

Life expectancy at birth for wards in England and Wales, 1999-2003 (experimental statistics).

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This report accompanies results released on the National Statistics website on 29th June 2006:

<http://www.statistics.gov.uk/statbase/Product.asp?vlnk=14466>

1. Background

In 2001 ONS reported on geographical differences in life expectancy at birth across the United Kingdom using data from 1995-1997.¹ This article found large inequalities in life expectancy between local authorities in the UK but noted that the analysis was subject to a number of limitations. As local authorities vary substantially in size an analysis at this geographical level could not examine variations in life expectancy within large authorities such as Birmingham and Manchester. It was also noted that there are known to be substantial variations in mortality at small area level within most local authorities that cannot be captured by authority level analysis.²

ONS has continued to report annually on life expectancy at birth figures for health and local authorities in the UK:

<http://www.statistics.gov.uk/statbase/Product.asp?vlnk=8841>

This report is the first time that ONS has tested methods for calculating life expectancy figures for areas smaller than local authorities. The results have been produced as a means of assessing the mortality experience of wards in 1999-2003.

These life expectancy results are one of a number of measures of mortality that ONS has been developing in order to provide information on health-related data for small populations via the Neighbourhood Statistics Service (NeSS). Although these figures are being released first on the National Statistics website they will also be transferred to the NeSS site.

Standardised Mortality Ratios for those aged under 85 for wards in England and Wales were also released on the National Statistics website in April 2006:

<http://www.statistics.gov.uk/statbase/Product.asp?vlnk=14359>

2. Definition and interpretation of life expectancy at birth

Life expectancy at birth for a ward in 1999-2003 is an estimate of the average number of years a newborn baby would survive if he or she experienced the particular ward's age-specific mortality rates for that time period throughout his or her life. The figure reflects mortality among those living in the ward in 1999-2003, rather than mortality among those born in each area. It is not therefore the number of years a baby born in the ward in 1999-2003 could actually expect to live, both because the death rates of the area are likely to change in the future and because many of those born in the ward will live elsewhere for at least some part of their lives.

Life expectancy at birth is also not a guide to the remaining expectation of life at any given age. For example, if female life expectancy was 80 years for a particular ward, life expectancy of women aged 75 years in that area would exceed 5 years. This reflects the fact that survival from a particular age depends only on the mortality rates beyond that age, whereas survival from birth is based on mortality rates at every age.

The ward-level life expectancy figures are often based on rather small numbers of deaths. As these will be affected by some random variation the results are therefore subject to some margin of error. Consequently 95 per cent confidence intervals have been calculated for these figures. For comparisons between areas, the confidence intervals allow differences which are statistically significant at the 95 per cent level (confidence limits do not overlap) to be distinguished from those more likely to result by chance (confidence limits do overlap).

For example, in Minehead North in West Somerset life expectancy at birth for males is 78.1 years, which is higher than life expectancy for males in England and Wales (75.9 years). As the lower confidence interval for this ward is lower than the upper confidence limit for England and Wales (75.6 compared to 75.9) this means however that the higher life expectancy in this ward may be the result of chance.

Quarme ward, also in West Somerset, also has a male life expectancy which is higher than that for England and Wales (80 years compared to 75.9 years). As its lower confidence interval (77.2 years) is higher than the upper confidence for England and Wales the life expectancy in this ward is statistically higher than the national figure, i.e. there is less than a one in twenty chance of the figures differing as a result of statistical variation.

3. Data used in the calculations

The mortality data used in the life table calculations were deaths registered in each year from 1999-2003. Five years of data were aggregated to try and provide a reasonable numbers of deaths for each ward. The period 1999-2003 was selected so

that we would have data centred on 2001 – the first year for which ward population estimates were available.

Deaths were allocated to 2001 Census Standard Table wards based on the postcode from the address recorded as the deceased's usual residence by the informant at death registration. Deaths were assigned to wards using the May 2005 version of the All Fields Postcode Directory (now known as the National Statistics Postcode Directory).

For all persons the mean number of deaths in wards in 1999-2003 was 306 but numbers ranged from 9 to 1,806.

The ward populations used in the calculations were 2001 experimental population estimates for Census wards. These were released by ONS in April 2005 and are available on the National Statistics website:

<http://www.statistics.gov.uk/statbase/Product.asp?vlnk=13893>

Following their release errors were identified and corrected in the boundaries of 23 wards. The life expectancy results have been produced using these corrected boundaries and so deaths were also assigned to the same consistent areas.

