# Sensitivity (Vulnerability Sub-Indices)

Data Dictionary

Sensitivity is a component of the vulnerability index framework developed in 2007 by the Intergovernmental Panel on Climate Change (IPCC). Sensitivity is defined as the susceptibility of a household, community, or population to various exposures. In phase 1 of AusEnHealth, sensitivity has been considered against three separate exposures: extreme heat, extreme cold, and air pollution.

This document defines the parameters used in sensitivity sub-indices, a crucial component in the creation of AusEnHealth’s vulnerability indices. For more information, please see the AusEnHealth Methods Report, hosted at <https://frontiersi.com.au/ausenhealth-digital-twin/>.

## Climate (Extreme Heat, Extreme Cold)

Parameters Specific to Climate

| **Parameter** | **Description and Derivation** |
| --- | --- |
| AST | Estimated number of people with asthma (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the chronic disease estimates dataset. |
| rsAST | A spatial percentile ranking of the AST parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| COPD | Estimated number of people with chronic obstructive pulmonary disease (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the chronic disease estimates dataset. |
| rsCOPD | A spatial percentile ranking of the COPD parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| RESP | Estimated number of people with respiratory system disease (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the chronic disease estimates dataset. |
| rsRESP | A spatial percentile ranking of the RESP parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |

## Air Quality

Parameters Specific to Air Pollution

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| **Parameter** | **Description and Derivation** |
| BP | Estimated number of people aged 18 years and over who had high blood pressure (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the adult risk factor estimates data. |
| rsBP | A spatial percentile ranking of the BP parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| BC | Estimated number of people aged 18 years and over with high blood cholesterol (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the chronic disease estimates dataset. |
| rsBC | A spatial percentile ranking of the BC parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| CS | Estimated number of people aged 2 years and over with circulatory system diseases (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the chronic disease estimates dataset. |
| rsCS | A spatial percentile ranking of the CS parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| VD | Estimated number of people with heart, stroke, and vascular disease (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the chronic disease estimates dataset. |
| rsVD | A spatial percentile ranking of the VD parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |

## Common

Parameters Utilised in Both Climate and Air Quality Adaptive Capacity Sub-Indices

