SecDev Urban Pandemic Preparedness Index: Methodology for Cities in England & Wales

The COVID-19 global pandemic has hit most cities of the world with the same force, however, some areas became worst affected whilst others were able to fend more effectively than others. The SecDev Urban Pandemic Preparedness Index (the "SecDev Index" or "Index") looks at the resilience at a city level to understand the hazard characteristics in comparison to its environment across seven (7) dimensions: economic, social, demographic, quality of life, burden of chronic disease, clinical care capability and digital preparedness. Thus, quantifying risks helps better manage them.

A 'Resilience Map' of a city helps emergency planners and community executives to quickly (visually) identify the specific communities (or geographic areas) that are most vulnerable and hence need support before, during and after a pandemic outbreak. Moreover, the resilience map could help city executives to allocate (scarce) resources to prepare for, put forth mitigation plans, respond to and/or use it to help in the recovery phase of an epidemic.

Index Composition

The SecDev Index for England and Wales is composed of a total of **30 factors**. Parsimony and practicality (of both data collection and relevance) have been kept in mind while choosing these factors. In the event, a specific factor is not available at a lowest geographical area, the LSOA (Lower Layer Super Output Area), then a higher geographical area, such as, MSOA (Middle Layer Super Output Area) or the Ward level data would be used. Also, in the event that information is not available or not accessible, then an appropriate proxy would be chosen to capture that specific indicator. Lastly, for the factors below, if data from public sources or a suitable proxy are not available, only then a factor is 'temporarily' dropped with an understanding that it could always be reinstated upon discussing with city officials on suitable measures or obtaining relevant data for the same.

The factors are chosen taking into account are classified under the following **7 themes**:

1. Economic factors (4)
    a. Below poverty
    b. Unemployment
    c. Income
    d. No high-school diploma
2. Demographic factors (4)
    a. 65 years or older

    b. 18 years or younger
    c. Disability population (older than 5 years)
    d. Vulnerable households (income deprived households that are affecting children, older population and single households with 65+ years living alone)
3. Social Factors (5)
    a. Minority (Immigrants)
    b. Non-native language speakers
    c. No Vehicle
    d. Crowding
    e. Geographic barriers (distance to post office, school, general store and GP surgery)
4. Quality of Life (4)
    a. Indoor air quality (housing in poor conditions and housing without central heating)
    b. Outdoor life quality (this includes outdoor air quality and road traffic accidents)
    c. Life expectancy at birth
    d. Crime
5. Burden of (Chronic) Disease (2)
    a. Years of potential life lost
    b. Acute morbidity
6. Clinical Care and Lifestyle Choices (6)
    a. Alcohol problem
    b. Smoking
    c. Mental health problems
    d. Low physical mobility*
    e. Physical exercise*
    f. Obesity
7. Digital Preparedness* (5)
    a. No digital device
    b. Mobile data access
    c. Broadband data access
    d. Do not have enough mobile data
    e. Uncomfortable using digital devices

** These indicators are only available only for 2019.*

Ranking

The SecDev Urban Resilience Index would rank (and calculate an index) each LSOA within a city on three (3) levels:

- First level, would be on each of these 30 individual factors
- Second level, it would provide an index for each LSOA on each of the 7 themes
- Third (final) level, it would provide an aggregated single index for each LSOA

In other words, the methodology generated percentile rank among all LSOAs within a city for each of the: (1) 30 individual factors, (2) 7 themes and (3) its overall position within a city. The theme rankings, for each of the 7 themes, are obtained by calculating a percentile ranking of the average (equally weighted sum) of the percentile rankings of the individual factors within that specific theme. Lastly, the overall tract urban preparedness ranking is obtained by calculating a percentile ranking of the sums of each theme.

LSOA rankings are based on percentile ranking. Percentile ranking values range between 0 and 100, with higher values indicating greater resilience and lower values implying vulnerability.

Percentile rank (PR) refers to the percentage of scores that is equal to or less than a given score and is calculated based on the total number of ranks, number of ranks below and above percentile. PR is useful to understand quickly as to how a particular score will compare to the other values or observations or scores in a given dataset or in a given distribution of scores. For example, the PR method is used to calculate student rankings within a specific grade and within a specific curriculum. This gives a measure to meaningfully and relatively compare performance of a specific cohort of students. For avoidance of doubt, the percentile rank of a class of students in grade 9 in Ontario cannot be compared to another student in grade 9 in Dallas, unless the data is standardized across both places.

Moreover, for ease of identification, the LSOA in the bottom 10% (i.e, the lowest geographical areas in the 10th percentile) and top 10% (i.e, the lowest geographical areas at the 90th percentile values) are highlighted using two independent ‘flags’. In other words, the bottom 10% were assigned the *vulnerability flag* and the top 10% of the LSOAs were assigned the *resilience flag*. These flags are calculated for each of the 30 factors and for the 7 themes and also at the unified overall index level.

Area Measure

The cities in England and Wales, for administrative purposes, are divided as follows:

I. **Wards** in England are electoral districts at sub-national level represented by one or more councillors. The **ward** is the primary unit of English electoral geography for civil parishes, borough and district councils.

II. **Middle-layer Super Output Area (MSOA)** is a subdivision of Output Areas (OAs) with a mean population of 7,500 people. As of 2019, there are 6,791 MSOAs in England. These

III. **Lower-layer Super Output Areas (LSOA)** are much more narrowed down areas within a MSOA. An LSOA, on average, has approximately 1,500 residents (a minimum threshold population of 1,000 people) or 650 households. As of 2019, there are 32,844 LSOAs in England. These LSOA are flexible units, up until 2010 England had 32,482 LSOA, however this changed in 2011 to 32,844 and it all depends on the population of an area.

The problem we faced when collecting data is that LSOAs do not neatly map into Wards, i.e., an LSOA can be split between two wards. However, the MSOA on the other hand are an exact aggregation of the LSOAs. An useful website to understand area divisions in England and Wales https://www.restore.ac.uk/geo-refer/35235denws00y20010000.php

The SecDev Index used the LSOA as the measure of area. For example, the City of Bristol has 263 LSOA that were aggregated into 55 MSOAs and there are currently a total of 34 wards.

Other Notes

- The SecDev Index pertains to specific England and Wales cities and the mapping and analysis cannot be used to compare with performance against other cities in England and Wales or with other cities across the globe, for which this index is calculated.
- There are some LSOAs that have either zero estimates or blank values. These areas were removed during the ranking process. However, these were kept in the database for further investigation.

