archive/assessment/assessment/assessment-reports/assessment-report-268---statistics-on-crime-in-england-and-wales.pdf
ID25, ID26, ID27, ID28	Action plans to address requirements made by UK	http://www.ons.gov.uk/ons/guide-method/method-quality/specific/crime-statistics-methodology/uk-statistics-authority-assessment/index.html

Table K.1. Quality assurance documents available for the input data sources		
Indicator codes(s)	Document / resource name	Web link (if available)
	Statistics Authority on crime statistics	
ID25, ID26, ID27, ID28	HMICFRS crime data integrity programme	https://www.justiceinspectors.gov.uk/hmicfrs/news/news-feed/crime-data-integrity/
ID25, ID26, ID27, ID28	Crime in England and Wales Quality and Methodology Information report	https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/methodologies/crimeinenglandandwalesqmi
ID34	MHCLG - Statement of administrative sources	https://www.gov.uk/government/publications/statement-of-administrative-sources-for-statistical-purposes
ID34	MHCLG - Revisions policy	https://www.gov.uk/government/publications/statistical-notice-dclg-revisions-policy
ID34	Homelessness statistics	https://www.gov.uk/government/collections/homelessness-statistics
ID34	MHCLG open data strategy	https://www.gov.uk/government/publications/the-second-department-for-communities-and-local-government-open-data-strategy
ID30	Ordnance survey data positional accuracy improvement (PAI) programme	http://www.ordnancesurvey.co.uk/business-and-government/help-and-support/navigation-technology/pai.html
ID39	Road accident and safety statistics guidance	https://www.gov.uk/government/publications/road-accidents-and-safety-statistics-guidance
ID39	DfT statistics - corporate information	https://www.gov.uk/government/organisations/department-for-transport/about/statistics#corporate-information
ID39	DfT - statement on data quality	https://www.gov.uk/government/publications/standards-for-official-statistics-published-by-the-department-for-transport
ID39	DfT - statement of administrative sources	https://www.gov.uk/government/publications/statement-of-administrative-sources-for-official-statistics-published-by-the-department-for-transport

Table K.2. Lookup from indicator codes used in Table L.1. to indicator names	
Indicator code	Indicator name
ID1	Adults and children in Income Support families
ID2	Adults and children in income-based Jobseeker's Allowance families
ID3	Adults and children in income-based Employment and Support Allowance families
ID4	Adults and children in Pension Credit (Guarantee) families
ID5	Adults and children in Universal Credit families where no adult is classed within the 'Working – no requirements' conditionality group
ID6	Adults and children in Working Tax Credit and Child Tax Credit families not already counted, that is those who are not in receipt of Income Support, income-based Jobseeker's Allowance, income-based Employment and Support Allowance or Pension Credit (Guarantee) and whose equivalised income (excluding housing benefit) is below 60 per cent of the median before housing costs
ID7	Asylum seekers in England in receipt of subsistence support, accommodation support, or both
ID8	Claimants of Jobseeker's Allowance (both contribution-based and income-based), women aged 18-59 and men aged 18-64
ID9	Claimants of Employment and Support Allowance (both contribution-based and income-based), women aged 18-59 and men aged 18-64
ID10	Claimants of Incapacity Benefit, women aged 18-59 and men aged 18-64
ID11	Claimants of Severe Disablement Allowance, women aged 18-59 and men aged 18-64
ID12	Claimants of Carer's Allowance, women aged 18-59 and men aged 18-64
ID13	Claimants of Universal Credit in the 'Searching for work' and 'No work requirements' conditionality groups
ID14	Key Stage 2 attainment
ID15	Key Stage 4 attainment
ID16	Secondary school absence
ID17	Staying on in education post 16
ID18	Entry to higher education
ID19	Adult skills
ID20	English language proficiency
ID21	Comparative Illness and Disability Ratio
ID22	Acute morbidity
ID23	Mood and anxiety disorders: Prescription data
ID24	Years of potential life lost
ID25	Violence
ID26	Burglary
ID27	Theft
ID28	Criminal Damage
ID29	Road distance to a post office
ID30	Road distance to general store or supermarket
ID31	Road distance to a primary school
ID32	Road distance to a GP surgery
ID33	Household overcrowding