Due to the small populations of the City of London and Isles of Scilly, population estimates were not produced for the individual wards within these local authorities. Life expectancy figures are therefore reported at local authority rather than ward-level for these two areas.

The mean population of the 2001 wards was 5,950 with a range from 995 to 35,770.

In order to provide a population at risk for the period 1999-2003 the 2001 population estimates were multiplied by 5 in the life table calculations.

4. Methods of calculation

Life expectancy results for local authorities have been calculated by ONS using abridged life tables where deaths and populations are aggregated into age groups (rather than complete life tables which are calculated using data by single year of age). The life table model used in these calculations was taken from that developed by Chiang.³

In 2003 ONS reviewed whether the Chiang method was the most suitable for use in the production of life expectancy results for small populations and whether this could also be used to calculate standard errors on which confidence intervals could be based. It also considered other methodological questions such as what was the smallest population for which meaningful life expectancy results could be calculated. A summary of this work was published in the National Statistics Methodological Series:

<http://www.statistics.gov.uk/statbase/Product.asp?vlnk=10626>

This report concluded that the Chiang method was suitable for calculating life expectancy at birth, and standard errors, at ward-level. It also concluded that consistently reliable and robust calculations of life expectancy at birth, and standard errors, could not be made for populations of less than 5,000. For populations of 5,000 and over, life expectancy and standard error results approximated well to reference data based on real underlying mortality rates from the English Life Tables.

A report based on work conducted for the South East Public Health Observatory published in 2004 also reached similar conclusions.⁴

The ONS report also considered whether adjustments should be made to the abridged life tables to help present a more accurate estimation of possible variance, such as by imputing a value into age bands where there were no deaths or adjusting age-specific death rates in the highest age band (ages 85+). The report concluded that no imputation should be made where there were zero deaths and that the option of adjustment of death rates in the highest age band would require further assessment.

The experimental life expectancy results follow the recommendations in the methodology report and figures have therefore not been calculated where the population at risk was less than 5,000 in the period 1999-2003. No adjustment has been made to death rates for those aged 85+ and no values have been imputed into age groups where there were zero deaths. However in some cases, such as when there were no deaths or no populations in the final age band the life expectancy calculation fails. In cases like these a modification has therefore been made. The wards which have been subject to adjustment are indicated in the tables of results. A template which illustrates the life table method used in the calculation of these results is available on the National Statistics website:

<http://www.statistics.gov.uk/statbase/Product.asp?vlnk=14466>

This also gives example of the types of adjustments made to a small number of wards.

5. Contents of the tables of results

Three tables of ward-level results have been produced for all persons, males and females.

The ONS review of methodological options for calculating life expectancy for small populations concluded that results should not be produced for populations under 5,000. The 2001 experimental ward estimates were used to assess how many wards met this criteria. As deaths were aggregated over a 5 year period the population estimates for 2001 were also multiplied by 5 to give a population at risk for the period 1999-2003. The ward population in 2001 therefore needed to be 1,000 or more for a life expectancy result to be calculated. For all persons all but one ward met this threshold. The one exception was Ennerdale ward in Copeland local authority in Cumbria. As the population there was only just below the threshold (995 persons) it was decided not to exclude it and so the table of results for all persons includes

figures for all Census Standard Table wards in England and Wales (except for the City of London and Isles of Scilly where results are reported at local authority level).

For all persons life expectancy at birth figures are presented for 8,797 wards. For males 1,071 wards with a 2001 population below 1,000 were excluded and results are thus presented for 7, 726 wards. 910 wards where the 2001 female population was below the threshold were also excluded and results thus included for 7,887 wards.

Each table includes the 2001 Census Standard Table ward name and code for all of these areas in England and Wales. Local authority and Government Office Region codes for each ward are also provided (a look-up file for these names and codes is available on the National Statistics website).

The life expectancy results were calculated with 95 per cent confidence intervals and the upper and lower confidence limits are presented in the tables. Notes on the interpretation of these are included in Section 2.

The 2001 experimental ward population estimate for each ward is included. These figures were multiplied by 5 in the life table calculations to give a population at risk for the period 1999-2003.

To give a simple indication of how each ward ranks within results for England and Wales the life expectancy results for all persons were ordered from highest to lowest and then divided into fifths. The tables of results indicate in which of these quintiles each ward lies. For example Burwell ward in East Cambridgeshire is in Quintile 1 and is thus among the fifth of wards in England and Wales which have the highest life expectancy. Quintile 5 includes those wards with the lowest life expectancies. As results were not calculated for all wards for males and females the quintiles are only presented in the table for all persons.

