Public Health England

Protecting and improving the nation's health

Health profile for England: 2018

The second annual report combining data and knowledge with information from other sources to give a broad picture of the health of people in England in 2018.

Research and analysis

Chapter 1: population change and trends in life expectancy

Published 11 September 2018

1. Main messages

The population of England has increased steadily over recent decades. At the same time the population has also been ageing and in 2017, the percentage of the population aged 85 years and over was 2.7 times greater than it was in 1971.

The number of people aged 85 years and over is expected to increase substantially in the future. In 2017 there were 1.35 million people aged 85 and over in England. By 2023 this is projected to reach 1.54 million (an increase of 14%) and in 2031 (when ‘baby boomers’ born after World War 2 move into this age group) it could reach 2.01 million.

The ageing population is reflected in the changing distribution of deaths by age. In England and Wales in 1971, deaths among those aged 85 and over made up 15% of all deaths. By 2016 they made up 39% of all deaths.

With England’s population both increasing and ageing, it was inevitable that the downward trend in number of deaths, seen since the late 1980s, could not continue indefinitely. Since 2011, when there were just over 450,000 deaths in England, the numbers have been generally increasing. By 2017 there were almost 500,000 deaths.

The number of deaths will increase considerably in the next few years if the population continues to experience recent rates of mortality. If this is the case, it is anticipated that in the year 2023 there will be around 550,000 deaths. That is just over 50,000 more deaths than in 2017, a 10% increase.

Provisional data for 2017 indicate that life expectancy at birth in England has now increased to 79.6 years for males and 83.2 years for females. People are living longer than at the start of the century, but since 2011 the rate of increase in life expectancy has slowed for both sexes. Based on life expectancy trends from 1981 to 2017, forecasts indicate that the future trend to 2023 is uncertain.

The latest data on healthy life expectancy at birth (the number of years lived in good health) show that it is now 63.3 years for males and 63.9 years for females (2014 to 2016) in England.

Since the period 2009 to 2011, life expectancy at birth has increased more than healthy life expectancy and therefore the number of years lived in poor health has increased slightly, as has the proportion of life spent in poor health. In the period 2014 to 2016, males lived 16.2 years in poor health, while females lived 19.3 years in poor health.

In 2016, UK life expectancy at birth was above the European Union (EU) average for males, but below the EU average for females. For both sexes, since 2011 it has improved more slowly in the UK than the EU average. However, with the exception of Italy, all of the 6 largest EU member states have seen a reduction in the rate of improvement in life expectancy since 2011.

2. Introduction

Average life expectancy has increased in England in recent decades, as presented in the Health Profile for England 2017.
Less than a century ago, deaths from infectious diseases were common and often death would follow a relatively short period of illness[1]. However, chronic non-communicable diseases are now the leading causes of death (see Chapter 2) and long periods of moderate and severe ill health often precede death.
We have an ageing population: in England in 2017, 1.35 million people were aged 85 and over, almost half a million of whom were in their 90s. The size of the population at older ages is important as the older a person is, the more likely they are to live with chronic conditions such as dementia, diabetes and some musculoskeletal conditions (see Chapter 3).
The size of the population aged 85 years and over is, therefore, an important determinant of demand for health and social care as older people have the highest usage[2],[3].

As well as looking at population changes, this chapter updates analysis in the Health Profile for England 2017 and looks at trends in the following measures:

- life expectancy (the average number of years that an individual is expected to live based on current mortality rates)
- healthy life expectancy (the average number of years that an individual is expected to live in a state of good or very good health, based on current mortality rates and prevalence of self-assessed good or very good health)
- average number of years lived in poor health (the difference between life expectancy and healthy life expectancy)
- proportion of life spent in poor health (number of years in poor health as a percentage of life expectancy)

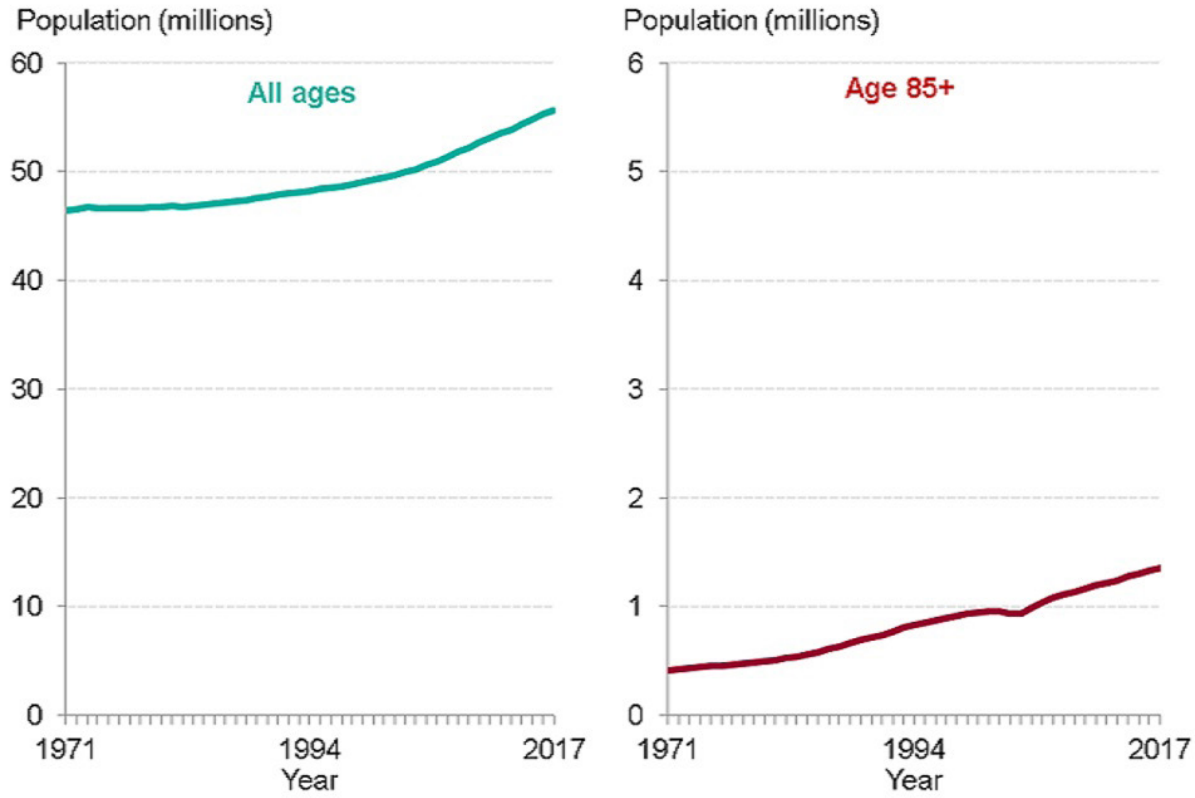
Average life expectancy and healthy life expectancy are both important headline measures of the health status of the population. The healthy life expectancy measure adds a 'quality of life' dimension to estimates of life expectancy by dividing them into time spent in different states of health. The number of years of life in poor health is also important as it relates more closely to demand for health and social care, and associated costs.

When comparing outcomes for groups with very different life expectancies, the proportion of life spent in poor health is also useful. Two populations may both spend on average 15 years in poor health, which might be a quarter of life for a group with life expectancy of 60, but only a sixth of life for a group with life expectancy of 90.

3. Population change and trends in the number of deaths

The total population of England has increased steadily over recent decades (Figure 1). At the same time the population has also been ageing and the number of people aged 85 years and over has increased. In 2017 the proportion of the population aged 85 years and over was 2.7 times greater than it was in 1971.

Figure 1: trend in population size, all ages and ages 85+ years, England, 1971 to 2017



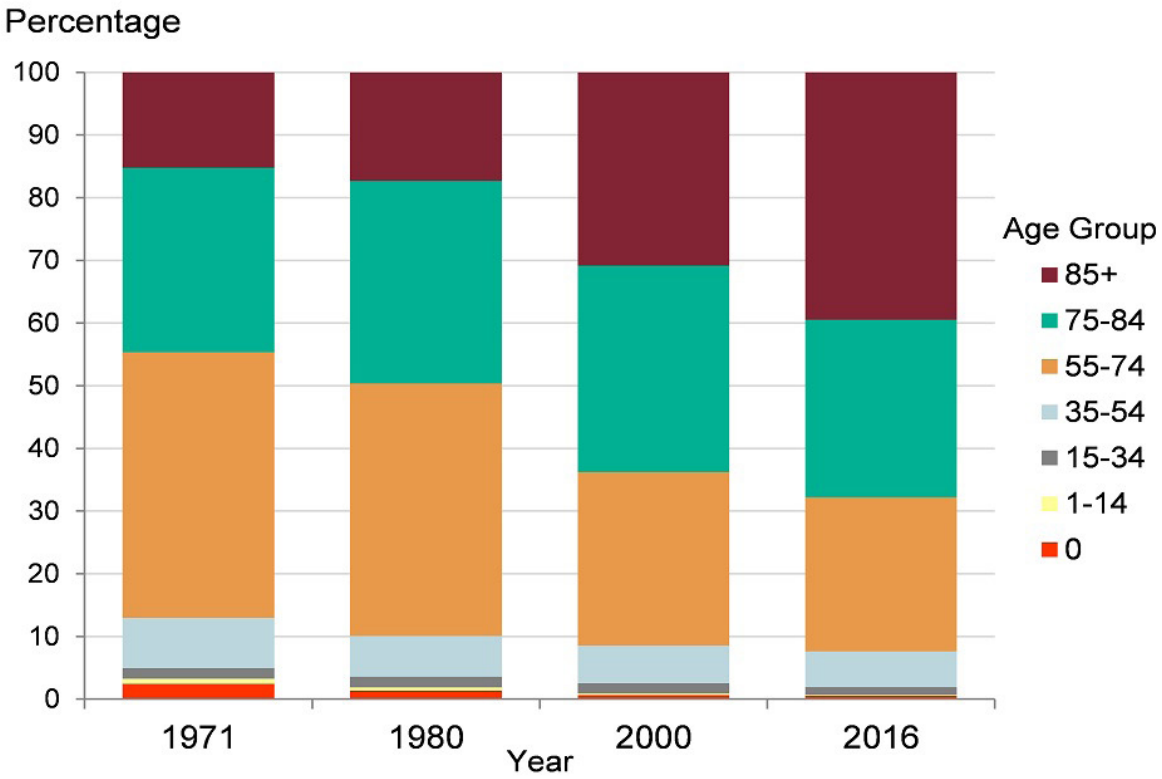
Source: PHE analysis of ONS population estimates

See the full data source:

1971 to 2016
2017

The distribution of deaths by age group has changed as the population has aged. In 1971, deaths among those aged 85 years and over made up just 15% of all deaths in England and Wales, but by 2016 they accounted for 39% of the total (Figure 2). In 1971, the number of deaths at ages 85 years and over was 6 times as great as the number of deaths under age one. In 2016, there were 76 times more deaths at age 85 years and over than under age one.