Factors, Sources & Calculations

Variable Name	Description	Table Field Calculation	Additional Notes
1. Generic Data			
Population Estimates	The population estimates provides data for: *total population; population by gender;*	NOMIS Database	
Ethnicity of Population	The data distributes the population according to their ethnicity, according to the 2011 Census. More specifically, it provides estimates of the number of Whites, Asians, Blacks, Mixed and Others	NOMIS Database: Table QS201EW	The table QS201EW, from NOMIS, lists out the Ethnic group of all usual residents. The variable is provided at the LSOA level.
2. Economic Factors			
PVRTY_E	This Domain measures the proportion of the population 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 scores relate to a proportion of the relevant population experiencing that type of deprivation.	Column name in the original database is: **IncScore**	This IMD indicator includes: ● 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 not already counted, and whose equivalised income (excluding housing benefit) is below 60 percent of the median before housing costs ● Asylum seekers in England in receipt of subsistence support, accommodation support, or both ● Adults and children in Universal Credit families where no adult is classed within the 'Working - no requirements' conditionality regime **Source**: IMD Domain # 1: Income Deprivation Score. (Score obtained from File 7 of IMD)

PVRTY_PLR	Percentile percentage of persons below poverty estimate (Poverty Index)	Formula used is: PERCENTRANK.INC on PVRTY_E array with 4 significant digits	In this case, the initial percentile rank that was based on % of population below poverty line, i.e, high poverty percentage would give a high percentile rank; however, to make this consistent with the SecDev scale, this initial percentile rank is inverted to the final percentile rank (PVRTY_PLR). In summary, high poverty rate, means low percentile rank (after inversion) and means highly vulnerable
PVRTY_FLAG_VLNRBL	A binary variable (Flag) that takes 1, if the % of persons in poverty is in the 10th percentile (1 = yes, 0 = no)	PVRTY_PLR < = 0.10	This binary variable is 1 for all the most vulnerable LSOA
PVRTY_FLAG_RSLNC	A binary variable (Flag) that takes 1, if the % of persons in poverty is in the 90th percentile (1 = yes, 0 = no)	PVRTY_PLR > = 0.90	This binary variable is 1 for all the most resilient LSOA
UNEMP_E	This Domain measures the proportion of the working age population in an area involuntarily excluded from the labor market.	Column name in the original database is: **EmpScore**	This IMD indicator includes: • Claimants of Jobseeker's Allowance (both contribution- based and income-based), women aged 18-59 and men aged 18-64 • Claimants of Employment and Support Allowance (both contribution-based and income-based), women aged 18-59 and men aged 18-64 • Claimants of Incapacity Benefit, women aged 18-59 and men aged 18-64 • Claimants of Severe Disablement Allowance, women aged 18-59 and men aged 18-64 • Claimants of Carer's Allowance, women aged 18-59 and men aged 18-64 Claimants of Universal Credit in the 'Searching for work' and 'No work requirements' conditionality groups. **Source**:IMD Domain # 2: Employment Deprivation Score. (Score obtained from File 7 of IMD)
UNEMP_PLR	Percentile Percentage of civilian deprived because of unemployment (Unemployment Index)	Formula used is: PERCENTRANK.INC on UNEMP_E array with 4 significant digits	In this case, the initial percentile rank that was based on % of population that is deprived due to unemployment, i.e, high unemployment rate would mean a high percentile rank; however, to make this consistent with our scale, this initial percentile rank is inverted to the final percentile rank (UNEMP_PLR). In summary, a high unemployment rate, means low percentile rank (after inversion) and this means high vulnerability. And, vice versa.

UNEMP_ FLAG_ VLNRBL	A binary variable (Flag) that takes 1, if the % of persons in poverty is in the 10th percentile (1 = yes, 0 = no)	UNEMP_PLR <= 0.10	This binary variable is 1 for all the most vulnerable LSOA
UNEMP_ FLAG_ RSLNC	A binary variable (Flag) that takes 1, if the % of persons in poverty is in the 90th percentile (1 = yes, 0 = no)	UNEMP_PLR >= 0.90	This binary variable is 1 for all the most resilient LSOA
PCI_E	This provides an average household income estimate by MSOA for the financial year ending 2018.	Column name in the dataset is: **Net annual income after housing costs (£)**	Total annual household income is the sum of the gross income of every member of the household plus any income from benefits such as Working Families Tax Credit. Net annual household income after housing costs is composed of the same elements of net household weekly income but is subject to the following deductions prior to the OECD's equivalisation scale being applied: • rent (gross of housing benefit); • water rates, community water charges and council water charges; • mortgage interest payments (net of any tax relief); • structural insurance premiums (for owner occupiers); and • ground rent and service charges. For the purpose of the SecDev index 'Net Annual Household Income after Housing Costs' is considered, as this represents the Disposable Income. However, income data is only available at the MSOA level. For the purpose of this Index it is assumed that all the LSOA within the MSOA will have the same average household disposable income. **Source**: This data on net annual household income costs was accessed from the ONS dataset on 12 Jul 2021.
PCI_PLR	Percentile per capita income estimate (Income Index)	Formula used is: PERCENTRANK.INC on PCI_E array with 4 significant digits	This index is straightforward as high index means resilient tract and vice versa, hence there is no need for inversion for this index
PCI_FLAG_ VLNRBL	A binary variable that takes 1, if the PCI index is less than 0.10, else 0	PCI_PLR < = 0.10	This is a binary variable that indicates all the most vulnerable LSOA