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| --- | --- |
| **Parameter** | **Description and Derivation** |
| PD | Population density (population/km2). |
|  | This parameter is derived from two sources of Australian Bureau of Statistics (ABS) data. Total population counts were attained from the ABS Data by Region catalogue (Population and People dataset), and were divided by region area in kilometres squared, attained from ABS ASGS region shapefiles. |
| rsPD | A spatial percentile ranking of the PD parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| MI | Median employee income ($). |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Income dataset. |
| rsMI | A spatial percentile ranking of the MI parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| LI | Persons earning $1-$499 per week (%). Otherwise referred to as percentage of low income (LI) persons. |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Income dataset. |
| rsLI | A spatial percentile ranking of the LI parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| HS | Completed year 12 or equivalent (%). Otherwise referred to as percentage of persons who have completed high school (HS). |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Education and Employment dataset. |
| rsHS | A spatial percentile ranking of the HS parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| UR | Unemployment rate (%). |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Education and Employment dataset. |
| rsUR | A spatial percentile ranking of the UR parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| ELD | Persons 65+ years old (%). |
|  | This parameter is derived from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter is the sum of the “Persons 65-69 (%)”, through to the “Persons 85 and over (%)” parameters in the Population and People dataset. |
| rsELD | A spatial percentile ranking of the ELD parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| INF | Persons 0-4 years old (%). |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Population and People dataset. |
| rsINF | A spatial percentile ranking of the INF parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| SP | One parent families with children under 15 and/or dependent students (%). |
|  | This parameter is derived from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter is the “One parent families with children under 15 and/or dependent students (no.)” parameter divided by the “Total families (no.)” parameter, both from the Population and People dataset. |
| rsSP | A spatial percentile ranking of the SP parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| UC | Unpaid childcare (%). |
|  | This parameter is derived from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter is the sum of the “Persons who care for own child/children (%)”, “Persons who cared for other child/children (%)”, and “Persons who cared for own child/children and other child/children (%)” parameters, all from the Family and Community dataset. |
| rsUC | A spatial percentile ranking of the UC parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| ASS | Persons who have need for assistance with core activities (%). |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Health and Disability dataset. |
| rsASS | A spatial percentile ranking of the ASS parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| WD | Persons with a disability (%). |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Health and Disability dataset. |
| rsWD | A spatial percentile ranking of the WD parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| LA | Lone person households (%). Otherwise referred to as percentage of people living alone (LA). |
|  | This parameter is derived from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter is the “Lone person households (no.)” parameter divided by the “Total households (no.)” parameter, both from the Family and Community dataset. |
| rsLA | A spatial percentile ranking of the LA parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| SL | Speaks a language other than English at home (%). Otherwise referred to as percentage of people primarily speaking a second language (SL). |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Population and People dataset. |
| rsSL | A spatial percentile ranking of the SL parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| IND | Aboriginal and Torres Strait Islander Peoples (%). Otherwise referred to as indigenous (IND) percentage. |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Population and People dataset. |
| rsIND | A spatial percentile ranking of the IND parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| MH | Campervans (%). |
|  | This parameter is derived from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter is the “Campervans (no.)” parameter divided by the “Total registered motor vehicles (no.)” parameter, both from the Economy and Industry dataset. |
| rsMH | A spatial percentile ranking of the MH parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| CD | Dwellings with extra bedrooms needed (%). Otherwise referred to as the percentage of crowded dwellings (CD). |
|  | This parameter is derived from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter is the “Dwellings with extra bedrooms needed (no.)” parameter divided by the “Total private dwellings (no.)” parameter, both from the Family and Community dataset. |
| rsCD | A spatial percentile ranking of the CD parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| RD | Rented private dwellings (%). |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Family and Community dataset. |
| rsRD | A spatial percentile ranking of the RD parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| MP | Owned private dwellings with a mortgage (%). Otherwise referred to as percentage of mortgage payers (MP). |
|  | This parameter is shared directly from the Australian Bureau of Statistics (ABS) Data by Region Catalogue. Specifically, this parameter has been accessed from the Family and Community dataset. |
| rsMP | A spatial percentile ranking of the MP parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| ALC | Estimated number of people aged 15 years and over who consumed more than two standard alcoholic drinks per day on average (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the adult risk factor estimates dataset. |
| rsALC | A spatial percentile ranking of the ALC parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| OB | Estimated number of people aged 18 and over who were obese (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the adult risk factor estimates dataset. |
| rsOB | A spatial percentile ranking of the OB parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| OW | Estimated number of people aged 18 and over who were overweight, but not obese (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the adult risk factor estimates dataset. |
| rsOW | A spatial percentile ranking of the OW parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |
| SMO | Estimated number of people aged 18 and over who were current smokers (age-standardised rate per 100). |
|  | This parameter is shared directly from the Public Health Information Development Unit (PHIDU) Social Health Atlas, specifically from the adult risk factor estimates dataset. |
| rsSMO | A spatial percentile ranking of the SMO parameter, in ascending order from lowest to highest. |
|  | For derivation, see the Spatial Ranking section at the bottom of the document. |

## Spatial Ranking

Methodology Applied to all Spatially Ranked Parameters

A number of parameters are converted to spatially ranked percentiles for use in the creation of overall vulnerability indices. As this method is frequently applied, a small summary of the method is given below.

Spatially ranked percentiles are created in AusEnHealth by taking national data for a parameter at a specific time, and using Rstudio’s frank function to produce, in ascending order, indexed spatial ranks. Arguments are selected in the frank function to continue recording missing values (na.last = "keep"), and to set ties as the minimum rank of the set of tied values (ties.method = c("min")). The result is then divided by the number of regions to produce a percentile ranking, which provides a consistent scale from 0 to 1 for index creation.

A spatial percentile represents how high or low that parameter is compared to the rest of Australia at that time. For example, if a region’s temperature spatial percentile is 1 in January 2011, that means that region is the hottest in Australia for the month of January 2011.