Figure 2: trend in percentage of deaths by age, England and Wales, 1971, 1980, 2000 and 2016



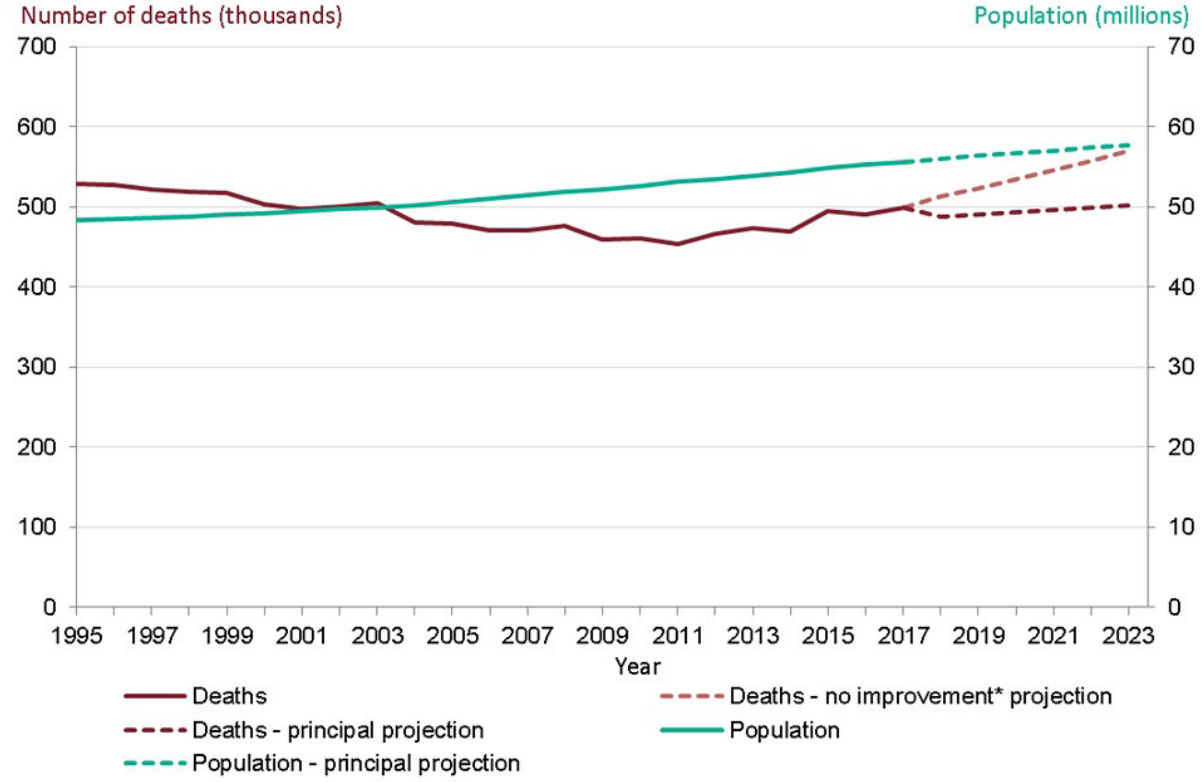
Source: PHE analysis of ONS mortality data

See the full data source

Despite an increasing and ageing population, a general decline in the annual number of deaths in England started in the late 1980s. In 1995, there were almost 530,000 deaths in England but by 2011 this had reduced to just over 450,000 (Figure 3).

With England's population both growing and ageing, it was however inevitable that the downward trend in the number of deaths could not continue indefinitely. Since 2011 the numbers have been generally increasing and by 2017 there were almost 500,000 deaths in England (Figure 3).

Figure 3: trend in the number of deaths and population size, persons, England, 1995 to 2017, projected from 2018 to 2023



Source: PHE analysis of ONS population, population projection, and mortality data

*projected number of deaths assuming no improvement in mortality rates from those in 2016

See the full data source:

Numbers of deaths
Populations
Population projections (principal projections)
Population projections (no mortality improvement variant)

To provide an indication of the future size and age structure of the population, the Office for National Statistics (ONS) produces regular sets of population projections. These are based on assumptions of what will happen in the future with levels of births, deaths and migration.

The number of people aged 85 years and over is projected to increase substantially in the future. In 2017 there were 1.35 million people aged 85 and over in England. By 2023, this is projected to increase by 14% to 1.54 million. Between 2023 and 2031 (when those 'baby boomers' born immediately after World War 2 will reach 85) the population aged 85 and over is projected to increase by 31% to 2.01 million.

From their current principal projections, ONS estimate that there would be around 502,000 deaths in England by 2023 (Figure 3). This is based on an assumption that mortality rates will fall in the future. ONS also produce

an alternative set of projections which assume that mortality rates in the future will not improve but will stay at the same level as in 2016. From these, ONS estimate that there will be around 550,000 deaths in 2023, just over 50,000 more than the number in 2017 (Figure 3).
Later sections of this chapter and Chapter 2 will show how there has been relatively little improvement in mortality rates in England since 2011. If mortality rates were to rise in the future, the number of deaths could be even higher than those in the ONSprojections.

4. Trends in life expectancy at birth

Life expectancy at birth in England has increased in recent decades and provisional data for 2017 show that it has reached 79.6 years for males and 83.2 years for females (Figure 4). This is an increase of 0.1 years, since 2016, for both males and females. Male life expectancy has increased faster than that for females and the gap in life expectancy is now less than 4 years, whereas in 1981 it was 6 years.

Life expectancy at birth for males increased by an average of 13.9 weeks per year from 1981 to 2011, while for females the increase was 10.3 weeks per year (Figure 4). Between 2011 and 2017, the average increase in life expectancy slowed for both sexes, to 4.3 weeks per year for males and 1.7 weeks for females. There has thus been a reduction in the rate of improvement in life expectancy since 2011.

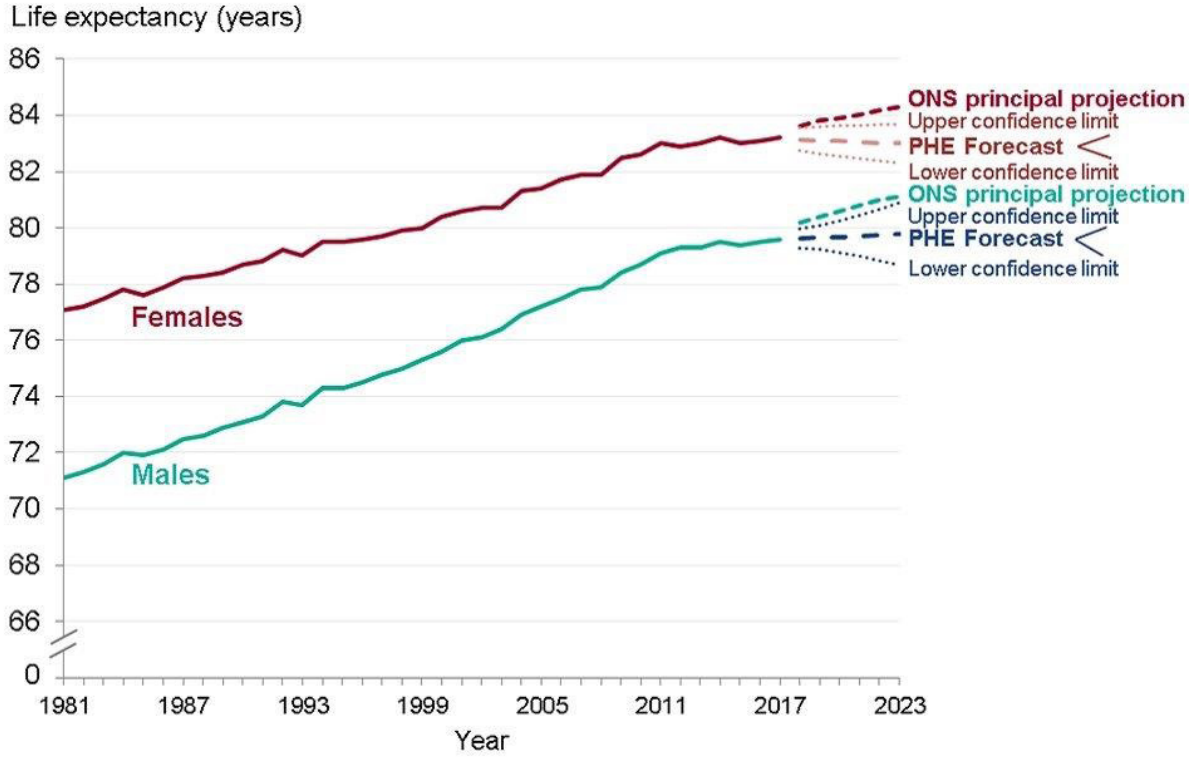
ONS produces regular projections of life expectancy which are derived by estimating long term trends in mortality improvement and projecting them forward for future decades. The latest principal projections from ONS (which assume that mortality rates will fall in the future) project that in 2023 life expectancy at birth will be 81.1 years for males and 84.3 years for females (Figure 4), an increase of 9.4 weeks and 7.3 weeks per year respectively, over the period of the projection (2018 to 2023).

Besides the principal projections of life expectancy illustrated in Figure 4, ONS also produce high and low life expectancy variants, which respectively assume more and less improvement in mortality rates. If it is assumed that mortality rates remain constant then life expectancy would also remain constant.

PHE have produced life expectancy forecasts based on fitting a model to the trends in life expectancy from 1981 to 2017 (Figure 4) (See Methods, data and definitions). These forecasts show that the more slowly rising trend since 2011

has not been observed for long enough to be clear whether it will continue. The upper and lower confidence limits shown around the forecasts indicate that the future trend is uncertain for both sexes.
See Methods, data and definitions for more information on the PHE forecasting methodology and ONS projections.

Figure 4: trend in life expectancy at birth, males and females, England, 1981 to 2017, projections and forecasts from 2018 to 2023



Source: PHE analysis of ONS data

See how your area compares:

Males
Females
Full data source

5. Breakdown of trends in life expectancy at birth by age

The contribution of different age groups to the change in life expectancy between time points can be assessed using a method of 'decomposition'.

Contributions that increased life expectancy (that is, where the mortality rate has reduced over time) have a positive value, while contributions that offset

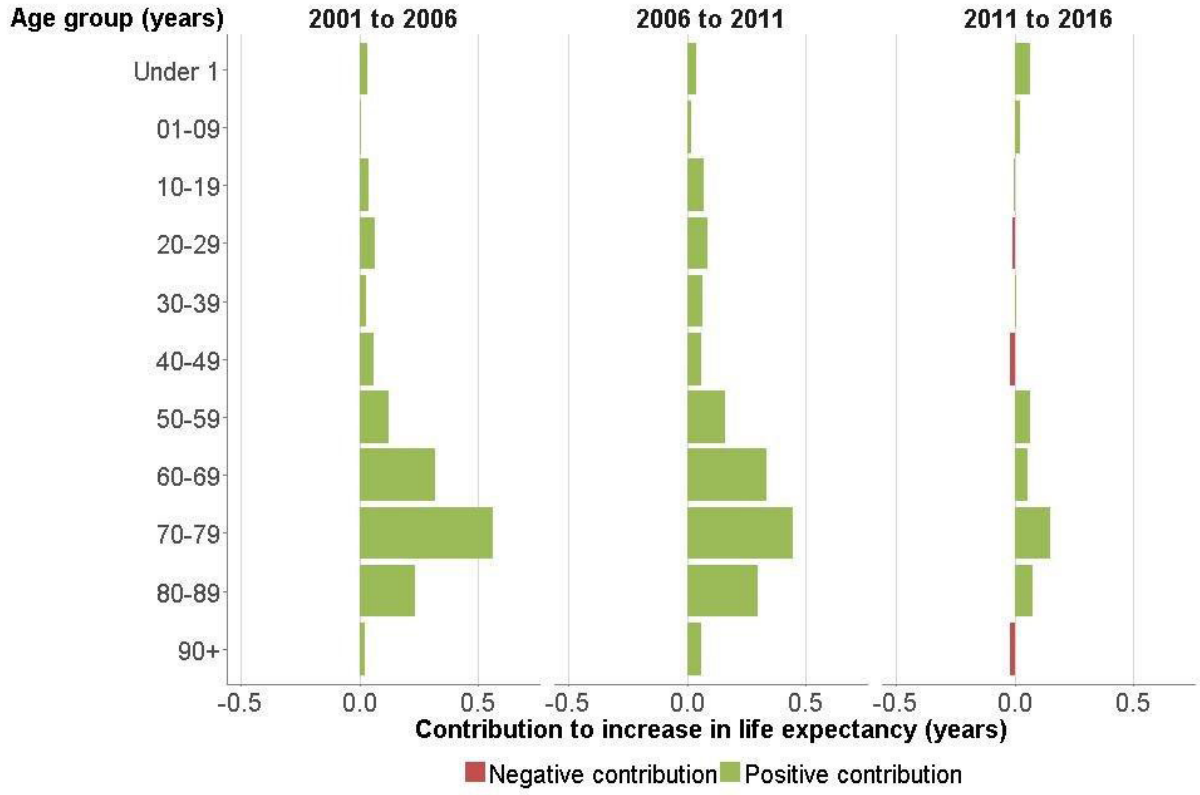
the life expectancy increase (where the mortality rate has increased over time) have a negative value (Figure 5).