PCI_FLAG_ RSLNC	A binary variable that takes 1, if the PCI index is greater than 0.90, else 0	PCI_PLR >= 0.90	This is a binary variable that indicates all the most resilient LSOA
NOHSDP_E	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. The higher score (or percentage) means higher deprivation on the education front.	The variable is calculated by taking an equally weighted average of the following indicators: (1) **Staying on in education post 16 indicator** (2) **Entry to higher education indicator** (3) **Adult skills and English language proficiency indicator**	This IMD indicator includes: • Staying on in education post 16: The indicator measures the proportion of young people not staying on in school or non-advanced education above age 16; • Entry to higher education: The indicator measures the proportion of young people aged under 21 not entering higher education; • Adults skill with no or low qualifications & English language proficiency, aged 25 - 59/64: 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. The English language proficiency indicator is the proportion of the working-age population who cannot speak English or cannot speak English 'well'. These indicators are combined as the numerator and denominator were generated as a special table by the Office for National Statistics. **Source**: IMD Domain # 3: Education, Skills & Training Deprivation Domain. (Score obtained from File 7 of IMD)
NOHSDP_ PLR	Percentile Percentage of young people not staying on in school or non-advanced education above age 16 (Education Index)	Formula used is: PERCENTRANK.INC on NOHSDP_E array with 4 significant digits	The original percentile is inverted to make it consistent with SecDev Scale. So, a high NOHSDP_E means a low percentile rank meaning high vulnerability, and vice versa
NOHSDP_ FLAG_ VLNRBL	A binary variable that takes 1 for all the LSOAs that have a NOHSDP_ PLR <= 0.10	NOHSDP_PLR <= 0.10	This binary variable indicates the most vulnerable LSOA
NOHSDP_ FLAG_ RSLNC	A binary variable that takes 1 for all the LSOAs that have a NOHSDP_ PLR >= 0.90	NOHSDP_PLR >= 0.90	This binary variable indicates the most resilient LSOA
3. Demographic Factors			
AGE65P_E	Persons aged 65 and over, for 2019.	The indicator is calculated as: **Aged 65-69 +** **Aged 70-74 +** **Aged 75-79 +** **Aged 80-84 +** **Aged 85+**	The latest available are for mid-2019. The time series 2011-2020 will be revised sometime in 2022 following the release of the 2021 Census results. **Source**: The data is from the NOMIS database and was last accessed on 12 Jul 2021.

AGE65P_ PLR	Percentile Percentage of population above 65 years.	Formula used is: PERCENTRANK.INC on AGE65P_E array with 4 significant digits	The original percentile is inverted to make it consistent with SecDev Scale. A high percentage of older population (AGE65P_E) means a low percentile rank after inversion and it means high vulnerability; and vice versa
AGE65P_ FLAG_ VLNRBL	A binary variable that takes 1 for all the areas that have a AGE65+_PLR <= 0.10	AGE65+_PLR <= 0.10	This binary variable indicates the most vulnerable LSOA, i.e., LSOA with a higher number of older population.
AGE65P_ FLAG_ RSLNC	A binary variable that takes 1 for all the areas that have a AGE65+_PLR >= 0.90	AGE65+_PLR >= 0.90	This binary variable indicates the most resilient LSOA, i.e., LSOA with a lesser number of older population.
AGE18U_E	Persons aged below 18 years, for 2019.	The indicator is calculated as: **Age 0 - 4 +** **Aged 5-9 +** **Aged 10-14 +** **Aged 15-19**	The latest available are for mid-2019. The time series 2011-2020 will be revised sometime in 2022 following the release of the 2021 Census results. **Source**: The data is from the NOMIS database and was last accessed on 12 Jul 2021.
AGE18U_ PLR	Percentile Percentage of population below 18 years.	Formula used is: PERCENTRANK.INC on AGE18U_E array with 4 significant digits	The original percentile is inverted to make it consistent with SecDev Scale. So, a high percentage of the younger population (AGE18U_E) means a low percentile rank after inversion and it means high vulnerability; and vice versa.
AGE18U_ FLAG_ VLNRBL	A binary variable that takes 1 for all the areas that have a AGE18U_PLR <= 0.10	AGE18U_PLR <= 0.10	This binary variable indicates the most vulnerable LSOA, i.e., a higher number of younger population, means higher dependents.
AGE18U_FLAG_RSLNC	A binary variable that takes 1 for all the areas that have a AGE18U_PLR >= 0.90	AGE18U_PLR >= 0.90	This binary variable indicates the most resilient LSOA, i.e., lower number of younger population, means lower dependents.

DISABL_E	Disability population (older than 5 years)	Column name in the dataset is: **Comparative illness and disability ratio indicator**	Comparative illness and disability ratio indicator (sub-indicator # 2): 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. It is an age-sex standardised measure. A higher score for the indicator represents a higher level of deprivation. *Note: This cannot be directly interpreted as a percentage as the provided number is not a ratio per se, but a score indicating the ratio of the disability population.* **Source:** IMD Domain # 4: Health Deprivation and Disability Domain. (Score obtained from File 8 of IMD)
DISABLE_PLR	Percentile rank of DISABLE_E (Disability Index).	Formula used is: PERCENTRANK.INC on DISABLE_E array with 4 significant digits	The original percentile is inverted to make it consistent with SecDev Scale. A high percentage of Disabled population (DISABLE_E) means a low percentile rank after inversion and it means high vulnerability; and vice versa.
DISBLE_FLAG_VLNRBL	A binary variable that takes 1 for all the areas that have a DISABLE_PLR <= 0.10	DISABLE_PLR <= 0.10	This binary variable indicates the most vulnerable LSOA, i.e., those with a high number of physically challenged population
DISBLE_FLAG_RSLNC	A binary variable that takes 1 for all the areas that have a DISABLE_PLR >= 0.90	DISABLE_PLR >= 0.90	This binary variable indicates the most resilient LSOA, i.e., those with a low number of physically challenged population.

VLNRBL_ HHD_E	Vulnerable households (single parent households with children less than 18 years old and single households with 65+ years living alone)	The indicator is: **Equally weighted average of (IDCScore; IDOScore; One person household that has Aged 65 and over)**	The variables used are: + **IDCScore**: Income Deprivation Affecting Children score that measures the proportion of all children aged 0 to 15 living in income deprived families + **IDOScore**: Income Deprivation Affecting Older People score that measures the proportion of those aged 60+ who experience income deprivation + **One person household that has Aged 65 and over**: This provides the percentage of households that are vulnerable. Basically, the numerator is One Person Households: Aged 65 or over and the denominator is the total number of households in the LSOA. The numerator is from the Table QS113EW which lists the household composition. The first two indicators give income vulnerability and the last one provides the vulnerability in terms of a household structure (i.e, households with higher proportion of single households are considered to be more vulnerable, as they might require greater medical attention, etc). **Source**: IMD Domain # 1: Income Deprivation Score. (Score obtained from File 7 of IMD). The table for QS113EW is from NOMIS and it lists the household composition. This dataset provides 2011 estimates.
VLNRBL_ HHD_PLR	Percentile ranking of the vulnerable households.	Formula used is: PERCENTRANK.INC on VLNRBL_HHD_E array with 4 significant digits	The original percentile is inverted to make it consistent with SecDev Scale. So, a high percentage of vulnerable households (VLNRBL_HHD) means a low percentile rank after inversion and it means high vulnerability; and vice versa.
VLNRBL_ HHD_ FLAG_ VLNRBL	A binary variable that takes 1 for all the areas that have a VLNRBL_HHD_PLR <= 0.10	VLNRBL_HHD_PLR <= 0.10	This binary variable indicates the most vulnerable LSOA, i.e., those with high number of vulnerable households
VLNRBL_ HHD_ FLAG_ RSLNC	A binary variable that takes 1 for all the areas that have a VLNRBL_HHD_PLR >= 0.90	VLNRBL_HHD_PLR >= 0.90	This binary variable indicates the most resilient LSOA, i.e., those with low number of vulnerable households