As noted in Section 4, where the life table calculation has been adjusted for a ward this is indicated. Types of modification made are listed within the tables of results.

The final column in the tables is an indicator of the proportion of the 2001 population of each ward aged 65 and over which was resident in a 'Medical and Care' communal establishment. The calculation of this indicator is described in more detail in Section 9.

Wards within the tables have been listed in order of their ward code. They can be sorted within the Excel spreadsheets though so that results can be listed within Government Office Regions, for example, or sorted into highest and lowest.

6. Comparison with figures for local authorities and regions

Life expectancy results for local authorities and Government Office Regions (GORs) have also been calculated using the same method as the wards figures. They are also based on deaths from 1999-2003 and ward population estimates for 2001.

The ward estimates were aggregated up to local authority and GOR level for these calculations. In all but three cases the ward population estimates are consistent with mid-year population estimates for local authorities for 2001 published by the Population Estimates Unit at ONS.²

The three exceptions are the Welsh Unitary Authorities of Carmarthenshire, Ceredigion and Pembrokeshire. When the ward estimates were constrained to mid-year estimates for local authorities, special account was taken for the population change of around 1,100 persons (as at mid-2001) resulting from April 2003 boundary changes in these three areas. The ward counts for these areas, if aggregated to local authority level, are not consistent with the published mid-year estimates, as the latter boundaries are as at mid-2001, whereas the ward estimates reflect ward boundaries as at May 2003.

These results for local authorities and GORs have been provided purely for comparison purposes with the ward-level figures. ONS has also published annual results for local authorities and GORs based on three-year rolling averages from 1991-1993 to 2002-2004. These are based on deaths and mid-year population estimates for each three-year period and are available on the National Statistics website:

<http://www.statistics.gov.uk/statbase/Product.asp?vlnk=8841>

It is these results which are used to monitor the progress of the Government's health inequality target: to raise life expectancy in the most disadvantaged areas faster than elsewhere by 2010.

The three-year results have however always excluded figures for the local authorities of the City of London and Isles of Scilly. Life expectancy at birth for these two areas is therefore reported here for the first time.

7. Accuracy of results

The ward-level life expectancy results were calculated using STATA - a method which has been extensively tested in the production of figures for local authorities. To validate the results a duplicate set of figures were also calculated using Excel.

As ward-level Standardised Mortality Ratios (SMRs) have already been published by ONS checks were carried out to examine their consistency with the life expectancy figures. Although the SMRs were based on deaths under age 85 the two sets of results correlated well.

As many of the calculations were based on small numbers of deaths and populations some outlying results were found. The most extreme of these were investigated to verify the figures. Some of these extreme results are discussed further in Section 8.

8. Limitations of results

The 95 per cent confidence intervals which have been calculated for each life expectancy at birth result provide an indication of possible variation for each ward. As noted above many of these results are based on small numbers of deaths and populations. The confidence intervals for many wards are therefore wide. For results for all persons the interval between the upper and lower confidence intervals is around one and a half years for even the largest populations. For smaller populations the interval can be considerably wider and the biggest range was over 16 years. Some of the sex-specific results have even wider confidence intervals, even with the exclusion of the smallest wards. Such wide confidence intervals need to be considered when differences between areas are examined.

Where calculations are based on very small number of deaths and populations extreme values will also result which may be considered implausible. Moreton Hall in Suffolk, for example, has the highest life expectancy for all persons in 1999-2003 – 93.4 years. Female life expectancy at birth for this ward in 1999-2003 was almost 120 years (also the highest in England and Wales) but this was based on just 15 deaths across the 5 year period.

Similarly many of the results for the lowest life expectancy figures are in areas where the numbers of deaths and populations were very small. Some of these areas were also affected by local factors such as the presence of communal establishments. (This is discussed further in Section 9.)

Life expectancy is a measure of mortality in which deaths at younger ages are weighted more than deaths at older ages. In small populations the number of infant deaths can therefore have a large impact on the life expectancy at birth result.

