Life Expectancy at Birth 2016: Analysis
What is life expectancy?

Life expectancy is an estimate of the mean average number of years that a population will live, usually calculated from birth, and assumes that all factors will stay the same until a person’s death. It is calculated using mortality rates seen at different age groups and for different sexes. This report relates to overall life expectancy. There are other measures of life expectancy such as disability free life expectancy and healthy life expectancy which are not considered here.

Life expectancy is not static throughout a person’s life as it can change depending on different factors and this can be measured at different life points such as at age 65 (age of retirement). As an example, when a person is born, there is a probability of death for each year of their life, these probabilities combine to give an average life expectancy, say 80 years. If they survive to age 65 then the probabilities of death for each of the years they’ve been alive no longer count and only future year's probabilities count. This means someone who has lived to age 65 could, for example, expect to live on average for another 20 years. Thus their life expectancy would have increased to 85 years.

These changes in older age life expectancy vary much more from year to year at local authority level than they do overall for the United Kingdom. This means slight declines in life expectancy or no changes in life expectancy are more frequently observed at a local authority level. Data is aggregated using 3 year datasets.

During recent decades the overall direction of travel usually represents an improvement in life expectancy, as these small annual changes do not represent significant change across a longer period of time. It is suggested that local variation is exactly that – statistical random fluctuation that adjusts itself the following years. However, this should be monitored closely as the implications of a reversal of life expectancy would be that people would be dying sooner than previously predicted.

ONS publishes life expectancy calculations annually and the data used in this report is the latest version (published May 2016).

What is the Index of Deprivation?

The English Indices of Deprivation 2015¹ (usually referred to as IMD 2015) ranks local authorities and small areas on relative levels of deprivation, on a range of seven measures, in relation to; income, employment, health, education, housing/services, crime, and living environment. These are combined (using weightings) to form the Overall Index of Deprivation.

What is the local story?

Male life expectancy at birth has increased from 73.2 years in 2001-2003 up to 76.7 years in 2013-2015. The gap between the UK and Salford’s life expectancy for males at birth has narrowed from 2.7 years in 2001-2003 down to a gap of 2.5 years in 2013-2015. Compared to GM, Salford’s life expectancy for males at birth (gap of 1.0 years) is the same in 2001-2003 and this gap remained unchanged as of 2013-2015.

Female life expectancy has increased from 78.0 years in 2001-2003 up to 80.8 years in 2013-2015. The gap between the UK and Salford’s life expectancy for females at birth has narrowed from 2.5 years in 2001-2003 down to a gap of 2.0 years in 2013-2015. Compared to GM, Salford’s life expectancy for females at birth has narrowed from a gap of 1.1 years in 2001-2003 down to a gap of 0.5 years in 2013-2015.
### How do we compare to our statistical neighbours (Males)?

#### Life Expectancy for males at birth, United Kingdom, 2009-2011 to 2013-2015

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Source: PHE

Compared with Salford’s statistical neighbours (as defined by CIPFA\(^2\)), the city has the 5\(^{th}\) lowest male life expectancy (out of 15 LA’s) at 76.7 years, compared with 78.1 in Bolton (highest) and 76.1 in Middlesbrough (lowest).

During the period 2009-2011 to 2013-2015 male life expectancy in Salford increased by 1.2 years, and this is the 2\(^{nd}\) highest increase among Salford’s statistical neighbours, after Tameside which saw an increase of 1.5 years during the same period.

During the most recent period 2011-2013 to 2013-2015 several local authorities have experienced a fall in male life expectancy including Nottingham (-0.2 years), Newcastle (-0.3), Oldham (-0.3), and Middlesbrough (-0.5). None of these are ‘statistically significant’ which means that we cannot say for certain that the decline is due to anything more than random variation in the underlying data. Change in male life expectancy at birth may be slowing down, if not witnessing small reductions in some local authority areas. It is not yet possible to say whether this will lead to reductions in some areas in future years.

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\(^{2}\) CIPFA produces a list of the 15 most similar local authorities based on a range of indicators including economic, demographic, geographic and housing related measures

[https://www.cipfastats.net/resources/nearestneighbours/](https://www.cipfastats.net/resources/nearestneighbours/)
How do we compare to our statistical neighbours (Females)?