4. Social Factors			
MNRTY_E	Minority population is defined as the number of non-whites as a proportion of total population, according to the 2011 Census.	The formula used is: **((1- ['White'])/['All categories: Ethnic group'])*100**	**Source**: The table QS201EW is from NOMIS and it lists out the Ethnic group of all usual residents. In total there are 18 ethnic groups defined in the 2011 census. And, the variable is provided at the LSOA level.
MNRTY_ PLR	This calculates the minority population percentile rank per LSOA.	PERCENTRANK.INC on MNTRY_E array with 4 significant digits	The index calculation is inverted to be inline with SecDev scale where 0 is most vulnerable and 1 is most resilient
MNRTY_ FLAG_ VNRBL	A binary variable that takes 1 when percentile rank of minorities in a tract is high	MNRTY_PLR <= 0.10	The LSOA takes a value of 1, if the MNRTY_PLR <=10%
MNRTY_ FLAG_ RSLNC	The binary variable takes 1 when a tract has a very minimal number of minorities	MNRTY_PLR >= 0.90	The LSOA takes a value of 1, if the MNRTY_PLR >=90%
LIMENG_E	This variable provides proficiency in English language for people aged 3 and over whose main language is not English according to their ability to speak English.	The formula used is: **((['Main language is not English (English or Welsh in Wales): Cannot speak English']+['Main language is not English (English or Welsh in Wales): Cannot speak English well'])/['All categories: Proficiency in English'])*100**	**Source**: The table QS205EW is from the NOMIS dataset that lists out the population's proficiency in english language. This dataset provides 2011 estimates. A person is classified in one of the categories: can speak English very well, can speak English well, cannot speak English well or cannot speak English. The data is at the LSOA level.
LIMENG_ PLR	Percentile ranking of people who can speak english less than well	PERCENTRANK.INC on LIMENG_E array with 4 significant digits	This is inverted, so areas with less english speaking would be towards 0 and those that have better English language skills are towards 1. This is an indicator that provides the extent of integrability into the society
LIMENG_ FLAG_ VLNRBL	This variable gives 1 for most Vulnerable LSOAs	LIMENG_PLR <= 0.10	A binary variable; on the inverted scale, 0 indicates LSOA with highest percent of non-english speakers and 1 indicates the exact opposite
LIMENG_ FLAG_ RSLNC	This variable gives 1 for most resilient LSOAs	LIMENG_PLR>= 0.90	

NOVEH_E	This variable measures the households with no vehicle available. (No cars or vans in household)	The formula used is: **(['No cars or vans in household']/['All categories: Car or van availability']) *100**	**Source**: The table QS416EW is from the NOMIS database that lists percent of the total population that have 'NO Vehicles' or a mode of private transport in the LSOA. This dataset provides 2011 estimates.
NOVEH_ PLR	Percentile ranking of people who do not have a vehicle	PERCENTRANK.INC on NOVEH_E array with 4 significant digits	The index is calculated and inverted, i.e., the original is INVERTED to make it inline with SecDev Index
NOVEH_ FLAG_ VLNRBL	This variable gives 1 for most Vulnerable LSOAs	NOVEH_PLR <= 0.10	A binary variable; on the inverted scale, 0 indicates LSOA with highest percent of non-english speakers and 1 indicates the exact opposite
NOVEH_ FLAG_ RSLNC	This variable gives 1 for most resilient LSOAs	NOVEH_PLR >= 0.90	
CROWD_E	This variable measures the crowding of households in an area.	The indicator is an **average of the following variables: (1) Owner-occupation affordability (component of housing affordability indicator) (2) Private rental affordability (component of housing affordability indicator) and (3) Household overcrowding indicator**	**Source**: Barriers to Housing and Services' (IMD Domain # 6): Household overcrowding (sub-indicator # 5) + Housing affordability (sub-indicator # 7). The overall indicator (Housing_Barrier) is an equally weighted average of both Household Overcrowding and Housing Affordability. (The scores are obtained from File 8 of IMD)
CROWD_ PLR	Percentile ranking of people who live in crowded households	PERCENTRANK.INC on CROWD_PE array with 4 significant digits	The index is calculated and inverted to be in line with SecDev Scale.
CROWD_ FLAG_ VLNRBL	This variable gives 1 for most Vulnerable LSOAs	CROWD_PLR<= 0.10	On the inverted scale, 0 indicates LSOA with highest percent of crowded households and 1 indicates the exact opposite.

CROWD_ FLAG_ RSLNC	This variable gives 1 for most Resilient LSOAs	CROWD_PLR>= 0.90	
GeoBarr_E	This variable measures the geographic barriers or distances to: (i) Post office, (ii) Primary School, (iii) General store or supermarket and (iv) GP surgery	The indicator is an **average of:** **(1) Road distance to a post office indicator (km)** **(2) Road distance to a primary school indicator (km)** **(3) Road distance to general store or supermarket indicator (km),** **(4) Road distance to a GP surgery indicator (km)**	**Source**: The Barriers to Housing and Services (IMD Domain # 6) - Geographic Barriers (sub-domain # 1) includes distances. The overall indicator is an equally weighted average of all the geographic barriers. (The scores are obtained from File 8 of IMD)
GeoBarr_ PLR	Percentile ranking of geographical barriers	PERCENTRANK.INC on GeoBarr_E array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
GeoBarr_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable areas	GeoBarr_PLR<= 0.10	A binary variable; on the inverted scale, 0 indicates LSOA with highest percentage of multi house units and mobile units; and, 1 indicates the exact opposite
GeoBarr_ FLAG_ RSLNC	This variable gives 1 for most resilient areas	GeoBarr_PLR>= 0.90	
5. Quality of Life			
LQ_Indoor_ E	This variable measures the indoor living environment or the quality of life. This is a combination of two indicators: (i) housing in poor condition and (ii) houses without central heating. The variable created is an equally weighted average of these two indicators.	The indicator is an **average of:** **(1) Housing in poor condition indicator; and, (2) Houses without central heating indicator**	Living Environment Deprivation (item # 7) - Indoors living (subdomain # 1) and this includes two factors: 1. **Housing in poor condition** (sub-indicator # 1) - The housing in poor condition indicator is an estimate of the proportion of social and private homes that fail to meet the decent homes standard. 2. **Houses without central heating** (sub-indicator # 2) - The houses without a central heating indicator are used to measure housing which is expensive to heat. For the SecDev Index, we have taken the proportion to understand the vulnerability only. The higher the proportion means, higher vulnerability.