In interpreting the results local knowledge and access to further information regarding the nature of the wards may be an important. ONS has been making local information for small areas available via the Neighbourhood Statistics Service:

<http://neighbourhood.statistics.gov.uk/dissemination/>

Other sources also provide information for wards such as the ONS 2001 Area Classification which groups wards according to key characteristics of their populations:

http://www.statistics.gov.uk/about/methodology_by_theme/area_classification/

To provide a measure of relative material deprivation for wards in England and Wales ONS also published Carstairs deprivation scores in 2005, based on data from the 2001 Census:

<http://www.statistics.gov.uk/statbase/Product.asp?vlnk=14068&More=n>

It should also be remembered that the population estimates used in the calculation of the life expectancy results are currently experimental. As the estimates used were only

for 2001 there are also possible numerator/denominator discrepancies with the mortality data which covered the period 1999-2003.

There are also limitations in methods used to assign deaths to ward boundaries. The allocation is made using the postcode of usual residence of the deceased. All deaths which share the same postcode are allocated to the same area, even when postcodes are divided by ward boundaries. The quality of allocation within the National Statistics Postcode Directory are also not the same for all postcodes. For example, for some recent postcodes allocation may be based on imputed grid references. Imputation may cause wrong assignments until data can be corrected, such as following clerical checks. Full details can be found in the postcode directory user guide:

<http://www.statistics.gov.uk/geography/afpd.asp>

9. Impact of Communal Establishments

A limitation of examining life expectancy for small populations is the potential impact that nursing homes and other communal establishments may have on mortality rates within wards. This impact was considered in a recent report which noted that age-specific death rates in nursing homes are higher than those found in the general population⁵ and examined what effect this would have on life expectancy figures for wards in the West Sussex local authority.⁶

By examining deaths of residents of nursing homes this research found that wards with a high proportion of nursing homes deaths tended to have lower life expectancy. It estimated that in those wards where 25% of deaths were of nursing home residents the life expectancy was reduced by about two years. This study only considered all persons but it did note that as most deaths in nursing homes are of women that for female life expectancy the impact could be even greater.

While the results for West Sussex, which has local authority populations with some of the oldest age structures in the country, may not be consistent elsewhere it is clear that ward-level life expectancy results need to be interpreted with additional information on the potential impact of nursing homes and other communal establishments.

ONS routinely codes the type of establishment where deaths took place (home, hospital, nursing home etc). It does not however currently code the type of establishment in which the deceased was normally resident. It is not possible therefore for a national study to duplicate the West Sussex research which identified deaths of nursing home residents by checking the postcodes and address text of deaths within the county.

Using data from the 2001 Census it has however been possible to identify the proportion of the population of wards which were resident in nursing homes, and other communal establishments, in 2001. Census data were used to tabulate counts of people by sex and age group who were resident in establishments defined in the Census outputs: nursing homes, residential homes, other Medical & Care establishments, all Medical & Care establishments, and all communal establishments.

As it was not possible to adequately identify separately residents from staff and their families, these tables included everyone who was resident in an establishment as recorded in the Census. (An article documenting this problem is anticipated for publication in Health Statistics Quarterly 31 in August 2006.)

These population counts were used to calculate the proportion of the population resident in each type of establishment in 2001. Rather than use counts of the total population from the 2001 Census the proportions were calculated using the same experimental ward population estimates for 2001 that the life expectancy figures were based on. These estimates largely reflect the 2001 Census counts but also take into account adjustments made to 2001 mid-year population estimates for local authorities where there was considered to be under reporting in the Census.

Analysis was undertaken which examined the correlation between the proportions of populations in communal establishments and life expectancy at birth. It was found that on average wards with higher proportions of their populations in communal establishments had lower life expectancy. This analysis was carried out for different age groups and different types of establishments. The conclusions from this study indicated that the best way to consider the impact on life expectancy at birth was to consider the proportion of the ward population aged 65 and over who were resident in all Medical and Care establishments in 2001. Medical and Care establishments include nursing homes, residential care homes, hospices and hospitals.

An indicator has therefore been produced which indicates for each ward the proportion its population aged 65 and over who were resident in Medical and Care communal establishments in 2001. After excluding wards with no populations in Medical and Care establishments the remaining areas were standardised using the natural logarithm function (a classic method for standardising skewed distributions). After standardisation the wards were divided into fifths (quintiles). Quintile 1 indicates those wards with the lowest proportion of their older population resident in Medical and Care establishments while Quintile 5 represents those wards with the highest proportion of their population aged 65 and over in these establishments.

For males and females the same process was repeated but wards with a sex-specific population of less than 1,000 were also excluded.