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Compared with Salford’s statistical neighbours, the city has the 8th highest female life expectancy (out of 15 LA’s) at 80.8 years, compared with 81.6 in Bolton (highest) and 79.8 in Middlesbrough (lowest).
During the period 2009-2011 to 2013-2015 female life expectancy in Salford increased by 0.6 years, and this is the 3rd highest increase among Salford’s statistical neighbours*, after Stoke and Bolton which saw an increase of 0.7 and 0.6 years respectively during the same period.

During the most recent period 2011-2013 to 2013-2015 several local authorities have experienced a fall in female life expectancy including Nottingham (-0.1 years), Newcastle (-0.2), Rochdale (-0.2), Knowsley (-0.3), Middlesbrough (-0.3), Kingston upon Hull (-0.4), Wolverhampton (-0.5), and Oldham (-0.6), although none of these are statistically significant. As with male life expectancy, change in female life expectancy at birth may be slowing down, if not witnessing small reductions in some local authority areas. It is not yet possible to say whether this will lead to reductions in some areas in future years.

*Scale does not start at zero

Life Expectancy in CIPFA Local Authorities, 2013-15 (Females)
Source: ONS 2013-2015

[Graph showing life expectancy trends]
How do we compare to our GM neighbours (Males)?

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Source: PHE

Compared with Greater Manchester local authorities, the city has the 2nd lowest male life expectancy (out of 10 LA’s) at 76.7 years, compared with 79.9 in Trafford (highest) and 75.6 in Manchester (lowest). Data shows that during the period 2009-2011 to 2013-2015 male life expectancy at birth in Salford increased by 1.2 years, and this is the 3rd largest increase in GM after Manchester and Tameside.
How do we compare to our GM neighbours (Females)?

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<td>80.7</td>
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<td>-0.6</td>
<td>-0.1</td>
</tr>
<tr>
<td>Rochdale</td>
<td>81.0</td>
<td>80.7</td>
<td>80.9</td>
<td>80.7</td>
<td>80.7</td>
<td>-0.2</td>
<td>-0.2</td>
</tr>
</tbody>
</table>

Source: PHE

Compared with local authorities in Greater Manchester, the city has the 5th lowest female life expectancy (out of 10 LA’s) at 80.8 years, compared with 83.5 in Trafford (highest) and 79.8 in Manchester (lowest). During the period 2009-2011 to 2013-2015 female life expectancy at birth in Salford increased by 0.6 years, and this is the 3rd largest increase in GM after Bolton and Manchester.
Do things differ for men and women?

When comparing gender, female life expectancy at birth remains higher than male life expectancy through the last 12 years, now 80.8 and 76.7 years respectively.

Since the turn of the century the gap between male and female life expectancy has narrowed in Salford, reducing from 4.8 years in 2001-2003 to 4.1 in 2013-2015. This compares to a reduction from 4.9 to 3.6 across Greater Manchester and from 4.6 to 3.7 across the United Kingdom during the same period. This means that the gap between male and female life expectancy has narrowed at a slower rate overall in Salford (although there are changes within this period) than Greater Manchester and the UK, which may require further observation.

When comparing change between 2011-2013 to 2013-2015 and 2009-2011 to 2013-2015 it is evident that among Salford’s neighbours female life expectancy is growing to a lesser extent than male life expectancy.

Is there a correlation between LE or Change in LE and IMD Score 2015?

Life expectancy at birth during 2013-2015 was compared with the index of deprivation average score in 2015. Analysis shows a strong correlation between life expectancy and the index of deprivation score. At local authority level high deprivation scores equal low life expectancy while low deprivation scores equal high life expectancy. This is true for both male life expectancy ($R^2$ value = 0.75)$^3$ and female life expectancy ($R^2$ value = 0.61).

However there no correlation between change in life expectancy and the index of deprivation score. Again this is true for both male life expectancy ($R^2$ value = 0.02) and female life expectancy ($R^2$ value = 0.01). This suggests that there is no direct relationship between change in life expectancy and overall deprivation.