			The higher the indicator means higher the vulnerability and vice versa. **Source**: The Living Environment Deprivation (IMD Domain # 7) - Indoors Living (subdomain # 1) and includes the two factors: (1) Housing in poor condition (sub-indicator # 1) and (2) Houses without central heating (sub-indicator # 2). The scores are obtained from File 8 of IMD
LQ_Indoor_PLR	Percentile ranking of indoor quality of life	PERCENTRANK.INC on LQ_Indoor_E array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
LQ_Indoor_FLAG_VLNRB	This variable gives 1 for most vulnerable areas	LQ_Indoor_PLR<= 0.10	A binary variable; on the inverted scale, 0 indicates LSOA with lowest indoor quality of life; and, 1 indicates the exact opposite
LQ_Indoor_FLAG_RSLNC	This variable gives 1 for most resilient areas	LQ_Indoor_PLR>= 0.90	
LQ_Outdoor_E	This variable measures the outdoor living environment or the outdoor quality of life. This is a combination of two indicators: (i) air quality that estimates the concentration of pollutants and (ii) road traffic accidents. The variable created is an equally weighted average of these two indicators. The ndicator is based at a LSOA level. The higher the number, the higher is the deprivation.	The indicator is an **average of: (1) Road traffic accidents indicator; and (2) Air quality indicator**	Living Environment Deprivation (item # 7) - Outdoors living (subdomain # 2) includes two factors: 1. Air quality (sub-indicator # 3) - The indicator is an estimate of the concentration of the four pollutants nitrogen dioxide, benzene, sulphur dioxide and particulates. A higher score for the indicator represents a higher level of deprivation. 2. Road traffic accidents (sub-indicator # 4) - The indicator is based on reported accidents that involve death or personal injury to a pedestrian or cyclist. This indicator is expressed as a rate per 1000. **Source**: The Living Environment Deprivation (IMD Domain # 7) - Outdoors living (subdomain # 2) and includes two factors: Air quality (sub-indicator # 3) and road traffic accidents (sub-indicator # 4). The scores are obtained from File 8 of IMD
LQ_Outdoor_PLR	Percentile ranking of outdoor quality of life	PERCENTRANK.INC on LQ_Outdoor_E array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
LQ_Outdoor_FLAG_VLNRBL	This variable gives 1 for most vulnerable areas	LQ_Indoor_PLR<= 0.10	A binary variable; on the inverted scale, 0 indicates LSOA with lowest outdoor quality of life; and, 1 indicates the exact opposite

LQ_Outdoor_FLAG_RSLNC	This variable gives 1 for most resilient areas	LQ_Indoor_PLR>= 0.90	
AvgLifExp_E	This variable calculates the average life expectancy of population within an area	The indicator is calculated by taking **a weighted average of the life expectancy = (Ratio of Males in a LSOA x Life Expectancy of Males in a Ward) + (Ratio of Females in a LSOA x Life Expectancy of Females in a Ward)**	We have life expectancy data at the Ward Level (there are 34 wards). However, we only have life expectancy for male and females. Moreover, we know which LSOAs belong to which ward. Also, we have data for the sex-ratio of population in each LSOA. Based on this weighted average life expectancy, the Percentile ranking of each LSOA. Now, this is a positive index, i.e higher the percentile rank means less vulnerable or more resilient a LSAO.
AvgLifExp_PLR	Percentile ranking of average life expectancy	PERCENTRANK.INC on AvgLifExp_E array with 4 significant digits	The index is calculated and not inverted, to make it inline with SecDev Index
AvgLifExp_FLAG_VLNRBL	This variable gives 1 for most vulnerable areas	AvgLifExp_PLR<= 0.10	A binary variable; on the inverted scale, 0 indicates LSOA with lowest average life expectancy; and, 1 indicates the exact opposite
AvgLifExp_FLAG_RSLNC	This variable gives 1 for most resilient areas	AvgLifExp_PLR>= 0.90	
Crime_E	This variable calculates the recorded crime rates for violence, burglary, theft and criminal damage within an area	Column name in the dataset is: **Crime Score - exponentially transformed**	This factor had negative number scores and there was no adequate explanation provided even in the detailed IMD Report. Therefore, the transformed score (File # 9 of IMD) is chosen. Basically, IMD transformed all indices by using an exponential form, thereby getting rid of the negative numbers. The higher the number means greater is the deprivation. **Source:** The Crime domain (IMD Domain # 5) - Sub items include recorded crime rates for: violence (sub-item #1), burglary (sub-item # 2), theft (sub-item # 3) and criminal damage (sub-item # 4). The transformed crime score is from File 9.
Crime_PLR	Percentile ranking of crime score	PERCENTRANK.INC on Crime_E array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index

Crime_ FLAG_ VLNRBL	This variable gives 1 for most Vulnerable LSOAs	Crime_PLR<=0.10	A binary variable; on the inverted scale, 0 indicates LSOA with highest crime; and, 1 indicates the exact opposite
Crime_FLA G_RSLNC	This variable gives 1 for most Resilient LSOAs	Crime_PLR>=0.90	
6. Burden of Chronic Disease (both Morbidity and Mortality)			
Yrs_ Potential_ LifeLost	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). It is an age-sex standardised measure. A higher score for the indicator represents a higher level of deprivation.	Column name in the dataset is: **Years of potential life lost indicator**	**Source**: The IMD Health Deprivation & Disability Domain (Domain # 4) - Years of potential life lost (sub-indicator # 1). This information is available in File 8 of IMD data
Yrs_ Potential_ LifeLost_ PLR	Percentile ranking of years of potential life lost	PERCENTRANK.I NC on Yrs_ Potential_ LifeLost array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Yrs_ Potential_ LifeLost_ FLAG_ VLNRBL	This variable gives 1 for most Vulnerable LSOAs	Yrs_Potential_ LifeLost_PLR<=0.10	A binary variable; on the inverted scale, 0 indicates LSOA with highest years of potential life lost; and, 1 indicates the exact opposite
Yrs_ Potential_ LifeLost_ FLAG_ RSLNC	This variable gives 1 for most Resilient LSOAs	Yrs_Potential_ LifeLost_PLR >=0.90	
Acute Morbidity	The acute morbidity indicator measures the level of emergency admissions to hospital, based on administrative records of inpatient admissions. A higher score for the indicator represents a higher level of deprivation.	Column name in the dataset is: **Acute morbidity indicator**	**Source**: The IMD Health Deprivation & Disability Domain (Domain # 4) - Acute morbidity (sub-indicator # 3). This information is available in File 8 of IMD data