Table 1 shows that the mean life expectancy for all persons in those wards with the highest proportion of their 65+ population resident in Medical & Care establishments was two years less than the mean life expectancy in wards with the lowest proportion of their older population in these establishments (77.2 years compared to 79.2 years). The highest mean life expectancy at birth however was in those wards which in 2001 had none of their population aged 65 and over resident in Medical & Care establishments (80.1 years).

The indicator can be used to help interpret results as for some wards the presence of Medical and Care establishments clearly has a great impact on life expectancy figures. Rooksdawn ward in Basingstoke and Deane, for example, has the lowest life expectancy at birth for all persons in 1999-2003. This was the ward however with the

highest proportion of its 65+ population resident in Medical and Care establishments in 2001.

10. Summary of results

ONS has reported life expectancy trends for Government Office Regions (GORs) and local authorities from 1991-1993 to 2002-2004. These show a consistent geographical pattern with the lowest life expectancies in the North East and North West, and the highest results in the South East, South West and East of England.

This pattern is also reflected when the geographical distribution of ward-level life expectancy results is considered. Using life expectancy at birth results for all persons wards were ranked from highest to lowest and divided into fifths. These quintiles allow the distribution of wards with the highest and lowest results to be examined, such as within GORs. In the North East and North West, for example, around 40 per cent of wards were in the lowest quintile of life expectancy results for England and Wales. Only 12 per cent of wards in these regions were among the fifth of wards with the highest life expectancy. Conversely in the South East, South West and East of England fewer than one in ten wards were among the lowest quintile of life expectancy results. In these regions around 30 per cent of wards were among the fifth of wards with the highest life expectancy in England and Wales. These results are illustrated in Figure 1 below.

Wards with very high and very low life expectancies were found however in all Government Office Regions in England, and in Wales. This can be seen in Table 2 which summarises the ward-level results for all persons and shows the highest and lowest life expectancy figures for each area. This shows that while the lowest regional life expectancy in 1999-2003 was in the North West (76.9 years) this area also had a ward with a life expectancy of 91.3 years. There are very large differences between the highest and lowest life expectancies in each area. Many of these extreme life expectancies are however outlying values which may result from local factors, such as a high communal establishment population.

To help overcome this it is useful to exclude the highest and lowest 5 per cent of wards and concentrate on the interpercentile range which contains 90 per cent of wards in each GOR. These are presented in the second part of Table 2 and provide a measure of the range of life expectancy results within each area which excludes the extremes.

The results for the 5th percentile show that the lowest life expectancies were in the North East and North West. These regions also had the lowest results at the 95th percentile although their life expectancy was the same as for London and Wales (82.1 years). The North East and North West also had the largest range of values between the 5th and 95th percentiles. For both areas this was 9.3 years – 2 years more than in the South West which had the lowest range (7.2 years).

11. Consultation on experimental statistics

The life expectancy results in this report have been released as experimental statistics. These are defined as statistics that are in the testing phase and not fully developed.

This is the first time that ONS has tested methods to calculate life expectancy at birth for populations smaller than local authorities. The methods used reflect the recommendations in a review which considered methodological options for calculating life expectancy for small populations:

http://www.statistics.gov.uk/downloads/theme_other/GSSMethodology_No_33.pdf

The review also raised some questions which have not yet been addressed such as whether the calculation of variance could be improved by adjusting age-specific rates in the highest age group of the life table.

ONS has also used an experimental method to attempt to indicate those wards whose life expectancy may be most affected by the presence of communal establishments.

Feedback is invited on such methodological issues and on other aspects of the results, including how they meet user needs.

The consultation document, and details of how to respond, are available on the National Statistics website:

<http://www.statistics.gov.uk/about/consultations/default.asp>

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Table 1**Proportions of populations aged 65 and over resident in Medical and Care communal establishments, 2001, and mean life expectancy results.**

<u>All Persons</u>	<u>No of wards</u>	<u>Mean life expectancy (years)</u>
Zero 65+ population in Medical and Care establishments	2,914	80.1
Lowest proportion - Quintile - 1	1,010	79.2
2	1,898	78.7
3	1,190	78.4
4	856	78.0
Highest proportion - Quintile - 5	929	77.2
Total	8,797	
<u>Males</u>	<u>No of wards</u>	<u>Mean life expectancy (years)</u>
Zero 65+ population in Medical and Care establishments	2,743	77.2
Lowest proportion - Quintile - 1	729	76.5
2	1,844	76.3
3	989	75.8
4	658	75.5
Highest proportion - Quintile - 5	763	74.8
Total	7,726	
<u>Females</u>	<u>No of wards</u>	<u>Mean life expectancy (years)</u>
Zero 65+ population in Medical and Care establishments	2,468	82.8
Lowest proportion - Quintile - 1	998	81.7
2	1,660	81.0
3	1,060	80.5
4	788	80.1
Highest proportion - Quintile - 5	913	79.2
Total	7,887	

