**The Segment Tool**

**Update – May 2016**

**Technical document**

1. **Introduction**

This paper describes the data and methods used in the Segment tool, which was first published by Public Health England (PHE) in January 2014, and most recently updated in May 2016.

The tool is available in Excel format and can be downloaded from here:

[fingertips.phe.org.uk/profile/segment](http://fingertips.phe.org.uk/profile/segment).

An accompanying user guide provide more information on how to interpret results from the tool, along with a set of frequently asked questions.

1. **Areas included**

The tool provides data for upper and lower tier local authorities in England. Data for City of London and Isles of Scilly have not been included because of the small number of deaths in these areas.

1. **Time period**

The tool is based on deaths registered in 2012-14

1. **Comparisons available**

The tool currently allows two comparisons to be made.

1. The gap between the local authority as a whole and England as a whole
2. The gap between the most deprived quintile in the local authority and the least deprived quintile in the local authority.

For the purpose of this paper the area of interest is referred to as the ‘base area’ and the area that it is being compared to is referred to as the ‘comparator area’. In comparison 1, the base area is the local authority as a whole and the comparator area is England, and in comparison 2 the base area is the most deprived quintile in the local authority and the comparator area is the least deprived quintile in the local authority.

The tool provides data for all local authorities, irrespective of whether the life expectancy of the base area is higher or lower than the comparator area. This is so that every local authority can view the causes of death which are driving either low or high life expectancy in their area, and identify causes which may be reducing life expectancy in the area, even if the overall life expectancy in the local authority is high in relation to the comparator.

1. **Determining the most and least deprived quintiles in a local authority**

Each local authority was divided into quintiles based on Lower Super Output Area (LSOA) level Index of Multiple Deprivation (IMD) 2015 scores. The method used to assign each LSOA to a quintile is consistent with that used in previous versions of the tool. The method used is described in Appendix 1.

1. **Disease groups**

 The Segment tool presents data on the contribution to the life expectancy gap for three separate disease groupings: a small number of broad causes of death, a more detailed list of causes of death and deaths from alcohol specific causes.

Cause groups have been defined using International Classification of Diseases, Tenth Revision (ICD-10) codes and the groupings used are specified below.

1. *Broad causes*

These cause categories have been used to provide an overview of the causes of death which drive life expectancy. The data from these cause groups has been used to create the scarf charts presented in the Segment tool. Bar charts showing the number of life expectancy years lost or gained for each of the broad causes are also presented in the tool.

|  |  |
| --- | --- |
| **Broad cause** | **ICD-10 codes** |
| Circulatory diseases | I00-I99 |
| Cancer | C00-C97 |
| Respiratory diseases | J00-J99 |
| Digestive diseases | K00-K93 |
| External causes | V00-Y98 |
| Mental and behavioural disorders | F00-F99 and G30\* |
| Other | All remaining ICD-10 codes |
| Deaths under 28 days | ICD-10 code not assigned |

**\*** G30 – Alzheimer’s disease with early onset has been included in mental and behavioural disorders so that all dementia codes are together

1. *Detailed causes*

These cause categories have been used to provide a more detailed insight into the impact of causes of death on life expectancy, by providing further breakdowns under each broad cause category listed in section a. The years of life expectancy gained or lost if the base area had the same mortality rate as the comparator area for each of these causes is presented in the Segment tool.

|  |  |  |
| --- | --- | --- |
| **Broad cause** | **Detailed cause** | **ICD-10 codes** |
| Circulatory diseases | Coronary heart disease | I20-I25 |
| Stroke | I60-I69 |
| Other circulatory diseases | Rest of I00-I99 |
| Cancer | Lung cancer | C33, C34 |
| Other cancers | Rest of C00-C97 |
| Respiratory diseases | Pneumonia | J12-J18 |
| Chronic obstructive airways disease | J40-J44 |
| Other respiratory diseases | Rest of J00-J99 |
| Digestive diseases | Chronic liver disease including cirrhosis | K70, K73-74 |
| Other digestive diseases | Rest of K00-K99 |
| External causes | Suicide | X60-X84, Y10-Y34 (ages 15+ only) |
| Other external causes | Rest of V00-Y99 and U50 |
| Mental and behavioural disorders | Dementia | F01, F03, G30 |
| Other mental and behavioural disorders | Rest of F00-F99 |
| Other causes | Infectious and parasitic diseases | A00-B99 |
| Urinary conditions | N00-N39 |
| Ill-defined conditions | R00-R99 |
| Diabetes | E10-E14 |
| Other | All remaining ICD-10 codes |
| <28 days | Deaths under 28 days | ICD-10 code not assigned |

Deaths in the ‘other’ category include: benign neoplasms, metabolic diseases, diseases of the nervous system, eye, ear, and skin; musculoskeletal diseases, perinatal conditions, congenital diseases and conditions related to pregnancy and birth.