All age groups made a positive contribution to improvements in life expectancy between 2001 and 2006, and between 2006 and 2011. The age groups which made the biggest contribution to improvements were the older ages, 60 to 89.

The contribution from almost all age groups was smaller between 2011 and 2016, indicating that the slowdown in mortality improvement occurred across most age groups. For both sexes, some age groups made a negative contribution to the change in life expectancy, as indicated by the red bars in the charts. The most noticeable negative contribution was for females aged 90 years and over.

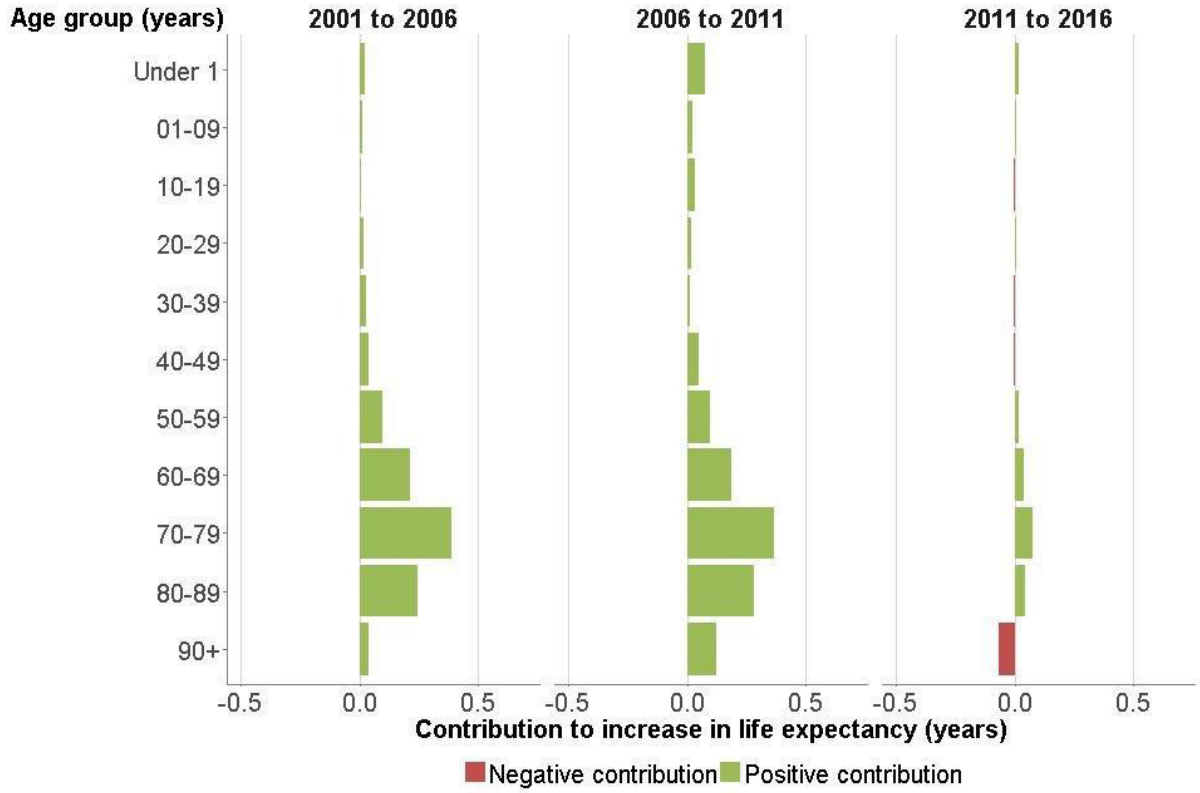
Figure 5: breakdown of change in life expectancy at birth by age, males and females, England, 2001 to 2006, 2006 to 2011 and 2011 to 2016

Males



Source: PHE analysis of ONS data

Females



Source: PHE analysis of ONS data

See Methods, data and definitions for a more detailed explanation of the decomposition method.

6. Healthy life expectancy at birth

Data for healthy life expectancy are published by ONS as three-year averages (for example, 2014 to 2016). Since 2009 to 2011 there has been no significant change to healthy life expectancy in England and data for 2014 to 2016 indicate that it is now 63.3 years for males and 63.9 years for females (Table 1).

Table 1: life expectancy, healthy life expectancy, number of years in poor health and proportion of life spent in poor health, from birth and age 65 years, males and females, England, 2014 to 2016

	At birth	At birth	At age 65	At age 65
	Males	Females	Males	Females
Life expectancy (years)	79.5	83.1	18.8	21.1
Healthy life expectancy (years)	63.3	63.9	10.5	11.3
Number of years in poor health	16.2	19.3	8.2	9.8
Proportion (%) of life in poor health	20.4	23.2	44.0	46.6

Source: Office for National Statistics: health state life expectancies at birth and at age 65

See how your area compares:

Male life expectancy at birth
Female life expectancy at birth
Male life expectancy at age 65
Female life expectancy at age 65
Male healthy life expectancy at birth
Female healthy life expectancy at birth
See the full data source

Although females live longer than males, in 2014 to 2016 there was little difference in healthy life expectancy between the sexes. Females, therefore, spent more years in poor health than males (19.3 years compared with 16.2 years for males) and a greater proportion of life in poor health (23.2% compared with 20.4%) (Table 1).

The majority of the extra years of life for females in 2014 to 2016 were spent in poor health: females lived 3.6 years longer than males but had only 0.6 years longer in good health. Therefore 3 of these extra years were spent in poor health.

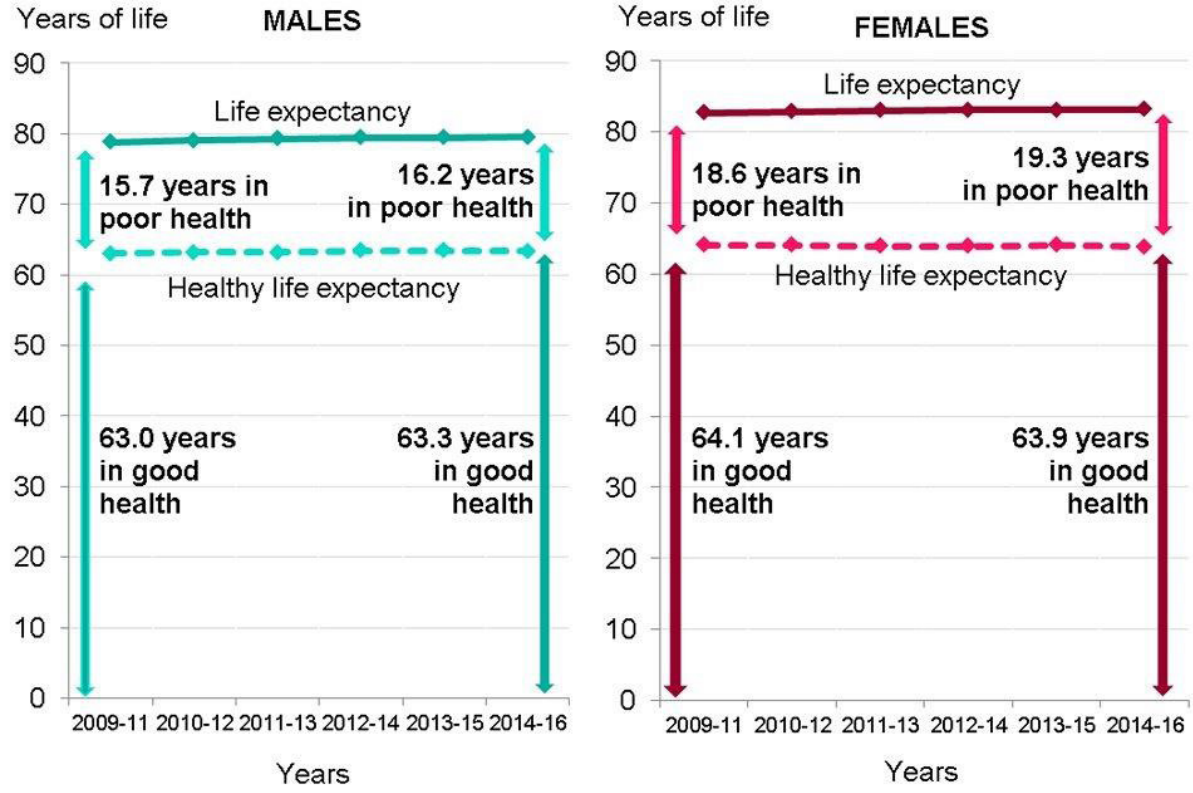
In the Health Profile for England 2017, an increase in male healthy life expectancy of 2.8 years was reported between 2000 to 2002 and 2012 to 2014. The increase for females was 1.5 years. Due to a change in methodology, comparable data for recent years are now only available back to 2009 to 2011. This short time frame limits the conclusions that can be made about trends, as indicators giving a summary picture of population health tend to change slowly.

Male life expectancy at birth increased by 0.8 years between 2009 to 2011 and 2014 to 2016, and healthy life expectancy increased by 0.3 years (Figure 6). Years spent in poor health thus increased by 0.5 years. The proportion of life lived in poor health increased slightly: 20.0% in 2009 to 2011; 20.4% in 2014 to 2016.

For females between 2009 to 2011 and 2014 to 2016, life expectancy at birth increased by 0.4 years but healthy life expectancy fell by 0.2 years, so years lived in poor health increased by 0.7 years. The proportion of life lived in poor health increased from 22.5% in 2009 to 2011, to 23.2% in 2014 to 2016.

It is important to note that this measure of years spent in poor health is self-reported and does not adjust for the severity of ill health or the types of conditions that may be present. Trends in ill health (morbidity) adjusted for severity of disease are presented in Chapter 3.

Figure 6: trend in life expectancy, healthy life expectancy and years spent in poor health from birth, males and females, England, 2009 to 2011 up to 2014 to 2016



Source: PHE analysis of ONS estimates of life expectancy and healthy life expectancy

7. Life expectancy and healthy life expectancy at age 65

The trend in life expectancy at age 65 years has been upwards in recent decades. In 2014 to 2016, males aged 65 lived a further 18.8 years (up from 16.3 years in 2001 to 2003) and females an additional 21.1 years (up from 19.2 years in 2001 to 2003).

Since 2009 to 2011, increases in life expectancy have slowed for both sexes at age 65 and increases in healthy life expectancy have kept pace, so the number of years lived in poor health has remained about the same. Males lived 8.2 years in poor health from age 65 in both 2009 to 2011 and 2014 to 2016, while females lived 10.0 years in poor health in 2009 to 2011 and 9.8 years in 2014 to 2016.