ID34	Homelessness
ID35	Housing affordability
ID36	Houses without central heating
ID37	Housing in poor condition
ID38	Air quality
ID39	Road traffic accidents

Appendix L. History of the Indices of Deprivation

- L.1.1. The Indices of Deprivation 2000 attempted to measure multiple deprivation with respect to a single overall index as well as separate domain indices. Previous indices (1981 z-scores, 1991 Index of Local Conditions and 1998 Index of Local Deprivation) that had been constructed did not attempt to measure each domain of deprivation separately before combining the indicators into an overall index; these earlier indices also comprised a smaller number of indicators, utilised proxy measures and relied heavily on Census data. The Indices of Deprivation 2000 therefore reflected an attempt to refine the conceptualisation of multiple deprivation and the methodology for constructing the indices and included new and more up-to-date indicators.
- L.1.2. In subsequent updates of the Indices of Deprivation, the number of domains and indicators has increased as more data sources become accessible, and the methodology has gradually been refined. The main focus in recent years has been to maintain a consistent methodology to allow meaningful comparisons between years.
- L.1.3. The Index of Multiple Deprivation 2000 consisted of six domains: Income Deprivation; Employment Deprivation; Health Deprivation and Disability; Education, Skills and Training Deprivation; Housing Deprivation; and Geographical Access to Services Deprivation.
- L.1.4. In updating these to the Indices of Deprivation 2004, the main change was the addition of the Crime Domain. Some changes were made to the Housing Deprivation Domain and the Geographical Access to Services Deprivation Domain, which became the Living Environment Deprivation Domain and the Barriers to Housing and Services Domain respectively. A small number of indicators were redistributed into these new domains. The Indices of Deprivation 2004 therefore consisted of seven domains:
- Income Deprivation
 - Employment Deprivation
 - Education, Skills and Training Deprivation
 - Health Deprivation and Disability
 - Crime
 - Barriers to Housing and Services
 - Living Environment Deprivation
- L.1.5. There was also a change to the geography used, from wards in the Indices of Deprivation 2000 to Lower-layer Super Output Areas¹⁰⁸ in the Indices of Deprivation 2004. The intention has always been to construct the Indices at the smallest practicable spatial scale to provide a detailed measure of deprivation at a small spatial unit. The 2004 Indices and all subsequent Indices have been constructed at using Lower-layer Super Output Area geography. This is a statistical geography which has more even and (on average) smaller

¹⁰⁸ For further information about Lower-layer Super Output Areas, see:

<http://neighbourhood.statistics.gov.uk/dissemination/Info.do?page=nessgeography/superoutputareasexplained/output-areas-explained.html>

population sizes than wards and, until it was reviewed following Census 2011, had not been subject to boundary changes (which happen regularly with wards). Lower-layer Super Output Areas are aggregations of Census Output Areas, the base unit for Census data releases.

- L.1.6. The Indices of Deprivation 2007 aimed to maintain the methodology of previous Indices and no changes were made to the domains or spatial scale. The same was true of the Indices of Deprivation 2010 and 2015. There were a modest number of changes to the basket of indicators used in the domains over this period, resulting in a small number of new, modified and dropped indicators.
- L.1.7. The aim when updating the Indices of Deprivation 2015 was to only introduce change when necessitated due to changes to the data landscape that prevented an indicator from being directly updated. The Indices of Deprivation 2019 are therefore very similar to the Indices of Deprivation 2015. As detailed in the relevant sections above, one component of the mood and anxiety indicator has been dropped due to data quality concerns (health benefits component) and a number of small modifications have been made to existing indicators due to the availability of additional data. The introduction of Universal Credit has also affected the indicators in the Income Deprivation Domain, Employment Deprivation Domain and Health Deprivation and Disability Domain.

Appendix M. What data has been published?