Acute_Morbidity_PLR	Percentile ranking of Acute Morbidity indicator	PERCENTRANK.INC on Acute Morbidity array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Acute_Morbidity_FLAG_VLNRBL	This variable gives 1 for most Vulnerable LSOAs	Acute_Morbidity_PLR<=0.10	A binary variable; on the inverted scale, 0 indicates LSOA with highest acute morbidity and, 1 indicates the exact opposite
Acute_Morbidity_FLAG_RSLNC	This variable gives 1 for most Resilient LSOAs	Acute_Morbidity_PLR>=0.90	
7. Clinical Care and Lifestyle Choices			
Alcohol Problems	This indicator measures the extent of alcohol related problems.	Column name in the dataset is: **% at a higher risk of alcohol related health problems**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "% at a higher risk of alcohol related problems". The higher the number, means higher deprivation.
Alcohol Problems_PLR	Percentile ranking of Alcohol Problems indicator	PERCENTRANK.INC on Alcohol Problems array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Alcohol Problems_FLAG_VLNRBL	This variable gives 1 for most Vulnerable LSOAs	Alcohol_Problems_PLR<=0.10	A binary variable; on the inverted scale, 0 indicates LSOA with highest % of residents with alcohol problems and, 1 indicates the exact opposite
AlcoholProblems_FLAG_RSLNC	This variable gives 1 for most Resilient LSOAs	Alcohol_Problems_PLR>=0.90	
Smokers	This indicator measures the extent of smokers in an area.	Column name in the dataset is: **% smokers**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "% of smokers". The higher the number, means higher deprivation.

Smokers_ PLR	Percentile ranking of Smokers indicator	PERCENTRANK.INC on Smokers array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Smokers_ FLAG_ VLNRBL	This variable gives 1 for most Vulnerable LSOAs	Smokers_PLR<= 0.10	A binary variable; on the inverted scale, 0 indicates LSOA with highest % of smokers and, 1 indicates the exact opposite
Smokers_FLAG_RSLNC	This variable gives 1 for most Resilient LSOAs	Smokers_PLR>= 0.90	
Mental Health	This indicator measures the mental wellbeing of residents in an area	Column name in the dataset is: **% below average mental wellbeing**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "% below average mental wellbeing". The higher the number, means higher deprivation.
Mental Health_PLR	Percentile ranking of Mental Health indicator	PERCENTRANK.INC on Mental Health array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Mental Health_ FLAG_ VLNRBL	This variable gives 1 for most Vulnerable LSOAs	MentalHealth_PLR<= 0.10	A binary variable; on the inverted scale, 0 indicates LSOA with highest mental health issues and, 1 indicates the exact opposite
Mental Health_ FLAG_ RSLNC	This variable gives 1 for most Resilient LSOAs	MentalHealth_PLR>= 0.90	
Low Physcl Moblty	The indicator measures the percentage of the population with illness or health condition that limits their physical day to day activities	Column name in the dataset is: **% with illness or health condition which limits day-to-day activities a lot**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "% with illness or health condition which limits day-to-day activities a lot". The higher the number, means higher deprivation.
LowPhyscl Moblty_PLR	Percentile ranking of Low Physical Mobility indicator	PERCENTRANK.INC on LowPhysicalMoblty array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index

LowPhyscl Moblty_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable areas	LowPhysicalMoblty _PLR<= 0.10	A binary variable; on the inverted scale, 0 indicates LSOA with highest issues due to low physical mobility and, 1 indicates the exact opposite
LowPhyscl Moblty_ FLAG_ RSLNC	This variable gives 1 for most resilient areas	LowPhysicalMoblty _PLR>= 0.90	
Physcl Exrcise	The indicator measures the percentage of the population that do enough regular exercise each week	Column name in the dataset is: **% who do enough regular exercise each week**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "% with illness or health condition which limits day-to-day activities a lot". The higher the number, means greater percent of exercise, means **LOWER** deprivation, as this is a positive measure.
Physcl Exrcise_PLR	Percentile ranking of Physical Exercise indicator	PERCENTRANK.INC on PhysclExcrise array with 4 significant digits	The index is calculated and is not inverted, as it is a positive indicator.
Physcl Exrcise_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable areas	PhysclExrcise_PLR <= 0.10	A binary variable where 0 indicates LSOA with lowest percentage of population getting adequate physical exercise and, 1 indicates the exact opposite
Physcl Exrcise_ FLAG_ RSLNC	This variable gives 1 for most resilient areas	PhysclExrcise_PLR >= 0.90	
Obesity	The indicator measures the percentage of the population that are obese	Column name in the dataset is: **% obese**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "% obese". The higher the number, means higher deprivation.
Obesity_ PLR	Percentile ranking of obese indicator	PERCENTRANK.INC on Obesity array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index

Obesity_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable areas	Obesity_PLR<= 0.10	A binary variable where 0 indicates LSOA with highest percentage of population that are obese and, 1 indicates the exact opposite
Obesity_ FLAG_ RSLNC	This variable gives 1 for most resilient areas	Obesity_PLR>= 0.90	
8. Digital Preparedness			
NoDEVICE	The indicator measures the percentage of the population that do not have enough digital devices	Column name in the dataset is: **% who do not enough digital devices**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level on a yearly basis. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "Community & Wellbeing"; and within this the indicator is called "% who do not have enough digital devices". The higher the number, means higher deprivation.
NoDEVICE_ PLR	Percentile ranking of NoDevice indicator	PERCENTRANK.INC on NoDevice array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
NoDEVICE_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable areas	NoDEVICE_PLR<= 0.10	A binary variable where 0 indicates LSOA with lowest percentage of digital devices and, 1 indicates the exact opposite
NoDEVICE_ FLAG_ RSLNC	This variable gives 1 for most resilient areas	NoDEVICE_PLR>= 0.90	
MobilDAT	The indicator measures the percentage of the population that that have access to internet via mobile phone or mobile broadband	Column name in the dataset is: **% who have access to the internet via mobile phone or mobile broadband**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level on a yearly basis. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "Community & Wellbeing"; and within this the indicator is called "% who have access to the internet via mobile phone or mobile broadband". The higher the number, means lower deprivation.
MobilDAT_ PLR	Percentile ranking of MobilDAT indicator	PERCENTRANK.INC on MobilDAT array with 4 significant digits	The index is a positive metric and hence after calculation it is not inverted, to make it inline with SecDev Index