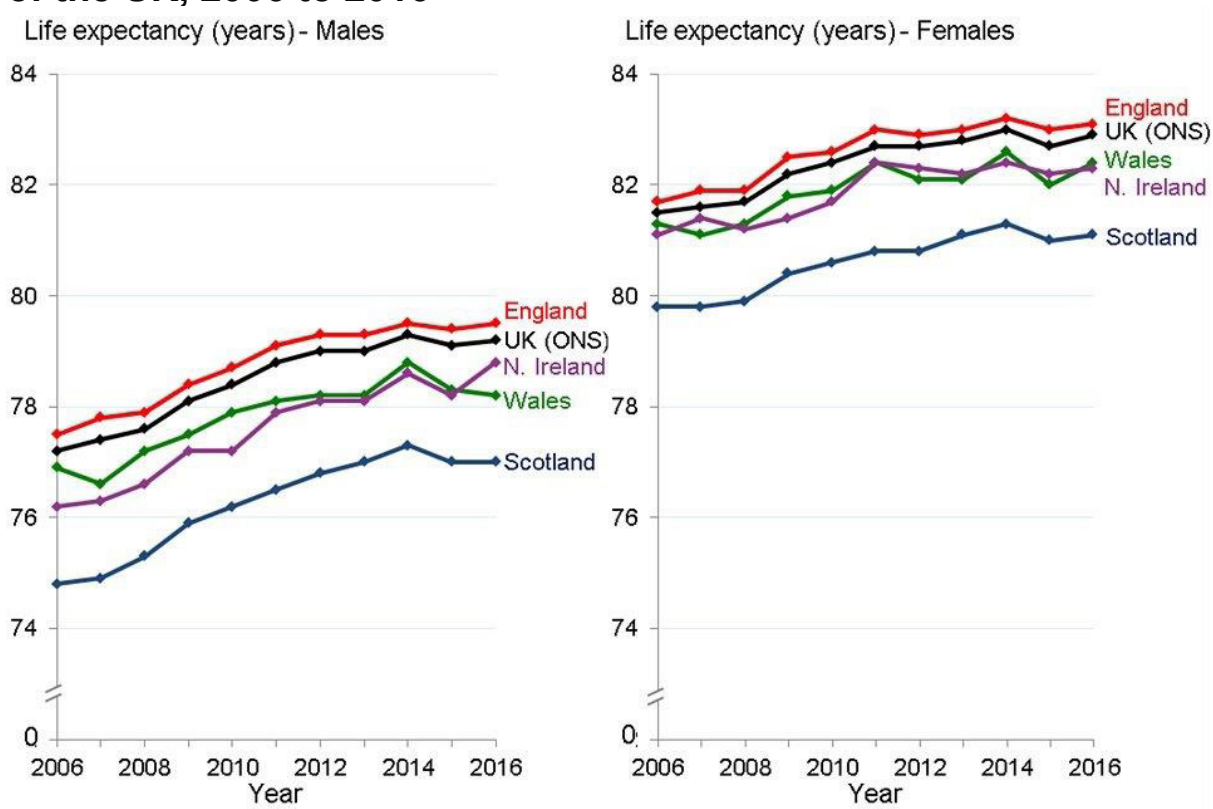
The proportion of life from age 65 spent in poor health was 44.0% for males and 46.6% for females in 2014 to 2016.

See the full data source

8. UK comparisons

Of the four UK nations, England had the highest life expectancy for both males and females in 2016. This has consistently been the case in recent years (Figure 7). All four nations have experienced a slowing of life expectancy improvement since 2011, and all had a decrease in life expectancy for both sexes in 2015.

Figure 7: trend in life expectancy at birth, males and females, countries of the UK, 2006 to 2016



Source: PHE analysis of data from ONS

See the full data source:

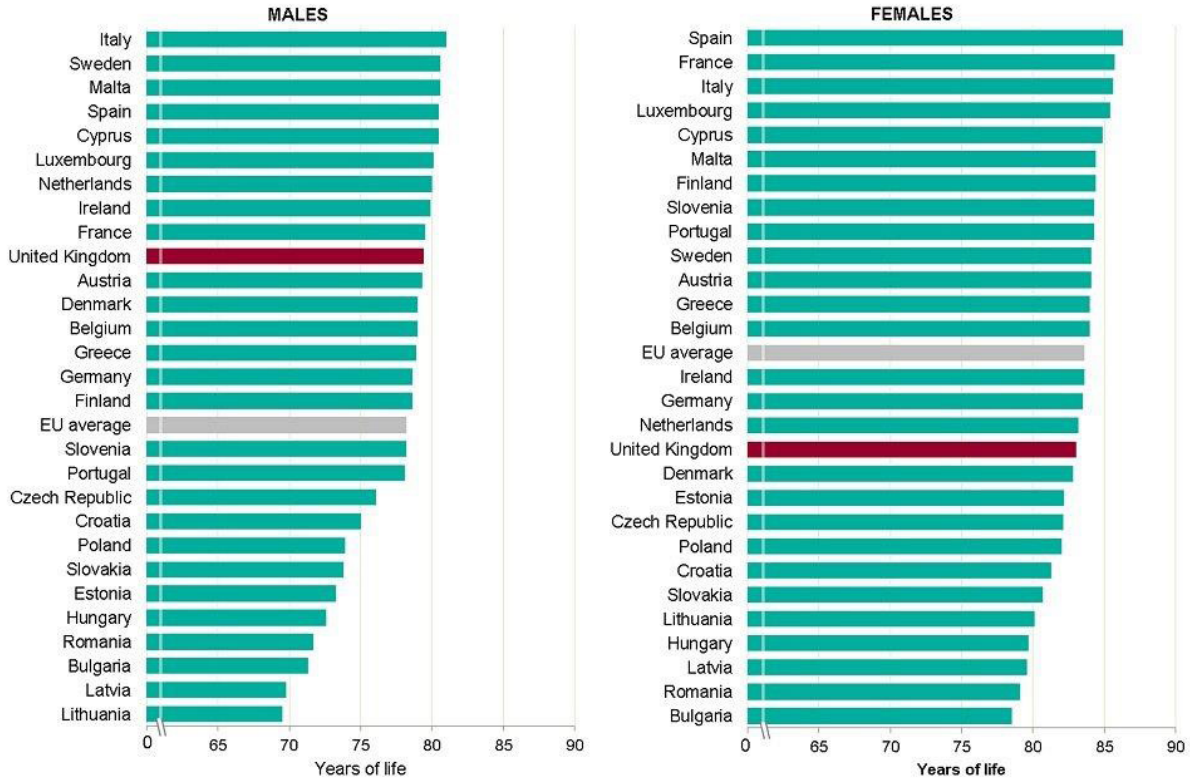
England
UK
Wales
Scotland
Northern Ireland

9. European comparisons

Female life expectancy is doing comparatively worse than male life expectancy when compared with the rest of the European Union (EU). Among the 28 EU member states in 2016, the UK was ranked 10th highest for male life expectancy but only 17th for female life expectancy (Figure 8). UK male life expectancy was above the EU average but was 1.6 years lower than the highest country (Italy). However, female life expectancy in the UK was lower than the EU average and 3.3 years lower than Spain, the country with the highest level in 2016.

These comparisons are made with the UK rather than England as it is the UK which is the EU member state. In addition, it is not possible to compare England with the EU as the EU data are calculated using a method which is not directly comparable to the method used by ONS to calculate life expectancy in England.

Figure 8: life expectancy at birth, males and females, EU member states, 2016



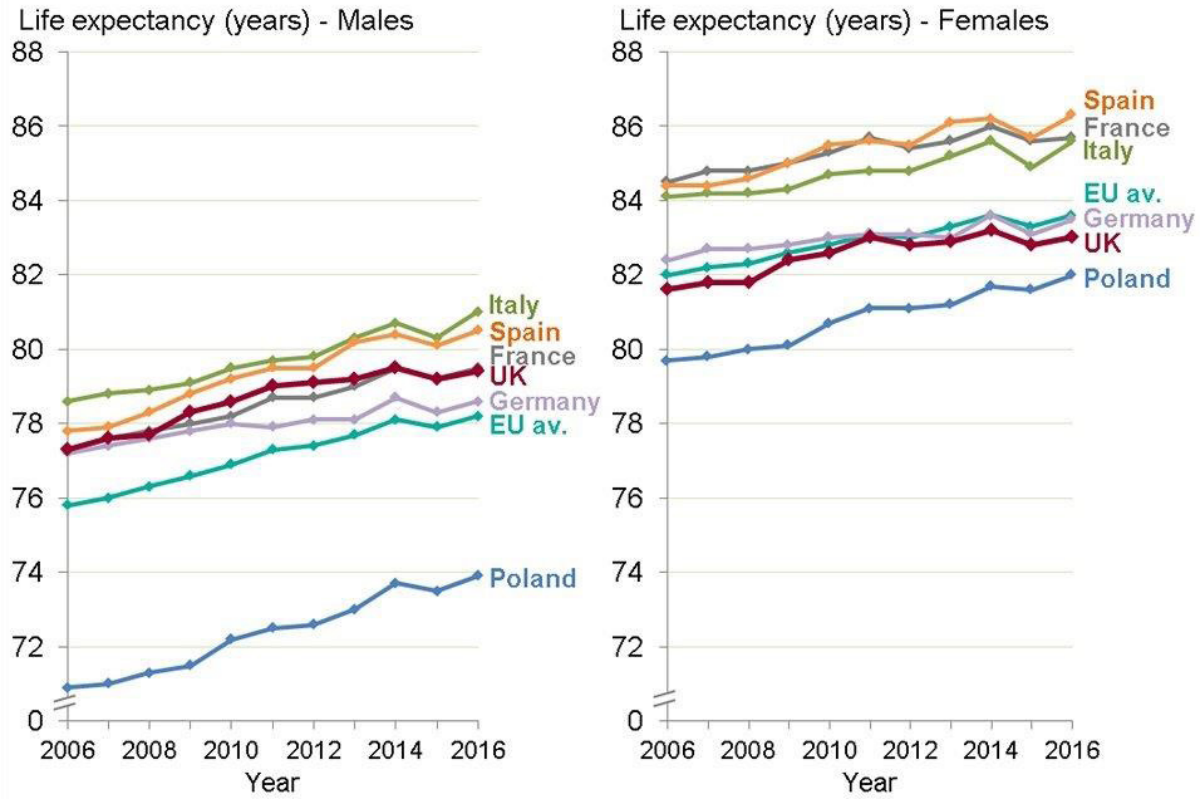
Source: PHE analysis of data from EUROSTAT

See the full data source

Between 2011 and 2016, the average annual increase in life expectancy in the EU as a whole was lower than the increase between 2006 and 2010, for males and females. With the exception of Italy, all of the 6 largest EU member states had a smaller annual improvement over the later period.

The average annual improvement in life expectancy in the UK between 2011 and 2016 was lower than in the other largest EU member states, and lower than the EU average, for both sexes. All of the largest EU member states had a fall in life expectancy in 2015 (Figure 9).

Figure 9: trend in life expectancy at birth, males and females, largest EU member states, 2006 to 2016



Source: PHE analysis of data from EUROSTAT

See the full data source

Data is also available on healthy life expectancy for all EU member states, based on responses to a survey question asking how respondents rate their health in general. In 2016, throughout the EU, although males lived shorter lives than females, they spent a smaller proportion of their lives in poor health. This suggests that the bulk of the extra years of life for females were spent in poor health (Table 2).