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$^3$ R² value = the closer a value is to 1 the stronger the association.
Correlation between Male LE 2013-2015, and IMD 2015 by Local Authority
(Source: ONS2013-2015, DCLG 2015)

$R^2 = 0.7481$

Correlation between Change in Male LE 2012-14 to 2013-15, and IMD 2015 by Local Authority
(Source: ONS2013-2015, DCLG 2015)

$R^2 = 0.0179$
Correlation between Female LE 2013-2015, and IMD 2015 by Local Authority
(Source: ONS2013-2015, DCLG 2015)

\[ R^2 = 0.6103 \]

Correlation between Change in Female LE 2012-14 to 2013-15, and IMD 2015 by Local Authority
(Source: ONS2013-2015, DCLG 2015)

\[ R^2 = 0.0119 \]
Life expectancy at local level

At local level the data covers 2010-2014. Male life expectancy ranges from 69.8 years in East Langworthy to 81.9 years in Worsley. Female life expectancy ranges from 75.1 years in East Barton to 85.0 years in Worsley.
At ward level life expectancy at birth during 2010-2014 was compared with the index of deprivation average score in 2015 (using a DCLG approved methodology). As with the LA level analysis, ward level analysis also shows a strong correlation between life expectancy and the index of deprivation score. At ward level high deprivation scores equal low life expectancy while low deprivation scores equal high life expectancy. This is true for both male life expectancy ($R^2$ value = 0.75) and female life expectancy ($R^2$ value = 0.57).
Change in Life Expectancy (at birth) and Index of Deprivation 2015

In March 2017 the ONS published new data on life expectancy at birth by 2015 Index of Deprivation (IMD) decile. These are published for the period 2011-2013 to 2013-2015 (3 yearly). The following charts show how male and female life expectancy at birth has changed during recent years (3 year periods) by deprivation decile.

Male life expectancy

Data shows that the increase in life expectancy between 2011-2013 to 2013-2015 is statistically significant (see green bars in table above) in 4 out of the 5 least deprived deciles. The increase in life expectancy between 2011-2013 to 2012-2014 is statistically significant in two deciles: decile 4 and 7, while the increase in life expectancy between the more recent period of 2012/14 to 2013/15 is not statistically significant in any decile. This suggests evidence that the increase in life expectancy may be slowing down.

The gap in male life expectancy between the most and least deprived decile was 9.04 years in 2011-2013 and is currently 9.14 years in 2013-2015.

During the period 2011-2013 to 2012-2014 all deciles experienced an increase in male life expectancy. During the same period 9 deciles experienced an increase in life expectancy of greater than 0.1 years (selected on the basis it is the half way point between zero and the highest value of difference in life expectancy in years).

During the period 2012-2014 to 2013-2015 most deciles experienced an increase in male life expectancy, although a fall in life expectancy is evident in deciles 2, 3, and 4. Any increases in life expectancy seen in this period were smaller than those in the previous period and all were less than 0.1 years.

Therefore the latest data suggests that the increase in male life expectancy may be slowing down in all deciles. Additionally the slow down is most pronounced in 3 out of
4 of the most deprived deciles as shown in the chart below although these are non-significant.

While the largest falls are in some of the most deprived deciles these are not significant statistically, and it may be too early to draw statistical conclusions.

**Female life expectancy**

Data shows that the increase in life expectancy between 2011-2013 to 2013-2015 is not statistically significant in any decile. Additionally the increase in life expectancy between 2011-2013 to 2012-2014 and between 2012-2014 to 2013-2015 also is not statistically significant in any decile.
The gap in female life expectancy between the most and least deprived decile was 6.88 years in 2011-2013 and is currently 7.18 years in 2013-2015. This gap is widening faster for females than for males.

During the period 2011-2013 to 2012-2014 all deciles except decile 1 experienced an increase in female life expectancy. During the same period 5 deciles experienced an increase in life expectancy of greater than 0.1 years.

During the period 2012-2014 to 2013-2015 most deciles experienced an increase in female life expectancy, although a fall in life expectancy is evident in deciles 1, 2, 5, and 6 (including the two most deprived deciles). During the same period 0 (none) deciles experienced in increase in life expectancy of greater than 0.1 years (threshold selected on the basis it is the half way point between zero and the highest value of difference in life expectancy in years).

Therefore the latest data suggests that the increase in female life expectancy may be slowing down or decreasing in the most deprived deciles while none of the deciles has experienced a change in life expectancy that is statistically significant.

![Female Life Expectancy - Annual change in number of years by deprivation decile](chart)

While the largest falls are in some of the most deprived deciles these are not significant statistically, and it may be too early to draw statistical conclusions.
Conclusion

Life expectancy in Salford has increased for both males and females. Although it is too early to draw any firm conclusions, the latest data is compatible with the hypothesis that the increase in life expectancy during recent years may now be slowing down. Were this to be the case, any slowdown would not be unique to Salford, but is more pronounced in the more deprived parts of the country for both males and females.