MobilDAT_FLAG_VLNRBL	This variable gives 1 for most vulnerable areas	MobilDAT_PLR<= 0.10	A binary variable where 0 indicates LSOA with lowest percentage of population have access to the internet via mobile phone or mobile broadband and, 1 indicates the exact opposite
MobilDAT_FLAG_RSLNC	This variable gives 1 for most resilient areas	MobilDAT_PLR>= 0.90	
BroadBandDAT	The indicator measures the percentage of the population that that have access to broadband internet at home	Column name in the dataset is: **% who have access to the internet at home**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level on a yearly basis. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "Community & Wellbeing"; and within this the indicator is called "% who have access to the internet at home". The higher the number, means lower deprivation.
BroadBandDAT_PLR	Percentile ranking of BroadBandDAT indicator	PERCENTRANK.INC on BroadBandDAT array with 4 significant digits	The index is a positive metric and hence after calculation it is not inverted, to make it inline with SecDev Index
BroadBandDAT_FLAG_VLNRBL	This variable gives 1 for most vulnerable areas	BroadBandDAT_PLR<= 0.10	A binary variable where 0 indicates LSOA with lowest percentage of population have access to the broadband at home and, 1 indicates the exact opposite
BroadBandDAT_FLAG_RSLNC	This variable gives 1 for most resilient areas	BroadBandDAT_PLR>= 0.90	
DontHavEnufMobDat	The indicator measures the percentage of the population that do not have enough mobile data	Column name in the dataset is: **% who do not have enough mobile data**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level on a yearly basis. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "Community & Wellbeing"; and within this the indicator is called "% who do not have enough mobile data". The higher the number, means higher deprivation.
DontHavEnufMobDat_PLR	Percentile ranking of DontHavEnufMobDat indicator	PERCENTRANK.INC on DontHavEnufMobDat array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index

DontHav EnufMobDat _ FLAG_ VLNRBL	This variable gives 1 for most vulnerable areas	DontHavEnufMob Dat_PLR<= 0.10	A binary variable where 0 indicates LSOA with lowest percentage of mobile data and, 1 indicates the exact opposite
DontHav EnufMobDat _FLAG_ RSLNC	This variable gives 1 for most resilient areas	DontHavEnufMob Dat_PLR>= 0.90	
Uncomfort UsingDigit Servcs	The indicator measures the percentage of the population that do not have enough mobile data	Column name in the dataset is: **% who are uncomfortable using digital services**	**Source**: This is not from a central database; it is available individually for each city. For example, for Bristol, it could be accessed from Bristol Open Database; it was last accessed on 12 Jul 2021. The data provided for Bristol is at the Ward level on a yearly basis. And the data is based on an annual resident sample survey of 'Quality of Life' and under the subsection "Community & Wellbeing"; and within this the indicator is called "% who are uncomfortable using digital services". This measures the demand side of the equation and is quite useful to understand the overall success of a digital drive by a city. The higher the number, means higher deprivation.
Uncomfort UsingDigit Servcs_PLR	Percentile ranking of UncomfortUsingDigitServcs indicator	PERCENTRANK.I NC on Uncomfort UsingDigitServcs array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Uncomfort UsingDigit Servcs_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable areas	UncomfortUsing DigitServcs _PLR<= 0.10	A binary variable where 0 indicates LSOA with highest percent of people that are not comfortable using digital services and, 1 indicates the exact opposite
Uncomfort UsingDigit Servcs_ FLAG_ RSLNC	This variable gives 1 for most resilient areas	UncomfortUsing DigitServcs_PLR>= 0.90	

Appendix 1 - About Index of Multiple Deprivation (IMD)

The Office for National Statistics for the reporting of small area statistics collects data at this granular level within a city in England. They also calculate an **Index of Multiple Deprivation** (IMD) at a small area level.The Index of Multiple Deprivation (IMD) is the official measure of relative deprivation in England and is part of a suite of outputs that form the Indices of Deprivation (IoD). The IoD2019 is based on

thirty-nine **(39)** separate indicators, organised across seven **(7)** distinct domains of deprivation which are combined and weighted to calculate the index:

1. **Income Deprivation (weight: 22.5%):** This measures the proportion of the population experiencing deprivation relating to low income. This measure consists of seven (7) separate indicators: (i) Adults and children in Income Support families; (ii) Adults and children in income based Jobseeker's Allowance families; (iii) Adults and children in income-based Employment and Support Allowance families; (iv) Adults and children in Pension Credit (Guarantee) families; (v) Adults and children in Working Tax Credit and Child Tax Credit families, below 60% median income not already counted; (vi) Asylum seekers in England in receipts of subsistence support, accommodation support, or both; and, (vii) Adults and children in Universal Credit families where no adult is in 'Working - no requirements' conditionally regime. The **IMD score for Income Deprivation** provides the sum of all the seven indicators contained within this domain.

   Moreover, IMD has also calculated two sub-indices to specifically measure the vulnerability of children (aged between 0 to 15) and older people (aged 60+):

   1.1. **Income Deprivation Affecting Children Index (IDACI)**: Measures the proportion of all children aged 0 to 15 living in income deprived families.

   1.2. **Income Deprivation Affecting Older People Index (IDAOPI)**: Measures the proportion of those aged 60+ who experience income deprivation.

2. **Employment Deprivation (weight: 22.5%)**: Measures the proportion of the working age population in an area involuntarily excluded from the labor market. This measure consists of six (6) separate indicators: (i) Claimants of Jobseeker's Allowance, aged 18-59/64; (ii) Claimants of Employment and Support Allowance, aged 18-59/64; (iii) Claimants of Incapacity Benefit, aged 18-59/64; (iv) Claimants of Severe Disablement Allowance, aged 18-59/64; (v) Claimants of Carer's Allowance, aged 18-59/64; and, (vi) Claimants of Universal Credit in the 'Searching for work' and 'No work requirements' conditionality groups. The **IMD score for Employment Deprivation** provides the sum of all the six indicators contained within this domain.