In 2016, the proportion of life spent in poor health was smaller in the UK than the EUaverage, except for males at birth. At age 65, both males and females in the UK spent a smaller proportion of life in poor health than the other large EU countries (Table 2).

Due to a different definition of poor health in the EU data, the figures for the proportion of life lived in poor health in the UK in Table 2 are very different to the figures quoted in Table 1 for the proportion of life lived in poor health in England. See Methods, data and definitions for further information.

Table 2: life expectancy and proportion of life in poor health*, from birth and age 65 years, males and females, largest EU countries, 2016

2016	Males	Males	Males	Males	Females	Females	Females	Females
Country	Life expectancy at birth	Proportion (%) in poor health*	Life expectancy at age 65	Proportion (%) in poor health*	Life expectancy at birth	Proportion (%) in poor health*	Life expectancy at age 65	Proportion (%) in poor health*
France	79.5	6.4	19.6	16.3	85.7	8.1	23.7	18.6
Germany	78.6	6.4	18.1	14.4	83.5	7.8	21.3	18.3
Italy	81.0	5.4	19.4	17.5	85.6	7.9	22.9	24.0
Poland	73.9	10.0	16.0	32.5	82.0	13.0	20.5	39.0
Spain	80.5	5.3	19.4	16.5	86.3	8.0	23.6	23.3
United Kingdom	79.4	6.9	18.8	13.8	83.0	8.0	21.1	13.7
EUaverage	78.2	6.5	18.2	17.6	83.6	8.7	21.6	23.1

Source: EUROSTAT Life expectancy and healthy life expectancy

*poor health = the difference between life expectancy and healthy life expectancy

See the full data source

Life expectancy
Healthy life expectancy

10. Further information

The data presented in this chapter show a high-level picture of trends in life expectancy and healthy life expectancy in England. These trends are influenced by changes in patterns of mortality (Chapter 2) and changes in the prevalence of disease over time (Chapter 3).

In addition, these high-level trends conceal inequalities between different parts of the country and different population groups (Chapter 5).

Data from the Global Burden of Disease (GBD) model are an alternative source of trends in life expectancy and healthy life expectancy. It shows similar results to the data presented in this chapter, an increase in life expectancy with smaller absolute increases in healthy life expectancy since the earlier point of 1990. Health is determined by both risk and protective factors. The presence of these factors determines the level of health and wellbeing in the

population and therefore the level of healthy life expectancy. Risk factors such as smoking, drinking and poor diet are discussed in Chapter 3.
Protective factors are not just the absence of risk and include the conditions and influences that create good health and wellbeing and/or buffer against disease. Examples include personal resilience, sense of control, social connectedness, physical activity, breastfeeding and school readiness. These are discussed throughout the Health Profile for England, but particularly in Chapters 4, 5 and 6. Social factors such as being in good work, having an adequate income, access to outdoor space and social capital are covered in Chapter 6.

11. References

1. Griffiths C and Brock A (2003) Twentieth century mortality trends in England and Wales. Health Statistics Quarterly 18:5-17. ↩
2. NHS Digital (2016) Hospital admissions hit record high as population ages:Accessed 29 June 2018. ↩
3. NHS Digital (2016) Community Care Statistics, Social Services Activity, England - 2015-16: Accessed 29 June 2018. ↩

Chapter 2: trends in mortality

Published 11 September 2018

1. Main messages

The overall age-standardised mortality rate in England, for both males and females, declined between 2001 and 2016. However, since 2011 the rates have fluctuated and the rate of improvement has reduced. This is reflected in the forecasts of mortality rates for 2023 which show that it is unclear what the future trend will be. This finding is consistent with the analysis of the trend in life expectancy in Chapter 1.

Age-specific mortality rates declined in all age groups between 2001 and 2016. However, in some age groups the rate has fluctuated in more recent years and the rate of improvement has reduced since 2011. Mortality rates in those aged 20 to 24 years through to 30 to 34, 40 to 44 through to 55 to 59, and 65 to 69 all increased between 2015 and 2016. However, none of these increases were statistically significant. Mortality rates for those aged over 75 years significantly increased between 2014 and 2015 but fell between 2015 and 2016, and returned to levels more similar to previous years.

In 2016 the most common cause of death in males was heart disease, accounting for 13.6% of deaths. The most common cause of death in females was dementia and Alzheimer's disease, accounting for 15.8% of deaths.

The mortality rate from dementia and Alzheimer's disease in males and females has increased steadily since 2006. The reasons for this are not clear, but increased awareness of dementia, making it more likely to be diagnosed and recorded, is a factor. Forecasts for 2017 to 2023 show that mortality rates from dementia and Alzheimer's are expected to continue to increase for both males and females. For males, it is estimated that the rate may overtake heart disease as early as 2020 if heart disease mortality rates continue to fall.

Falling mortality rates from heart disease were the biggest cause of increases in life expectancy between 2001 and 2016. However, between 2011 and 2016, improvements in heart disease mortality reduced and rising mortality from dementia offset these gains in life expectancy by 0.2 years in males

and 0.3 years in females. These are the causes that have made the biggest contribution to the reduction in the rate of improvement in life expectancy since 2011.

Drug misuse deaths increased between 2012 and 2016. There were nearly 2,400 drug misuse deaths in England in 2016, an increase of 3.6% on the year before and the highest figure on record. This rise has been linked to heroin and opioid use, and heroin-related deaths doubled over the period 2012 to 2016. Data for 2017 showed a decline in the rate of drug misuse deaths for the first time in 5 years.

The premature mortality rate in people with a serious mental illness (SMI) such as bipolar disorder or schizophrenia was 3.7 times higher than that of the general population in the financial year 2014 to 2015. This gap has widened since 2009 to 2010 and the mortality rate for people with an SMI has increased.

The burden of premature death in males in the UK was ranked 10th lowest among the 28 countries of the EU and was significantly lower than the EU average in 2016. However, for females, it was ranked 18th lowest and was significantly higher than the EU average.

A range of causes contributed to this difference in EU rankings for male and female premature mortality, however, the greatest difference in rankings (15 places) was for premature cancer mortality. For premature cancer mortality, the UK was ranked 8th lowest for males and 23rd lowest for females in 2016. The comparatively high burden of female cancer mortality in the UK makes a substantial contribution to the poorer relative position of female mortality, compared with males, when ranked across the EU.

2. Introduction

Mortality rates have fallen over time for a wide range of causes. Advances in medical science and public health interventions, including better sanitation, vaccination, improved housing and living conditions and safer water, have led to changes in the causes of death from communicable diseases to non-communicable diseases[1,2]. This has shifted deaths from younger to older ages (Chapter 1).

This chapter looks at mortality trends in England, it provides an update to last year's Health Profile for England 2017 report, but also includes some additional analyses that were not presented last year.

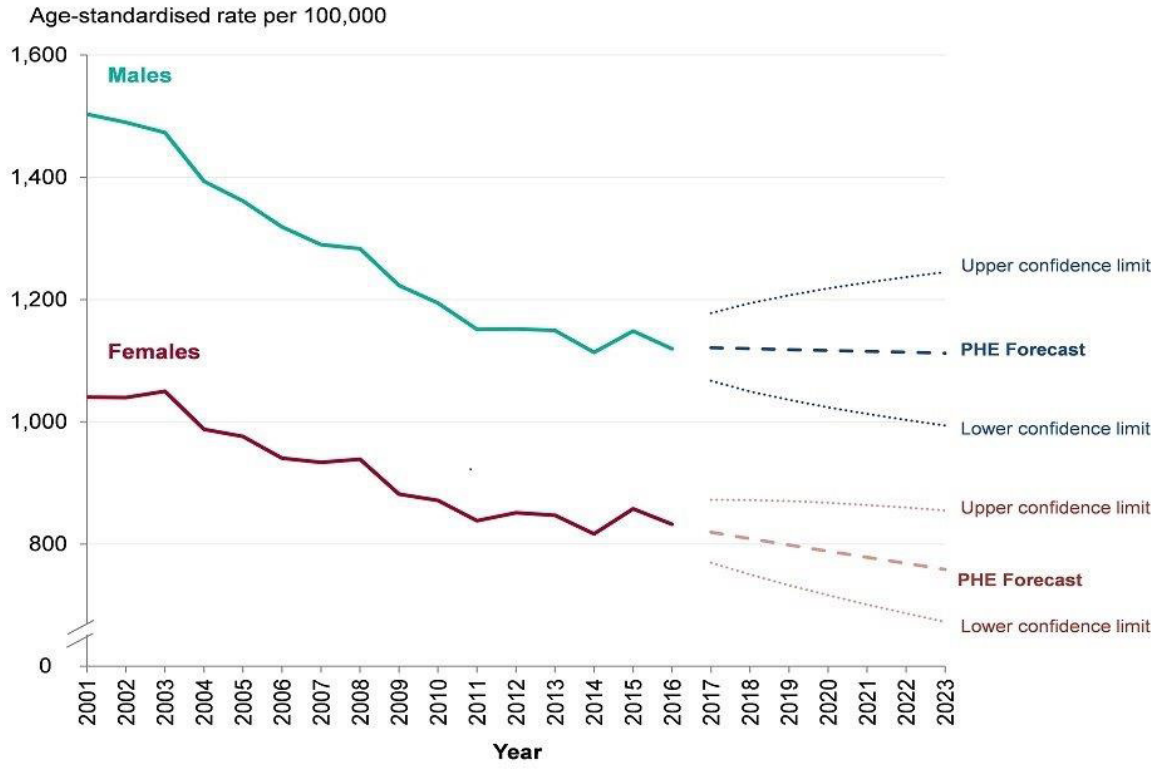
3. Trends in mortality from all causes

Between 2001 and 2016 there was a significant decline in the age-standardised mortality rate for all causes of death combined, in both males and females (Figure 1). However, since 2011 the rate has fluctuated and the rate of improvement has reduced.

Between 2014 and 2015 the age-standardised mortality rate in males and females significantly increased by 3.1% and 5.1% respectively. The reduction in the rate of improvement and the increase in the death rate in 2015 are being further examined by PHE, but influenza is likely to have contributed to the increase in 2015[3]. Data for 2016 show that the rates have significantly decreased from 2015 for males and females by 2.6% and 3.0% respectively (Figure 1).

The time series for the age-standardised mortality rates from 2001 to 2016 were used as a basis for forecasts for 2017 to 2023 shown in Figure 1. The confidence limits around the forecasts reflect the uncertainty around the recent fluctuations and reduction in the rate of improvement in the trend. They have not been observed for long enough to be clear on what the future trends will be. The forecasts indicate that, for both sexes, the future trend is unclear.