1. *Alcohol*

This category provides data on the impact of alcohol specific deaths on life expectancy. This only includes causes of death that are wholly attributable to alcohol.

|  |  |
| --- | --- |
| **Cause** | **Description and ICD-10 codes** |
| Alcohol specific deaths |

|  |  |
| --- | --- |
| Alcohol-induced pseudo-Cushing's syndrome | E24.4 |
| Mental and behavioural disorders due to use of alcohol | F10 |
| Degeneration of nervous system due to alcohol | G31.2 |
|  Alcoholic polyneuropathy | G62.1 |
| Alcoholic myopathy | G72.1 |
| Alcoholic cardiomyopathy | I42.6 |
| Alcoholic gastritis | K29.2 |
| Alcoholic liver disease | K70 |
| Alcohol-induced acute pancreatitis | K85.2 |
| Alcohol-induced chronic pancreatitis | K86.0 |
| Fetal alcohol syndrome (dysmorphic) | Q86.0 |
| Excess alcohol blood levels | R78.0 |
| Accidental poisoning by and exposure to alcohol | X45 |
| Intentional self-poisoning by and exposure to alcohol | X65 |
| Poisoning by and exposure to alcohol, undetermined intent | Y15 |
| Evidence of alcohol involvement determined by blood alcohol level | Y90 |
| Evidence of alcohol involvement determined by level of intoxication | Y91 |

 |

1. **Extraction of deaths data**

Deaths were extracted for the causes within the three groupings listed above for the years 2012, 2013 and 2014. Comparability ratios were applied to the 2012 and 2013 deaths to account for changes implemented by ONS to coding causes of death in 2014.

Comparability ratios rounded to three decimal places were used in this analysis.

A list of comparability ratios used in the Segment Tool can be downloaded from the webpage. Further information on the changes to coding of underlying cause of death and details of comparability ratios can be found in a PHE briefing here:

[www.apho.org.uk/resource/view.aspx?RID=184800](http://www.apho.org.uk/resource/view.aspx?RID=184800)

1. **Population data**

For the breakdown of the gap between a local authority/region as a whole and England, ONS mid-year estimates for local authorities for the years 2012, 2013 and 2014 were pooled.

For the breakdown of the gap between the most deprived quintile and the least deprived quintile in each area, ONS mid-year estimates for LSOAs for the years 2012, 2013 and 2014 were aggregated to quintiles and pooled.

1. **Method used to determine the number of years of life expectancy lost/gained and the contribution of diseases to the gap**

The number of years of life expectancy that would be lost or gained if the base area had the same age specific mortality rates as the comparator area was calculated for each of the causes within each of the three cause groupings.

For the broad cause grouping the percentage contribution of each cause to the life expectancy gap is also calculated and this is displayed in the ‘scarf’ charts to show the drivers of the life expectancy gap in the area.

The calculations were carried out for each of the three causes groupings specified in section 6. For all three cause groupings, stages 1 to 3 were completed. For the broad cause grouping, stages 1-5 were completed. Stages 4 and 5 are required to produce the figures for the scarf charts.

Stage 1: Calculate the adjusted number of deaths in each area if the comparator rate applied

The sex and age-specific expected number of deaths that would occur in the base area if it had the same mortality rate (for each of the specific causes of death) as the comparator area was calculated using the formula below.

Adjusted deaths

**=**

Deaths from all causes in the base area

**\_**

Deaths from the specific cause in the base area

**+**

Death rate from the specific cause in the comparator area

Population in the base area

**\***

Stage 2: Calculate an adjusted life expectancy for each cause.

This adjusted number of deaths calculated in stage 1 was used to calculate an adjusted life expectancy for each of the cause categories.

Stage 3: Calculate the years of life gained or lost for each cause if the mortality rate of the comparator was achieved.

The adjusted life expectancy calculated in stage 2 was subtracted from overall unadjusted life expectancy in the base area to give the number of years of life expectancy that would be gained or lost in the base area if it had the same mortality rate as the comparator area. A positive figure means that life expectancy years would be gained if the base area had the same age specific mortality rates as the comparator area, whereas a negative figure means that life expectancy years would be lost if the base area had the same age specific mortality rate as the comparator area.

The figures calculated in this stage are used to produce the bar charts in the tool.

Calculation of excess deaths for the period.

The number of excess deaths for each cause is calculated by subtracting the total number of adjusted deaths (from stage 1) from the total number of deaths in the base area.

Stage 4 (Broad causes only): Remove the figures for causes where life years were lost during the adjustment

The percentage contribution to the gap is only calculated for causes of death where there were excess deaths compared to the comparator area – in other words, causes of death where the mortality rate was worse in the base area than the comparator. Therefore, figures from stage 3 were removed if they were negative.

Stage 5 (Broad causes only): Calculate the percentage contribution to the gap of each of the causes.

Causes remaining after stage 4 all make a contribution to the gap. The contribution in years of each cause is summed, and a percentage of the total is calculated for each cause in turn. These are the figures which appear in the scarf charts.