M.1.1. The Indices of Deprivation 2019 datasets are available to download at <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019>

Lower-layer Super Output Area data

M.1.2. Nine sets of data have been published for Lower-layer Super Output Areas:

1. Index of Multiple Deprivation: The rank and decile for each area, on the overall Index of Multiple Deprivation.
2. Domains of deprivation: The rank and decile for each area, for each of the seven domains, as well as the Index of Multiple Deprivation.
3. Supplementary Indices - Income Deprivation Affecting Children Index and Income Deprivation Affecting Older People Index: The rank and decile for each area, for the Income Deprivation Affecting Children Index and the Income Deprivation Affecting Older People Index, as well as the Index of Multiple Deprivation.
4. Sub-domains of deprivation: The rank and decile for each area, for each of the six sub-domains, as well as their respective domains.
5. Scores for the Indices of Deprivation: The scores for each area, for the overall Index of Multiple Deprivation, the seven domains, the supplementary indices, and the six sub-domains.
6. Population denominators: The primary population denominators (all people, children, working age, and older people) used in the Indices of Deprivation 2019. These can be used for aggregating the datasets, weighted by population, to other geographies such as wards (see Appendix A of Research Report).
7. All ranks, deciles and scores for the Indices of Deprivation, and population denominators (CSV file): A single text file containing all of the datasets listed above.
8. Underlying indicators. The indicators used to construct the seven domains, for those that are able to be published.
9. Transformed domain scores: The seven domain scores in this file have been standardised by ranking, and then transformed to an exponential distribution. These transformed domain scores can be used as the basis for users to combine the domains together using different weights (see Appendix B of Research Report).

Higher-level geography files

M.1.3. To summarise the level of deprivation in larger areas, a range of summary measures of the Index of Multiple Deprivation 2019, the domains and the two supplementary indices (Income Deprivation Affecting Children Index and Income Deprivation Affecting Older People Index) have been created¹⁰⁹.

¹⁰⁹ For the Indices of Deprivation 2010 and previous versions, the majority of summary measures published were for the Index of Multiple Deprivation only. In response to demand from users, additional summary measures for the domains and supplementary indices were published for the Indices of Deprivation 2015, and this expanded list of measures is also published for the Indices of Deprivation 2019.

M.1.4. For each of the larger areas the following measures have been published:

10. Local Authority District Summaries.
11. Upper-tier Local Authority Summaries.
12. Local Enterprise Partnership Summaries.
13. Clinical Commissioning Group Summaries.
14. Local Authority District Summaries from the IoD2015 reaggregated to 2019 Local Authority District boundaries.

M.1.5. These measures are described in section 3.8 of the Technical Report and advice on their interpretation is provided in section 3.3 of the Research Report.

Appendix N. Worked examples of the higher-level summary measures

Overview

- N.1.1. The summary measures have been produced for the following higher-level geographies for the Index of Multiple Deprivation, domains and supplementary indices: Local Authority Districts, upper tier Local Authorities, local enterprise partnerships and clinical commissioning groups. As with the Lower-layer Super Output Area data, both ranks and scores are produced, with higher scores corresponding to higher levels of deprivation, and areas ranked so that a rank of 1 identifies the most deprived high-level area on that measure.
- N.1.2. In order that higher scores can consistently be interpreted as corresponding to higher levels of deprivation, those summary measures that are based on Lower-layer Super Output Area *ranks* (the average rank and local concentration summary measures) use a reversed ranking – where 32,844 rather than 1 corresponds to the most deprived area – in the calculation of the summary measure score.
- N.1.3. To help users understand each of the summary measures, the sections below describe how to calculate the measures for hypothetical Local Authority Districts.

Average rank

- N.1.4. A user wishes to calculate the Index of Multiple Deprivation average rank for their Local Authority District. The average rank measure summarises the average level of deprivation across the district, based on the population-weighted ranks of the Lower-layer Super Output Areas in the area.
- N.1.5. The district contains five Lower-layer Super Output Areas, with populations of 1,200, 1,800, 1,400, 1,500 and 1,700, giving a total population of 7,600, and have Index of Multiple Deprivation ranks of 3,000, 10,000, 500, 1,000 and 20,000 respectively.
- N.1.6. To calculate the average rank for the Local Authority District, each Lower-layer Super Output Area rank is multiplied by the Lower-layer Super Output Area population. These values are then summed, before dividing by the district's population to create the average rank for the district.
- N.1.7. In order that higher scores can consistently be interpreted as corresponding to higher levels of deprivation, those summary measures that are based on Lower-layer Super Output Area *ranks* use a reversed ranking - where 32,844 rather than 1 corresponds to the most deprived area. The user would therefore calculate the average rank for the district as:

$$\begin{aligned} \text{Average rank} &= 32,845 - \\ &\quad (3,000 \times 1,200 + 10,000 \times 1,800 + 500 \times 1,400 + \\ &\quad 1,000 \times 1,500 + 20,000 \times 1,700) / 7,600 \\ \text{Average rank} &= 25,240 \end{aligned}$$

When the average rank score is itself ranked then the rank of 1 (most deprived) is given to the largest average rank value.

Average score

N.1.8. The same user wishes to calculate the Index of Multiple Deprivation average score for their Local Authority District. The average score measure summarises the average level of deprivation across the district, based on the population-weighted scores of the Lower-layer Super Output Areas in the area.

N.1.9. The district contains five Lower-layer Super Output Areas, with populations of 1,200, 1,800, 1,400, 1,500 and 1,700, giving a total population of 7,600, and have Index of Multiple Deprivation scores of 45.90, 26.51, 65.67, 59.14 and 13.64 respectively.

N.1.10. In order to calculate the average score for the local district authority, each Lower-layer Super Output Area score is multiplied by the Lower-layer Super Output Area population. These values are then summed, before dividing by the district's population to create the average score for the district. The user would calculate the average score for the district as:

$$\begin{aligned}\text{Average score} &= (45.90 \times 1,200 + 26.51 \times 1,800 + 65.67 \times 1,400 + \\ &\quad 59.14 \times 1,500 + 13.64 \times 1,700) / 7,600 \\ \text{Average score} &= 40.35\end{aligned}$$

When the average score is ranked then the rank of 1 (most deprived) is given to the largest average score value.

Proportion of Lower-layer Super Output Areas in the most deprived 10 per cent nationally

5.3.23 A user wishes to calculate for their Local Authority District the proportion of Lower-layer Super Output Areas that are in the most deprived 10 per cent nationally.

5.3.24 Their Local Authority District contains 65 Lower-layer Super Output Areas. Of these, 18 are ranked in the most deprived decile (i.e., 10%) of all areas in England. The user would calculate the proportion of Lower-layer Super Output Areas in the most deprived 10 per cent nationally for the district as:

$$\begin{aligned}\text{Proportion of Lower-layer Super Output Areas in} &= 18 / 65 \\ \text{the most deprived 10 per cent nationally}\end{aligned}$$

$$\begin{aligned}\text{Proportion of Lower-layer Super Output Areas in} &= 0.277 \text{ (i.e. 27.7\%)} \\ \text{the most deprived 10 per cent nationally}\end{aligned}$$

When the score for this summary measure is ranked then the rank of 1 (most deprived) is given to the largest proportion.

Extent

5.3.25 A user wishes to calculate the extent measure for their Local Authority District. The extent measure is a summary of the proportion of the local population that live in areas classified as among the most deprived in the country. The extent measure uses a weighted measure of the population in the most deprived 30 per cent of all areas:

- The population living in the most deprived 10 per cent of Lower-layer Super Output Areas in England receive a 'weight' of 1.0.
- The population living in the most deprived 11 to 30 per cent of Lower-layer Super Output Areas receive a sliding weight, ranging from 0.95 for those in the most deprived eleventh percentile, to 0.05 for those in the most deprived thirtieth percentile. In practice this means that the weight starts from 0.95 in the most deprived eleventh percentile, and then decreases by $(0.95-0.05)/19$ for each of the subsequent nineteen percentiles until it reaches 0.05 for the most deprived thirtieth percentile, and zero for areas outside the most deprived 30 per cent.