Figure 1: trend in the age-standardised mortality rate, males and females, England, 2001 to 2016 and forecasts for 2017 to 2023



Source: PHE analysis of ONS Mortality data

See the full data source

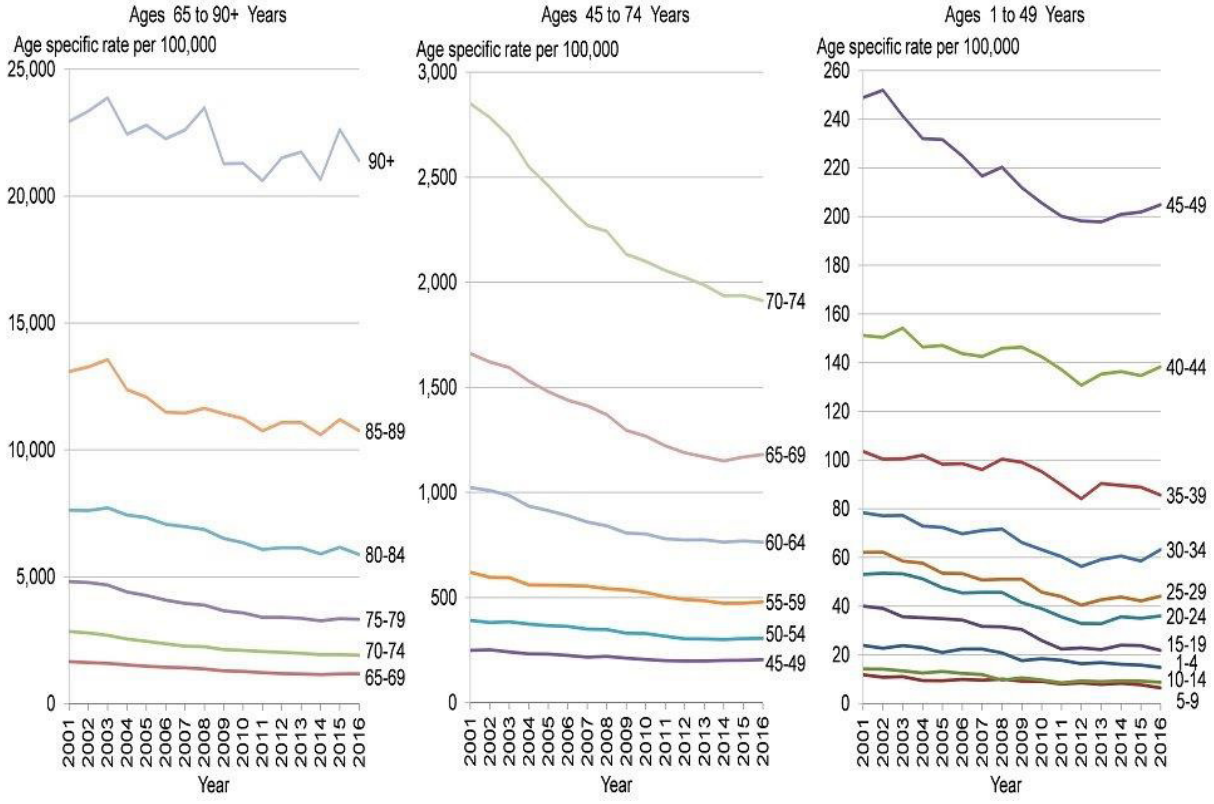
See how your area compares

4. Trends in age-specific mortality rates

Figure 2 shows all-cause mortality rates by 5 year age bands from 2001 to 2016. Three different scales have been used to present the data to clearly show the trends over time in each age band.

Mortality rates declined in all age groups between 2001 and 2016. However, improvements in the mortality rate reduced from around 2011 (Chapter 1) and some age groups showed an increase between 2015 and 2016 (Figure 2). Death rates in those aged 20 to 24 years through to 30 to 34, 40 to 44 through to 55 to 59, and 65 to 69 all increased in 2016 compared with 2015 (Figure 2). The largest percentage increase between 2015 and 2016 was seen in those aged 30 to 34 years where the rate increased by 8.0%. However, none of the increases between 2015 and 2016 was statistically significant.
Mortality rates at 75 to 79 through to 90 years and over significantly increased between 2014 and 2015 but fell between 2015 and 2016, and returned to levels more similar to previous years (Figure 2). The infant mortality rate, although not included in Figure 2, has also declined over time. Infant mortality is discussed further in Chapter 4.

Figure 2: trend in the age-specific mortality rate by age, persons, England, 2001 to 2016



Source: PHE analysis of ONS Mortality data

5. Leading causes of death in 2016

The Health Profile for England 2017 report identified heart disease and dementia and Alzheimer's as the most common underlying causes of death in males and females respectively and this remained the case in 2016 (Table 1).

The list of the most common site-specific cancers remained unchanged from 2015 in both sexes. Lung cancer, colorectal and anal cancer, and leukaemia and lymphomas were all in the top ten leading causes of death in 2016.

Prostate cancer and breast cancer remained amongst the top ten leading causes of death for males and females respectively, both ranked seventh, the same as in 2015. Lung cancer deaths remained the third most common cause of death for males and sixth most common for females in 2016.

When deaths from all cancers are grouped together, cancer accounted for 25.6% of all deaths in females and 30.3% of all deaths in males in 2016. This would make it the leading cause, in 2016, for both sexes.

Table 1: leading causes of death, males and females, England, 2016

Males			**Females**	
Rank	Cause	Percentage (%) of all deaths	Cause	Percentage (%) of all deaths
1	Heart disease	13.6%	Dementia and Alzheimer's disease	15.8%
2	Dementia and Alzheimer's disease	8.3%	Heart disease	8.3%
3	Lung cancer	6.5%	Stroke	7.0%
4	Chronic lower respiratory diseases	6.1%	Chronic lower respiratory diseases	5.8%
5	Stroke	5.4%	Influenza and pneumonia	5.5%
6	Influenza and pneumonia	4.8%	Lung cancer	5.2%
7	Prostate cancer	4.1%	Breast cancer	3.8%
8	Colorectal and anal cancer	3.1%	Colorectal and anal cancer	2.5%
9	Leukaemia and lymphomas	2.6%	Leukaemia and lymphomas	1.9%
10	Cirrhosis and other diseases of liver	2.0%	Kidney disease and other diseases of the urinary system	1.8%

Source: NOMIS

See how your area compares

In 2016 the most common cause of death between ages one and 9 years in both sexes was congenital anomalies (Figures 3 and 4). Brain cancer, acute respiratory diseases, and leukaemia and lymphomas were also common causes of death in persons under 20 years. However, the number of deaths, from any cause, in childhood was small and therefore the leading causes vary from year to year.

Infant mortality has not been included in the analysis because deaths under 28 days do not record an underlying cause of death in the same way as those 28 days and over. Infant mortality is discussed in more detail in Chapter 4. Deaths from external factors dominated the leading causes in those under the age of 50 years in 2016 (Figures 3 and 4). Suicide, including injury and poisoning of undetermined intent, was the leading cause of death in males and females aged 10 to 34 years, and in males aged 35 to 49 years. The Public Health Outcomes Frameworkshowed that in the period 2014 to 2016 there were over 14,000 deaths from suicide, of which 75% were males. Accidental poisonings appeared in the top 5 leading causes of death for males and females aged 20 to 49 years and males aged 10 to 19 years.

The leading causes of death in those aged 35 years and over remained largely unchanged from 2015 (Figures 3 and 4). Deaths from heart disease, stroke, cancers and respiratory disease were leading causes from age 50 years in both sexes.

Liver disease was a common cause of death in both males and females between the ages of 20 and 64 years. In females, breast cancer was one of the common causes of death between the ages of 20 and 64 years, and in males, colorectal and anal cancer, and prostate cancer were common in the 50 to 64 and 65 to 79 age groups respectively. Lung cancer was the second most common cause of death in males and the most common in females aged 50 to 79 years.

In the 80 plus age group, the most common cause of death was dementia and Alzheimer’s disease in both sexes (Figures 3 and 4).

Figure 3: leading causes of death by age, males, England, 2016

Age	1st	2nd	3rd	4th	5th
1 to 9 years	Congenital anomalies	Brain cancer	Leukaemia and lymphomas	Influenza and pneumonia	Transport accidents
10 to 19 years	Suicide & injury or poisoning of undetermined intent	Transport accidents	Homicide	Accidental poisoning	Leukaemia and lymphomas
20 to 34 years	Suicide & injury or poisoning of undetermined intent	Accidental poisoning	Transport accidents	Homicide	Liver disease
35 to 49 years	Suicide & injury or poisoning of undetermined intent	Heart disease	Accidental poisoning	Liver disease	Stroke
50 to 64 years	Heart disease	Lung cancer	Liver disease	Chronic lower respiratory diseases	Colorectal & anal cancer
65 to 79 years	Heart disease	Lung cancer	Chronic lower respiratory diseases	Stroke	Prostate cancer
80+ years	Dementia and Alzheimer's disease	Heart disease	Influenza and pneumonia	Stroke	Chronic lower respiratory diseases

External
Cancer
Circulatory
Respiratory
Other

Source: NOMIS

See how your area compares

Figure 4: leading causes of death by age, females, England, 2016

Age	1st	2nd	3rd	4th	5th
1 to 9 years	Congenital anomalies	Influenza and pneumonia	Transport accidents	Brain cancer	Other acute respiratory diseases
10 to 19 years	Suicide & injury or poisoning of undetermined intent	Transport accidents	Brain cancer	Leukaemia and lymphomas	Congenital anomalies
20 to 34 years	Suicide & injury or poisoning of undetermined intent	Accidental poisoning	Breast cancer	Liver disease	Transport accidents
35 to 49 years	Breast cancer	Liver disease	Accidental poisoning	Suicide & injury or poisoning of undetermined intent	Heart disease
50 to 64 years	Lung cancer	Breast cancer	Heart disease	Chronic lower respiratory diseases	Liver disease
65 to 79 years	Lung cancer	Chronic lower respiratory diseases	Heart disease	Dementia and Alzheimer's disease	Stroke
80+ years	Dementia and Alzheimer's disease	Heart disease	Stroke	Influenza and pneumonia	Chronic lower respiratory diseases

External
Cancer
Circulatory
Respiratory
Other

Source: NOMIS

See how your area compares

Notes: Deaths under 1 were not included in the analysis because only deaths at 28 days and over record on the death certificate using the International Statistical Classification of Diseases and Related Health Problems (ICD-10) recommended by the World Health Organisation (WHO). Neonatal deaths (under 28 days) are registered using a special death certificate which allows reporting of relevant diseases or conditions on both infant and mother.

In the youngest age group (1 to 9 years), the total number of deaths (male and female) was very small (630) and the total number of deaths for a given leading cause was similarly low; for example, 80 deaths were due to congenital malformations (47 males and 33 females).

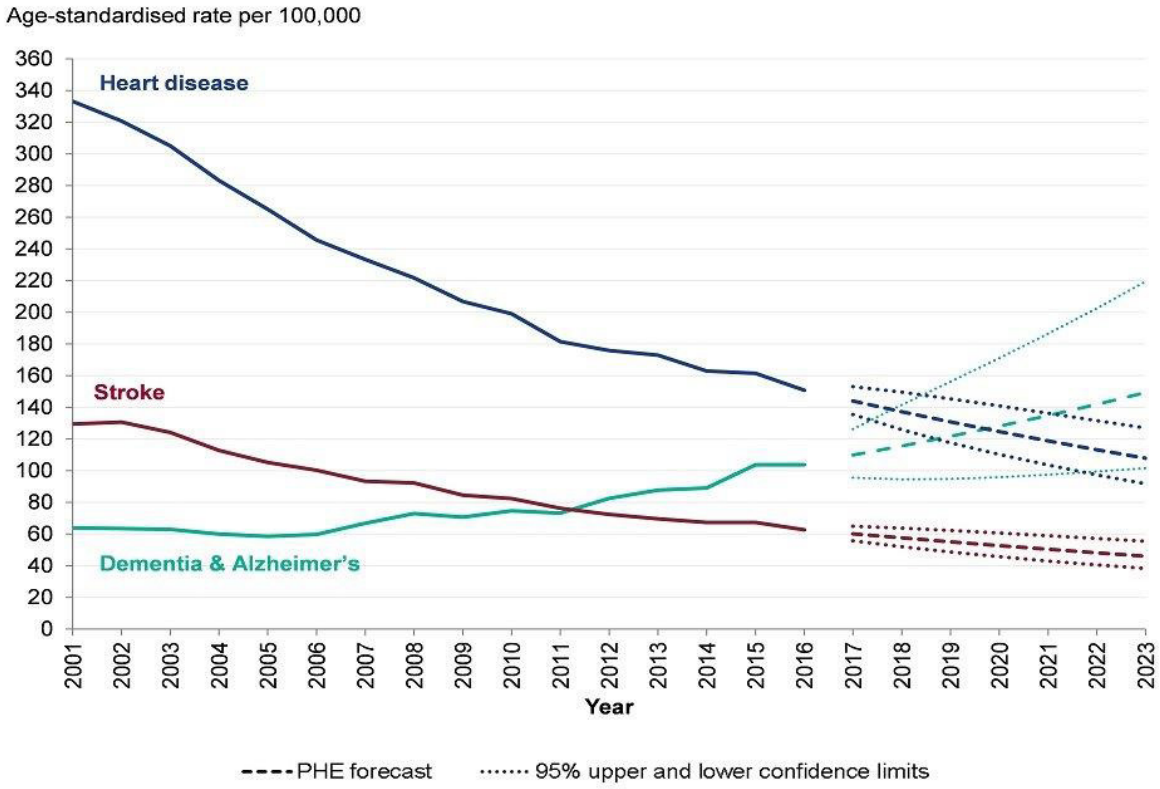
In females aged 1 to 9 years, brain cancer and other acute respiratory diseases were ranked equally as the 4th most common cause of death.