Figure 1

Proportions of wards in life expectancy quintiles for all persons: Government Office Regions, England, and Wales, 1999-2003

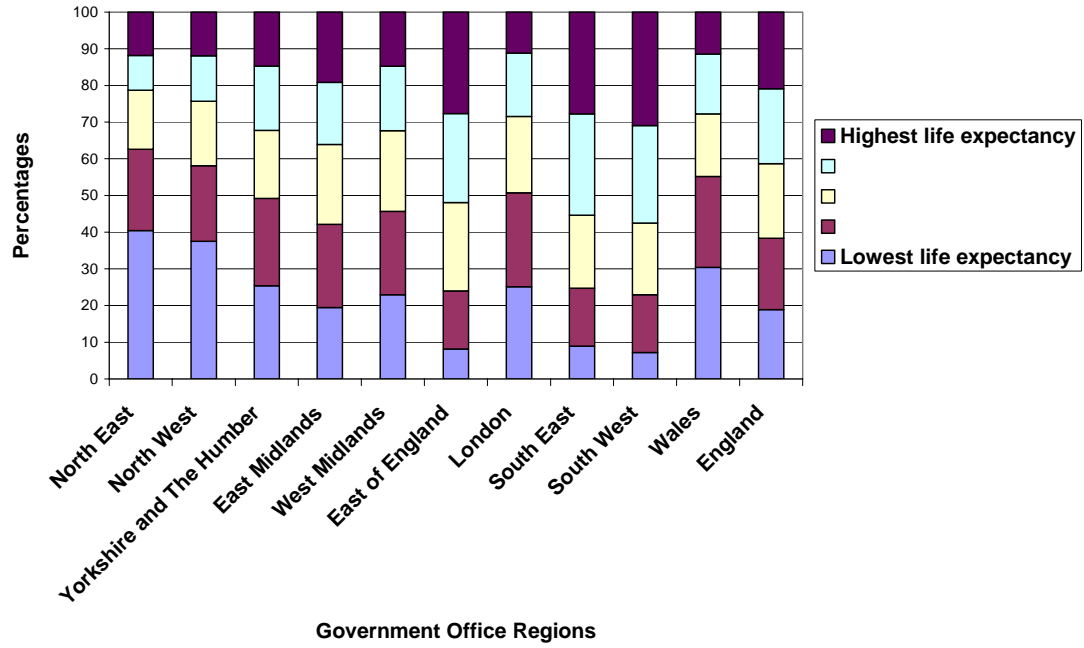


Table 2**Summary of ward-level life expectancy results for all persons, 1999-2003.**

Government Office Region (GOR)	GOR life expectancy	Lowest ward life expectancy	Highest ward life expectancy
North East	76.9	67.8	84.9
North West	76.9	69.4	91.3
Yorkshire and The Humber	77.8	70.4	85.5
East Midlands	78.2	71.1	90.1
West Midlands	77.8	71.1	88.3
East of England	79.2	70.1	93.4
London	78.3	72.7	87.3
South East	79.4	65.4	90.3
South West	79.5	71.5	89.1
Wales	77.6	66.8	86.6
England and Wales	78.3	65.4	93.4

Government Office Region (GOR)	5th percentile¹	95th percentile¹	Range between 5th and 95th percentiles
North East	72.9	82.1	9.3
North West	72.8	82.1	9.3
Yorkshire and The Humber	74.6	82.8	8.2
East Midlands	74.9	83.1	8.2
West Midlands	74.9	83.0	8.2
East of England	76.1	83.4	7.3
London	74.8	82.1	7.3
South East	76.0	83.3	7.3
South West	76.4	83.6	7.2
Wales	74.0	82.1	8.0
England and Wales	74.6	83.0	8.5

¹These figures for the 5th and 95th percentiles represent the range of life expectancy results for 90 per cent of wards in each area. They exclude the highest and lowest 5 per cent of wards which may have extreme outlying values.