5.3.26 A Local Authority District contains 70,000 people. Of the Lower-layer Super Output Areas in the district, only four are in the most deprived 30 per cent of all Lower-layer Super Output Areas in England; the populations for only these Lower-layer Super Output Areas are included in the extent calculation. The ranks for these four Lower-layer Super Output Areas are 500, 1,000, 3,000, and 9,000 respectively, with populations of 1,400, 1,500, 1,200, and 1,800 respectively.

- The first three Lower-layer Super Output Areas are in the most deprived 10 per cent of areas (with 32,844 areas in England, the areas ranked 1 to 3,284 are in the top 10 per cent). These receive a weight of 1.0, so contribute 100 per cent of their population.
- The fourth Lower-layer Super Output Area is ranked 9,000, so is in the 28th percentile (to find out which percentile an area is in, divide the rank by the total number of ranks, in this case 32,844, multiply by 100 and round up to the nearest integer). This receives a weight of 0.1447 so contributes 14.47% of its population: the weight decreases from 0.95 for the eleventh decile by $(0.95-0.05)/19$, so is 0.1447 for the 28th percentile.

5.3.27 The user would therefore calculate the extent summary measure for the district as:

$$\text{Extent} = (1,400 + 1,500 + 1,200 + 0.1447 \times 1,800) / 70,000$$

$$\text{Extent} = 0.062292$$

When the extent score is ranked then the rank of 1 (most deprived) is given to the largest extent score.

Local concentration

N.1.11. A user wishes to calculate the local concentration measure for their Local Authority District. The local concentration measure is a summary of how the most deprived Lower-layer Super Output Areas in the higher-level area compare to those in other areas across the country. It measures the population-weighted average rank for the Lower-layer Super

Output Areas that are ranked as most deprived in the higher-area, and that contain exactly 10 per cent of the higher-area population (in many cases, this will not be a whole number of Lower-layer Super Output Areas).

- N.1.12. A Local Authority District contains 70,000 people; 10 per cent of this population is 7,000 people. The local concentration measure calculates the population-weighted rank of the most deprived Lower-layer Super Output Areas containing exactly 7,000 people. Having sorted the Lower-layer Super Output Areas in descending order of deprivation, the five most deprived Lower-layer Super Output Areas in the Local Authority District have populations of 1,400, 1,500, 1,200, 1,800, and 1,700, giving a total population of 7,600 (just higher than the 7,000 population required).
- N.1.13. These Lower-layer Super Output Areas have ranks of 500, 1,000, 3,000, 10,000 and 20,000 according to the Index of Multiple Deprivation. In order that higher scores can consistently be interpreted as corresponding to higher levels of deprivation, those summary measures that are based on Lower-layer Super Output Area *ranks* use a reversed ranking - where 32,844 rather than 1 corresponds to the most deprived area.
- N.1.14. To reach the required population of 7,000 (i.e., 10 per cent of the district's population) the first four Lower-layer Super Output Areas are included plus 1,100 of the fifth Lower-layer Super Output Area population. The user would calculate the local concentration measure for the district as:

$$\text{Local concentration} = 32,845 - \frac{(1,400 \times 500 + 1,500 \times 1,000 + 1,200 \times 3,000 + 1,800 \times 10,000 + 1,100 \times 20,000)}{7,000}$$

$$\text{Local concentration} = 26,302.14$$

When the local concentration score is ranked then the rank of 1 (most deprived) is given to the largest local concentration score.

Income scale and employment scale (two measures)

- N.1.15. A user wishes to calculate the income scale and employment scale for their Local Authority District. The two scale measures summarise the number of people in the higher-level area who are income deprived (the income scale) or employment deprived (the employment scale).
- N.1.16. A district contains five Lower-layer Super Output Areas. The number of people in low income families in each Lower-layer Super Output Area (i.e., the Income Deprivation Domain numerator) is 1,563, 1,672, 1,745, 1,499 and 1,812.
- N.1.17. The user would calculate the income scale measure for the district as:
- $$\text{Income scale} = 1,563 + 1,672 + 1,745 + 1,499 + 1,812$$
- $$\text{Income scale} = 8,291$$
- N.1.18. The employment scale measure is calculated in the same way but using the numerator of the Employment Deprivation Domain.