6. Trends in the leading causes of death

The Health Profile for England 2017 outlined the trends in the leading causes of death from 2001 to 2015. The main findings showed a long-term decline in the death rate from heart disease, stroke and most major cancers, and an increase in dementia and Alzheimer's for both males and females. This report updates this analysis to include data for 2016 (Figures 5 to 8).
Figures 5 and 6 show trends in the mortality rates from dementia and Alzheimer's, heart disease and stroke for males and females respectively. A number of factors contributed to the increase in the death rates from dementia and Alzheimer's disease including an increase in awareness of dementia and historical NHS policies encouraging GPs to diagnose, leading to increased recording on death certificates[4]. This means that, in recent years, deaths may have been classified as dementia that would not have been in the past.

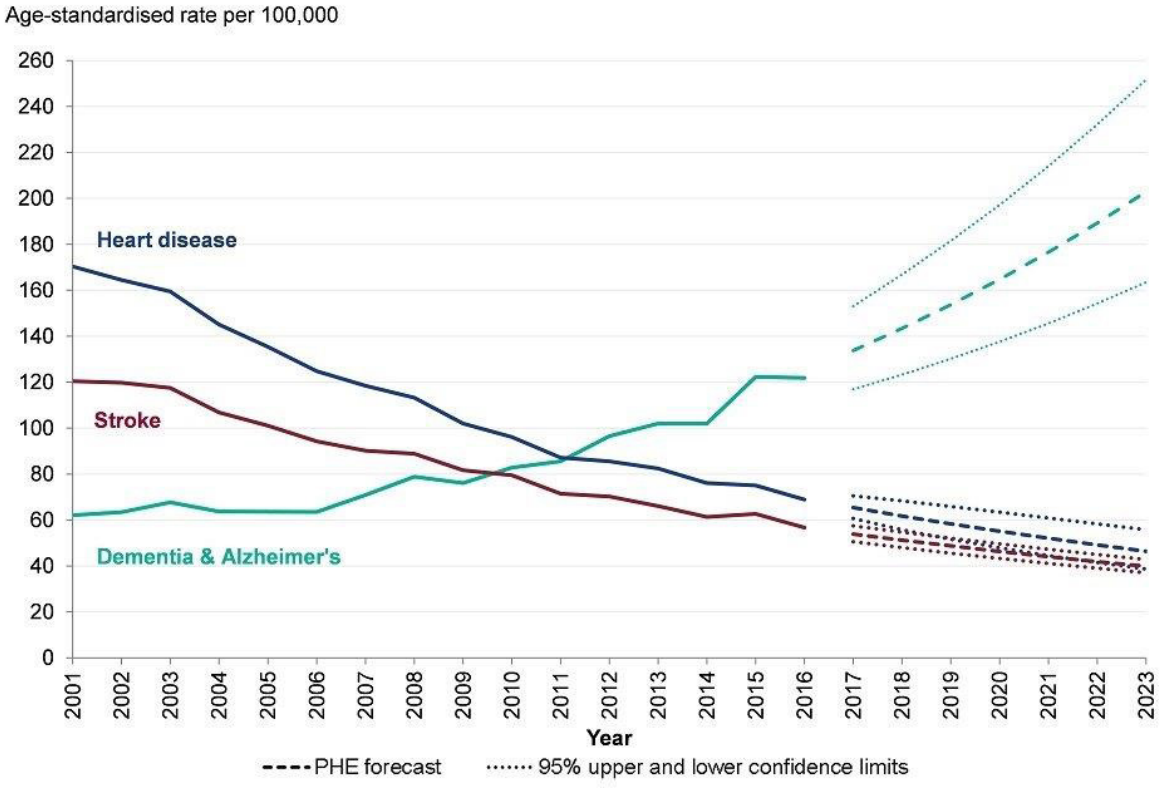
In 2012, the mortality rate from dementia and Alzheimer's among females overtook heart disease. The time series for mortality rates from 2001 to 2016 was used as a basis for forecasts for 2017 to 2023 and show that the mortality rates from dementia and Alzheimer's may continue to rise (Figures 5 and 6). In males, it is estimated that the rate may overtake heart disease as early as 2020 if the heart disease mortality rate continues to fall (Figure 5).

Figure 5: trend in the age-standardised mortality rate from 3 leading causes of death, males, England, 2001 to 2016 and forecasts for 2017 to 2023



Source: PHE analysis of ONS Mortality data

Figure 6: trend in the age-standardised mortality rate from 3 leading causes of death, females, England, 2001 to 2016 and forecasts 2017 to 2023



Source: PHE analysis of ONS Mortality data

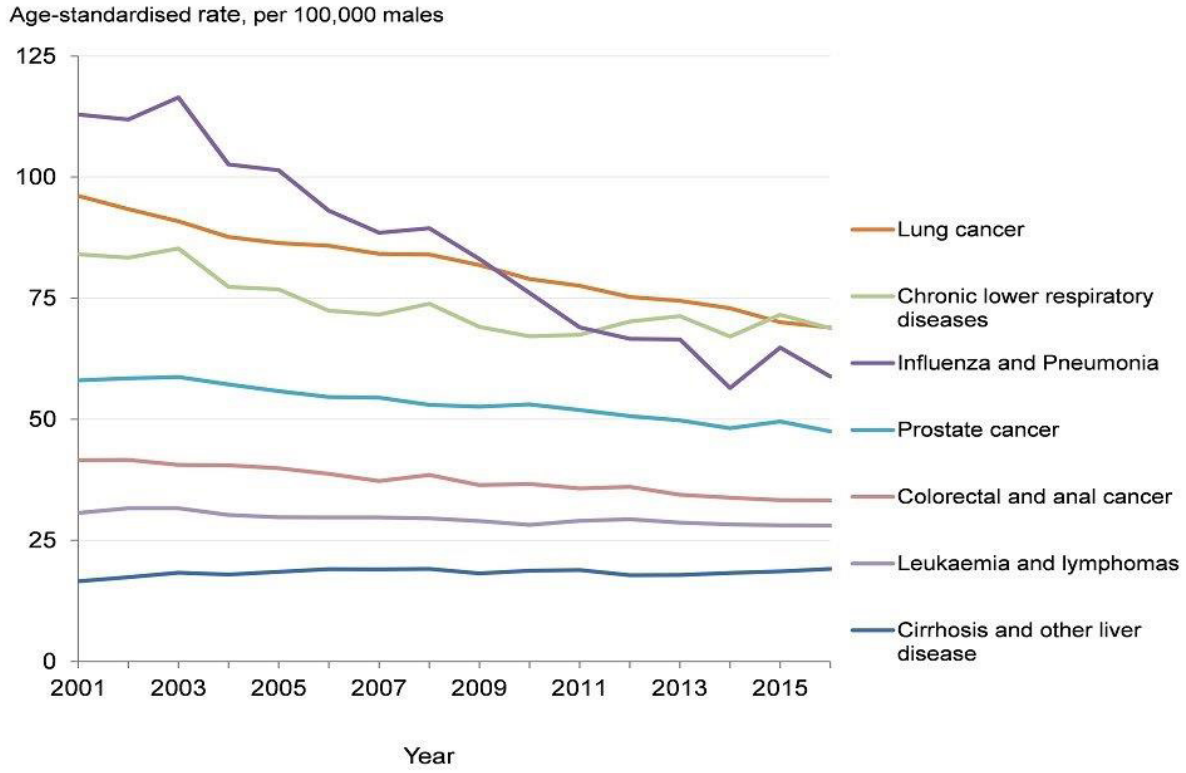
Despite the long-term trends in dementia and Alzheimer's, between 2015 and 2016 there was a decline in the mortality rate from most of the top ten leading causes in both males and females (Figures 5 to 8). The exceptions were cirrhosis and liver disease in males, which rose by 2.9% (Figure 7) and colorectal and anal cancer in females, which rose by 1.1% (Figure 8).

Table 1 highlighted lung cancer deaths as the third most common cause of death for males and the sixth most common for females in 2016. Although the rate in males has declined, in females there was an overall increase in the death rate from lung cancer between 2001 and 2016 (Figures 7 and 8). Between 2015 and 2016 there was a small reduction in the lung cancer death rate in females. It is too early to say if this is the start of a declining trend in the rates of lung cancer deaths in females.

The mortality rates from influenza and pneumonia have been declining for males and females since 2001 (Figures 7 and 8). Influenza immunisation has been recommended to those in clinical at risk groups since the late 1960's but was extended to all persons aged 65 years and over in 2000[5]. Further extension of the programme to children occurred in 2013.
In 2015 the mortality rates from influenza and pneumonia increased. Low vaccine effectiveness was seen in winter 2014 to 2015, reflecting the mismatch between the viruses which were circulating and the main strain which had been included in the flu vaccine formula[6].