The largest falls in male life expectancy are in some of the most deprived deciles although these are not significant statistically, while data on female life expectancy also shows a slowdown in life expectancy across all deciles yet none of these are statistically significant. Therefore it may be too early to draw statistical conclusions.

In Salford life expectancy at birth remains lower than the United Kingdom for both males and females. Compared with Salford’s GM neighbours over the period 2009-2011 to 2013-2015 the city has one of the highest increases in life expectancy for both males and females. However the actual life expectancy is 2nd lowest for males and 5th lowest for females.

Compared with Salford’s statistical neighbours (as defined by the CIPFA definition), the city has one of the highest increases in life expectancy for both males and females. However (out of 15 LA’s) the actual life expectancy is 5th lowest for males and 8th highest for females.

There is a strong correlation between life expectancy at birth and overall deprivation as shown by analysis at local authority level and ward level. However there is no correlation between change in male life expectancy at birth and overall deprivation, nor between change in female life expectancy at birth and overall deprivation.

Potential further research

1. Potential to update the previously published JSNA report on Life Expectancy in Older Ages (65+) Salford Analysis.
Appendix

Life Expectancy at Birth 2016: Supplementary Analysis

This appendix contains supplementary information on Healthy Life Expectancy (HLE) and Disability Free Life Expectancy (DFLE). Data contained within this appendix was published by the Office for National Statistics (ONS) on 7 Dec 2017. Figures are aggregated over 3 consecutive years to improve precision and reduce the impact of random variation.

Healthy Life Expectancy (HLE) 2009/11 to 2014/16

HLE is defined as the average number of years a person would expect to live in good health based on contemporary mortality rates and prevalence of self-reported good health. Data relating to good health is taken from the Annual Population Survey (APS). HLE is sometimes reported as a proportion of life expectancy. The charts left and below compare 1) male and 2) female HLE at birth in Salford and the UK for the last six rolling-three-year periods (2009-11 to 2014-16).

There has been no statistically significant change in male HLE in either Salford or the UK between 2009-11 and 2014-16. Male HLE has been significantly lower in Salford than in the UK overall. Males in Salford are expected to spend 75.3% of their lives in good health compared to 79.7% for the UK overall.

Similarly there has been no significant change in female HLE in either Salford or the UK between 2009-11 and 2014-16. Females in Salford are expected to spend 73.0% of their lives in good health compared to 77.1% for the UK overall.

There is a positive correlation between life expectancy and the percentage of that life spent in good health. This means that areas with low life expectancy experience the double whammy of shorter lives and a larger share of that life spent in poor health.

Disability-free Life Expectancy (DFLE) 2009/11 to 2014/16

DFLE is defined as the average number of years a person would expect to live free from disability based on contemporary mortality rates and prevalence of self-reported good health. Data relating to disability is taken from the Annual Population Survey (APS). It must be noted that the question asked in the APS changed in 2012 and therefore, estimates on either side of the discontinuity (before and after April 2013) should not be directly compared. The biggest change in definition was the inclusion of mental health conditions as well as physical health conditions.

As with HLE, DFLE is sometimes reported as a proportion of life expectancy. The charts above and below compare 1) male and 2) female DFLE at birth in Salford and the UK for the last six rolling-three-year periods (2009-11 to 2014-16).

Disability free male life expectancy is currently 57.2 years for Salford residents, this is statistically significantly lower than the UK figure of 62.5 years. Males in Salford are expected to spend 74.5% of their lives free from disability compared to 79.1% for the UK overall.

Disability free female life expectancy is currently 58.6 years for Salford residents, this is significantly lower than the UK figure of 62.1 years. In the last two periods DFLE is higher for males than females across the UK. Females in Salford are expected to spend 72.9% of their lives free from disability compared to 75.1% for the UK overall.

Because the definition of DFLE changed in 2012/3, comparisons over the whole time period shown in the charts are not possible. As such it is not legitimate to conclude any change in DFLE since 2009-11. Only two periods shown occurred wholly after the change (2013-15 and 2014-16). There is no statistically significant change in DFLE for these two periods at a local or national level.