



Office for Health
Improvement
& Disparities

Public Health Outcomes Framework: Method for the Slope Index of Inequality Indicators

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1. Introduction

The Public Health Outcomes Framework (PHOF) includes the following overarching indicators, based on the slope index of inequality (SII):

- A02a: Inequality in life expectancy at birth and at age 65
- A02b: Inequality in healthy life expectancy at birth ENGLAND
- A02c: Inequality in healthy life expectancy at birth LA

This document explains the method used to calculate these SIIs and provides guidance on interpretation.

2. Slope index of inequality

The SII is a measure of the social gradient in an indicator, i.e. how much an indicator varies with deprivation. It takes account of health inequalities across the whole range of deprivation within an area and summarises this in a single number. This represents the range in indicator values across the social gradient from most to least deprived.

3. Slope index of inequality method

The chart in Figure 1 based on life expectancy at birth shows how the SII is calculated. The population has been divided by level of deprivation, based on the Index of Multiple Deprivation¹. This has been done by ranking Lower Super Output Areas (LSOAs) from most to least deprived. These have then been divided into 10 groups, or deprivation deciles, with approximately equal numbers of LSOAs in each. Decile 1 contains people living in the most deprived areas and Decile 10 contains people in the least deprived areas. Life expectancy at birth has been calculated for each of these deciles, illustrated by the dark blue dots in Figure 1.

¹ <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019>

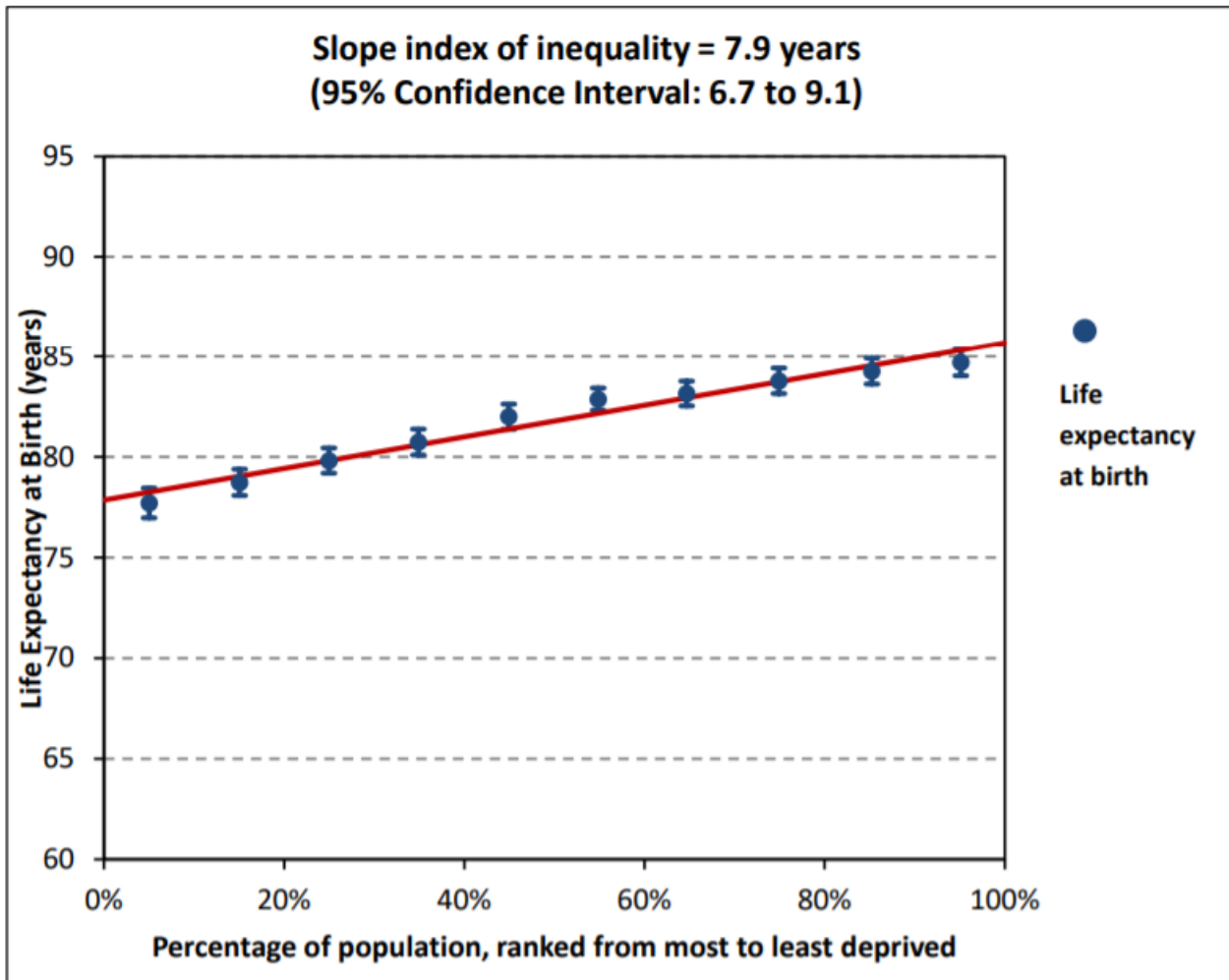


Figure 1: Life expectancy by deprivation decile and the slope index of inequality