1. **Worked example (uses dummy data, figures only shown to 1 decimal place)**

Base area (Local Authority X) has a life expectancy of 76.4 years for males

Calculated using the formula in stage 1 above

*Stage 1*

Example table showing calculation for cancer for local authority X.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | Stage 1 |
| Age group | Deaths from cancer in local authority X | Total deaths in local authority X | Population in local authority X | Deaths from cancer in England | Population in England | Adjusted deaths for life expectancy calculation |
| <1 | 0 | 10 | 2000 | 0 | 1,050,000 | 10 |
| 01-04 | 0 | 0 | 7000 | 0 | 4,000,000 | 0 |
| 05-09 | 0 | 0 | 8000 | 0 | 4,500,000 | 0 |
| 10-14 | 0 | 0 | 9000 | 0 | 4,800,000 | 0 |
| 15-19 | 0 | 10 | 10000 | 0 | 5,000,000 | 10 |
| 20-24 | 0 | 10 | 10000 | 0 | 5,500,000 | 10 |
| 25-29 | 0 | 10 | 10000 | 0 | 5,500,000 | 10 |
| 30-34 | 0 | 10 | 10000 | 0 | 5,000,000 | 10 |
| 35-39 | 0 | 20 | 10000 | 0 | 5,500,000 | 20 |
| 40-44 | 10 | 40 | 10000 | 300 | 6,000,000 | 31 |
| 45-49 | 10 | 30 | 10000 | 600 | 5,500,000 | 21 |
| 50-54 | 10 | 40 | 10000 | 1300 | 5,000,000 | 33 |
| 55-59 | 10 | 70 | 10000 | 3000 | 4,500,000 | 67 |
| 60-64 | 20 | 100 | 10000 | 5000 | 4,500,000 | 91 |
| 65-69 | 15 | 120 | 5000 | 7000 | 3,500,000 | 115 |
| 70-74 | 35 | 180 | 5000 | 8000 | 3,000,000 | 158 |
| 75-79 | 20 | 220 | 5000 | 8000 | 2,000,000 | 220 |
| 80-84 | 20 | 220 | 2000 | 8000 | 1,500,000 | 211 |
| 85+ | 10 | 300 | 2000 | 7000 | 1,000,000 | 304 |

This calculation would be repeated for all causes within local authority X and the results used to calculate an adjusted life expectancy.

Adjusted life expectancy after cancer adjustment in local authority X = 77.2 years

*Stages 2 - 5*

Table compiled following calculation of adjusted life expectancy for local authority X

Adjusted life expectancy – life expectancy in the base area

(77.0 -76.4)

Negative values removed

Life expectancy in base area: 76.4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Stage 2 | Stage 3 | Stage 4 | Stage 5 |
| Cause of death  | Adjusted life expectancy | Years of life gained/lost | Years of life gained  | Percentage contribution to gap |
| Circulatory diseases | 77.0 | 0.6 | 0.6 | 21.4 |
| Cancer | 77.2 | 0.8 | 0.8 | 28.6 |
| Respiratory diseases | 76.6 | 0.2 | 0.2 | 7.1 |
| Digestive diseases | 75.6 | -0.8 |   |   |
| External causes | 76.9 | 0.5 | 0.5 | 17.9 |
| Mental and behavioural disorders | 76.2 | -0.2 |   |   |
| Other | 77.1 | 0.7 | 0.7 | 25.0 |
| Deaths under 28 days | 76.4 | 0 | 0 | 0.0 |
| **Sum** |  |  | **2.8** |  |

Years of life gained / total years of life gained \*100

(0.7/2.8 \*100)

Total years of life gained

1. **Methodological differences between May 2016 version of the Segment Tool and the previous version (January 2015)**

There are two differences between this version of the Segment Tool and the previous versions which mean the results are not directly comparable. These are:

* Update to use the new Index of Multiple Deprivation 2015 to define the most and least deprived areas. In the last version, the most and least deprived areas were defined using the Index of Multiple Deprivation 2010.
* Adjustment of counts of deaths to take account of changes in ICD-10 coding made in 2014

For more details about these changes, please see sections 5 and 7 of this document.

**Appendix 1: Method used to assign LSOAs to deprivation quintiles**

To assign LSOAs to deprivation categories, the LSOAs were first sorted from most to least deprived within each area,  using the IMD 2015 scores, before being divided into quintiles.

Where the number of LSOAs within an area was exactly divisible by the number of deprivation categories, this could be done precisely. E.g. Where there are 150 LSOAs within a local authority (LA), each deprivation quintile in that LA has 30 LSOAs. Where the number of LSOAs was not exactly divisible, then the ‘extra’ LSOAs were allocated to deprivation categories in a systematic way.

The number of LSOAs was divided by the number of deprivation categories to derive the number after the decimal point. E.g. If assigning 163 LSOAs to deprivation quintiles within an LA then the number after the decimal point is 3 (163/5 = 32.6). In this case the three 'extra' areas were assigned to the 1st, 2nd and 4th quintiles.

The table below shows the quintiles which receive extra LSOAs, depending on the number after the decimal point. In these tables, the first quintile is the most deprived, and it can be seen that the 'extra' LSOAs have been weighted towards the most deprived categories rather than the least.

|  |  |
| --- | --- |
| **Number after the decimal point** | **Quintiles allocated 'extra' LSOAs** |
| .2 | 1 |
| .4 | 1, 3 |
| .6 | 1 ,2, 4 |
| .8 | 1, 2, 3, 4 |