3. **Education, Skills and Training Deprivation (weight: 13.5%):** Measures the lack of attainment and skills in the local population. This domain is further classified into two subdomains: Young People Subdomain and Adult Skill Subdomain.

   There are five (5) indicators within the Young People Subdomain: (i) Key Stage 2 attainment: scaled scores; (ii) Key Stage 4 attainment: average capped points score; (iii) Secondary school absence; (iv) Staying on in education post 16; and (v) Entry to higher education. The IMD provides an overall score for the domain and it provides data only for indicator (iv) and (v), but no data is provided for the other indicators.

   - Staying on in education post 16: *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.*
   - Entry to higher education: *The indicator measures the proportion of young people aged under 21 not entering higher education.*

   The Adult Skill Subdomain has two (2) indicators: (i) Adults with no or low qualifications, aged 25 - 59/64; and, (ii) Adults who cannot speak English or cannot speak English well, aged 25 - 59/64.

   - Adult skills and English language proficiency indicators - combined: *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. The English language proficiency indicator is the proportion of the working-age population who cannot speak English or cannot speak English 'well'. These*

indicators are combined as the numerator and denominator were generated as a special table by the Office for National Statistics.

4. **Health Deprivation and Disability (weight: 13.5%)**: Measures the risk of premature death and the impairment of quality of life through poor physical and/or mental health. This measure is composed of four (4) separate indicators: (i) Years of potential life lost; (ii) Comparative illness and disability ratio; (iii) Acute morbidity and (iv) Mood and anxiety disorders. IMD provides data for these 4 indicators and they are defined as follows:
   - Years of potential life lost: *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). It is an age-sex standardised measure. A higher score for the indicator represents a higher level of deprivation.*
   - Comparative illness and disability ratio: *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. It is an age-sex standardised measure. A higher score for the indicator represents a higher level of deprivation.*
   - Acute morbidity: *The acute morbidity indicator measures the level of emergency admissions to hospital, based on administrative records of inpatient admissions. A higher score for the indicator represents a higher level of deprivation.*
   - Mood and anxiety disorders: *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. A higher score for the indicator represents a higher level of deprivation.*
5. **Crime (weight: 9.3%)**: Measures the risk of personal and material victimization at local level. This consists of four (4) separate categories: (i) Violence; (ii) Burglary; (iii) Theft; and, (iv) Criminal damage. IMD only provides only an unified score and rank.
6. **Barriers to Housing and Services (weight: 9.3%)**: Measures the physical and financial accessibility of housing and local services. This domain is further classified into two subdomains: Young People Subdomain and Wider Barriers.

   There are four (4) indicators within the Geographical Barriers, that include road distance to: (i) Post office; (ii) Primary school; (iii) General store or supermarket and (iv) GP surgery.
   - Road distance to a post office: *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.*
   - Road distance to a primary school: *The indicator is defined as an average road distance measured in kilometres.*
   - Road distance to general store or supermarket: *The indicator is defined as an average road distance measured in kilometres.*
   - Road distance to a GP surgery: *The indicator is defined as an average road distance measured in kilometres.*

   There are three (3) indicators within the Wider Barriers, that include: (i) Household overcrowding; (ii) Homelessness and (iii) Housing affordability.
   - Household overcrowding: *The indicator is the proportion of households in a Lower-layer Super Output Area that are classed as overcrowded.*
   - Homelessness: *This local authority district level indicator is expressed as the rate of acceptances for housing assistance under the homelessness provisions of housing legislation.*
   - Housing affordability: *The housing affordability indicator is a measure of the inability to afford to enter owner-occupation or the private rental market. A higher score for the indicator represents a higher level of deprivation.*

7. **Living Environment Deprivation (weight: 9.3%)**: Measures the quality of both the 'indoor' and 'outdoor' local environment. In other words, this domain is further classified into two subdomains: Indoors Subdomain and Outdoors Subdomain. There are two (2) indicators within the Indoor Subdomain that include: (i) Housing in poor condition; and (ii) Houses without central heating.
   - Housing in poor condition: *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.*
   - Housing without central heating: *The houses without central heating indicator are used as a measure of housing which is expensive to heat.*

   There are two (2) indicators within the Outdoor Subdomain, that include: (i) Air quality and (ii) Road traffic accidents
   - Air quality indicator: *The indicator is an estimate of the concentration of the four pollutants nitrogen dioxide, benzene, sulphur dioxide and particulates. A higher score for the indicator represents a higher level of deprivation.*
   - Road traffic accidents indicator: *The indicator is based on reported accidents that involve death or personal injury to a pedestrian or cyclist. This indicator is expressed as a rate per 1000.*

Additional Notes:

Note1 *:* IMD is calculated at the LSOA level and rank of 1 represents the most deprived area (i.e., the most vulnerable tract) and the LSOA with a rank of 32,844 is the least deprived area (i.e., the most resilient tract). The Indices of Deprivation measure deprivation on a relative rather than an absolute scale, so a neighbourhood ranked 100th is more deprived than a neighbourhood ranked 200th, but this does not mean it is twice as deprived. ***The larger the score = more deprived the area = lower is its rank***

Note 2*: Shrinkage is an estimation technique used to improve reliability of the small area data by 'borrowing strength' from larger areas.*

Note 3*: A detailed notes of the indices and their basis is at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/833947/IoD2019_Research_Report.pdf*

Note 4*:* First IMD was released in 2004, 2007, 2010, 2015 and 2019.

Note 5: The Frequently Asked Questions (FAQs) about IMD are provided here. For our data, IMD data is taken from **File 7** (the data and notes about all indicators and all other files from File 1 to File 9 and 10 - 14 are available here). The detailed sub-indicators are in **File 8** and transformed indicators are in **File 9**.

Direct Interpretation	**NOT so Direct Interpretation**
The following indices can be directly interpreted: • Income Deprivation Domain (1), • Employment Deprivation Domain (2), • Supplementary Indices of Income Deprivation among Children and Older Population (1.1.1 and 1.1.2) The scores relate to a proportion of the relevant population experiencing that type of deprivation. For example, a LSOA with a score of 0.38 in the Income Deprivation Domain, means 38% of the population is income deprived.	All other indices and their sub-indices cannot be directly interpreted, i.e., they are less easy to interpret. The Scores do not directly relate to the proportion of the population experiencing deprivation. In this case, it is recommended to use 'ranks' and 'deciles'.