The life expectancy figures have also been plotted to take account of their population size. While the deprivation deciles have roughly one-tenth of the population in each, they are not precisely equal because they are aggregated up from LSOAs. The horizontal x-axis along the bottom of the chart in Figure 1 represents the whole population of an area. The blue dots in Figure 1 represent the life expectancy for each deprivation decile. If Decile 1 includes exactly 10% of the population, the first blue dot is positioned at 5%, the mid-point of the range of population covered by that decile. If the second decile includes 11% of the population, this would cover the range from 10% to 21%, so the midpoint is 15.5%, and that is where the point would be located on the x-axis.

The red line on the chart is a linear regression line of best fit for the data, calculated by the least squares method. The SII is simply the gradient of that line, or the difference between the top of the line (at 100% on the horizontal axis) and the bottom (0% on the horizontal axis) and represents the hypothetical absolute difference in life expectancy between the extremes of deprivation within the area as a whole. In the example in Figure 1, the regression line goes from 78.0 to 85.9 years. This gives an SII of 7.9 years (with a 95% confidence interval of 6.7 to 9.1 years). The range in life

expectancy across the social gradient from most to least deprived in this area is therefore 7.9 years. An SII of zero indicates there is no inequality. Confidence intervals are calculated around the gradient of the regression line using the simulation method described in the Fingertips technical guide for confidence intervals signposted below.

In some local authorities a meaningful life expectancy or health life expectancy estimate cannot be calculated for every deprivation decile. In these cases, an SII has not been calculated.

When calculating the SII for life expectancy and healthy life expectancy we assume that there is a linear relationship between the indicator decile values and deprivation.

The [Fingertips guidance page on public health methods](#) provides links to documents in support of the SII method including:

- Indices of Multiple Deprivation: an explanation of how the Index of Multiple Deprivation is applied over time
- Assigning Deprivation Categories: an explanation of how LSOAs are assigned to deprivation deciles prior to calculation of the SII
- Confidence Intervals: an explanation of the simulation method used to calculate confidence intervals for the SII

4. Slope index of inequality interpretation

Inequality in life expectancy

The PHOF inequality indicators for life expectancy at birth and life expectancy at age 65 are presented for England, English regions, and upper and lower tier local authorities.

Comparison across geographical levels

The SII for England should not be considered as a comparator for the regional or local authority figures. This is because the SII for England takes account of the full range of LSOA deprivation and mortality across the whole country, whereas the SIIs for English regions and local authorities only take into account the range of LSOA deprivation and mortality within those smaller geographies. Some local authorities will not have any of their population resident in LSOAs which are classified as amongst the least or most deprived deciles in England.

For this reason, the life expectancy SII results for local authorities in the PHOF tool are not colour coded to show whether they are statistically higher or lower than the England value.

Comparison within a geographical level

While the SII is broadly comparable between areas at the same geographical level, the deprivation deciles are defined separately for each local authority based on the local range of deprivation in the area. The most deprived 10% of the population in a local authority with a high level of deprivation might not therefore be comparable with the most deprived 10% of the population in a more affluent local authority. When interpreting the slope index figures it is therefore important to consider them in the context of the local authority's overall life expectancy at birth (Indicator A01b).

Some local authorities have more diverse populations than others, in terms of deprivation. Because life expectancy and deprivation are so strongly correlated, local authorities with a wider range of deprivation will tend to have greater ranges of life expectancy and therefore a larger SII.

Inequality in healthy life expectancy

The PHOF inequality indicators for healthy life expectancy are presented for England, and upper tier local authorities. These are presented as two different indicators in PHOF because the local authority inequality indicator uses an alternative data source for the self-reported general health part of the indicator methodology. For this reason, the England and local authority indicators should not be compared.

England method

The England inequality in healthy life expectancy indicator follows the method described for indicator A01a: Healthy life expectancy and assigns LSOAs to deprivation deciles using the method described above.

Local authority method

The local authority inequality in healthy life expectancy indicator uses data from the 2011 Census for the self-rated general health part of the healthy life expectancy methodology (since this is available at small area level) instead of the ONS Annual Population Survey used by indicator A01a: Healthy life expectancy. The use of the 2011 Census, means that this indicator includes data on self-rated health for residents of communal establishments. The inequality indicator then uses Middle Super Output Areas (MSOAs) to generate deprivation deciles within each local authority in calculation of the SII as the data are not available at LSOA level.

The local authority figures are based on data from the 2011 Census and so are produced for one time point only (2009-2013). The figures are taken from an ONS report (produced in conjunction with Public Health England) on inequalities in healthy life expectancy and disability-free life expectancy:

<https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/bulletins/inequalityinhealthandlifeexpectancieswithinuppertierlocalauthorities/2009to2013>

5. Contact

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