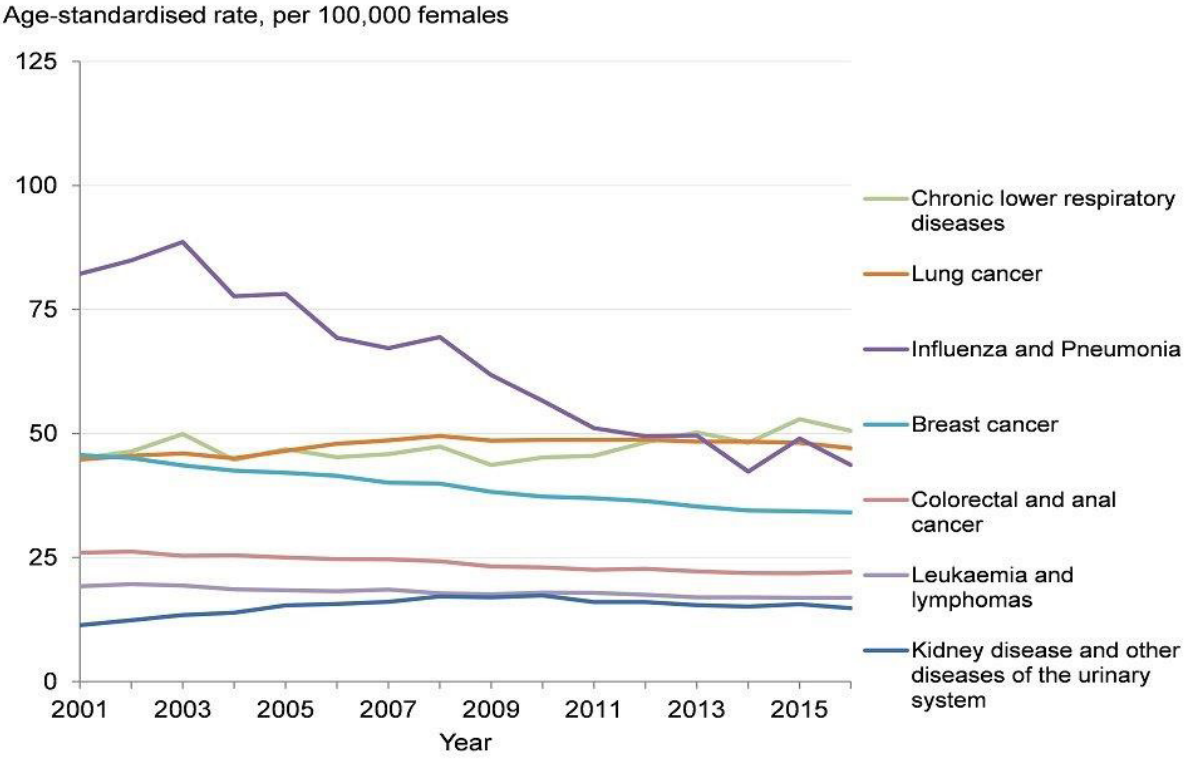
The trend in the chronic respiratory disease mortality rate in males between 2001 and 2016 showed an overall decline, however, there has been variability in the trend year on year (Figure 7). In females, the rate has also fluctuated and peaked in 2015.

Figure 7: trend in the age-standardised mortality rate from selected leading causes of death, males, England, 2001 to 2016



Source: PHE analysis of ONS mortality data

Figure 8: trend in the age-standardised mortality rate from selected leading causes of death, females, England, 2001 to 2016



Source: PHE analysis of ONS mortality data

7. Contribution of causes of death to trends in life expectancy

Chapter 1 discussed the analysis of the contribution of mortality in different age groups to changes in life expectancy over time. This chapter looks at the contribution the leading causes of death made to life expectancy gains over 3 six-year periods between 2001 and 2016. Life expectancy increased in males and females by 3.6 and 2.5 years respectively between 2001 and 2016.

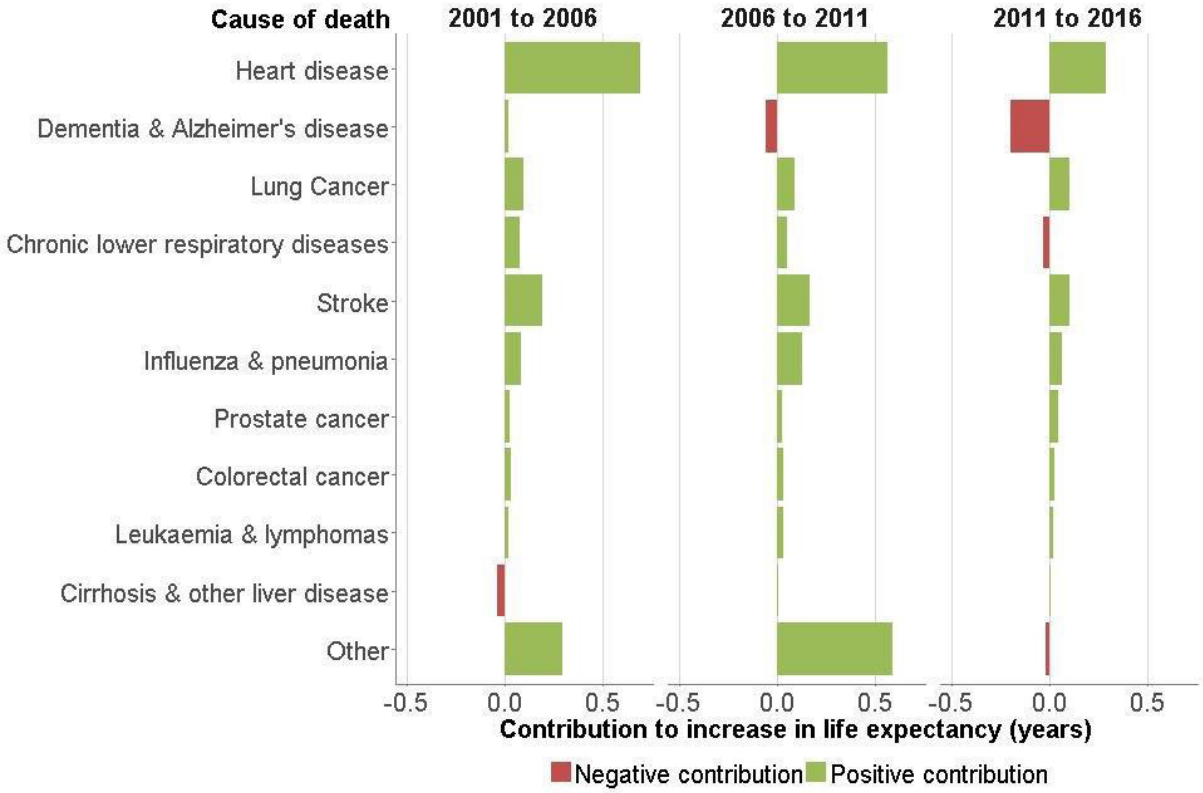
Between 2001 and 2006, a reduction in mortality from several causes led to a 1.5 year increase in male life expectancy. The biggest contributors to gains in life expectancy were reductions in mortality rates from heart disease (adding around 0.7 years to life expectancy), stroke (adding 0.2 years) and other causes (adding 0.3 years) (Figure 9).

Between 2006 and 2011 male life expectancy increased by 1.6 years. Again the biggest contributors were reductions in mortality rates from heart disease, stroke and other causes which accounted for gains in life expectancy of 0.6, 0.2 and 0.6 years respectively. The increase in life expectancy was offset by 0.1 years due to a rise in mortality from dementia and Alzheimer's (Figure 9).

Between 2011 and 2016 male life expectancy increased by 0.4 years. Reductions in mortality rates from heart disease still had a positive effect on life expectancy, adding 0.3 years, but this was a much smaller contribution than in previous years. Deaths from dementia and Alzheimer's continued to offset gains in life expectancy but had a larger effect than in the preceding period, offsetting life expectancy gains by 0.2 years (Figure 9).

The 'other' group comprised of deaths from a wide range of causes and further examination did not reveal a dominant cause that contributed to the change in life expectancy in males.

Figure 9: contribution of causes of death to changes in life expectancy, males, England, 2001 to 2006, 2006 to 2011 and 2011 to 2016



Source: PHE analysis of ONS Mortality data

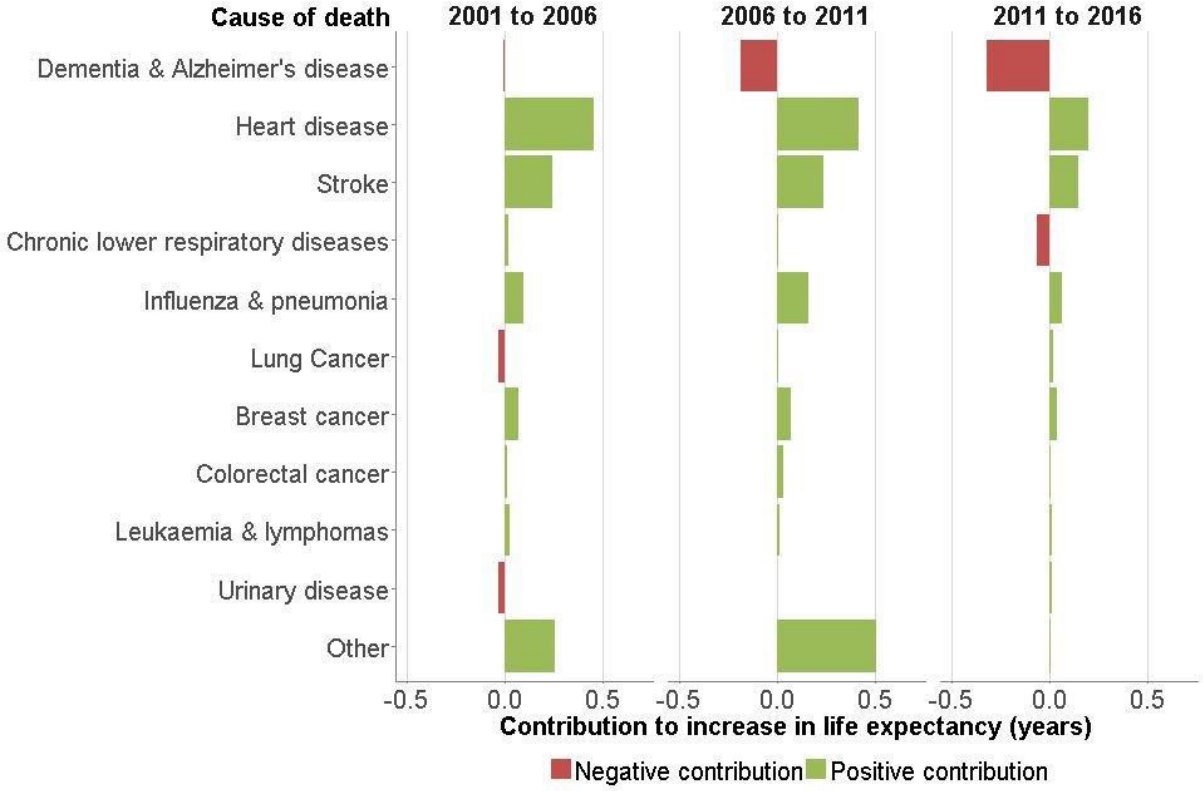
Between 2001 and 2006 female life expectancy at birth increased by 1.1 years. The biggest contributors to gains in life expectancy were a reduction in mortality rates from heart disease (adding 0.5 years), stroke (adding 0.2 years) and other causes (adding 0.3 years) (Figure 10).

Between 2006 and 2011 female life expectancy increased by 1.3 years. The biggest contributors were reductions in mortality from heart disease, stroke, influenza and pneumonia and other causes, accounting for gains in life expectancy of 0.4, 0.2, 0.2 and 0.5 years respectively. The increase in life expectancy was offset by 0.2 years due to a rise in mortality from dementia and Alzheimer's (Figure 10).

By 2016 the leading cause of death in females was dementia and Alzheimer's (Table 1). The effect that rising mortality rates from dementia and Alzheimer's had on life expectancy between 2011 and 2016 is shown in Figure 10. Rising dementia and Alzheimer's mortality offset gains in life expectancy by 0.3 years. Reductions in mortality rates from heart disease still contributed the biggest gains in life expectancy (adding 0.2 years), but the contribution was smaller than in previous years and female life expectancy only improved by 0.1 years between 2011 and 2016.

The ‘other’ group comprised of deaths from a wide range of causes and further examination did not reveal a dominant cause that contributed to the change in life expectancy in females.

Figure 10: contribution of causes of death to changes in life expectancy, females, England, 2001 to 2006, 2006 to 2011 and 2011 to 2016



Source: PHE analysis of ONS Mortality data

8. Premature mortality

Figure 11 describes trends in premature mortality rates (in those under 75 years) from all causes, and two of the main causes of death in the under 75s, cardiovascular disease (heart disease and stroke) and cancer. As the numbers of deaths by cause in those under 75 is relatively small and subject to significant variation year to year, the data are considered on a three-year rolling average basis.

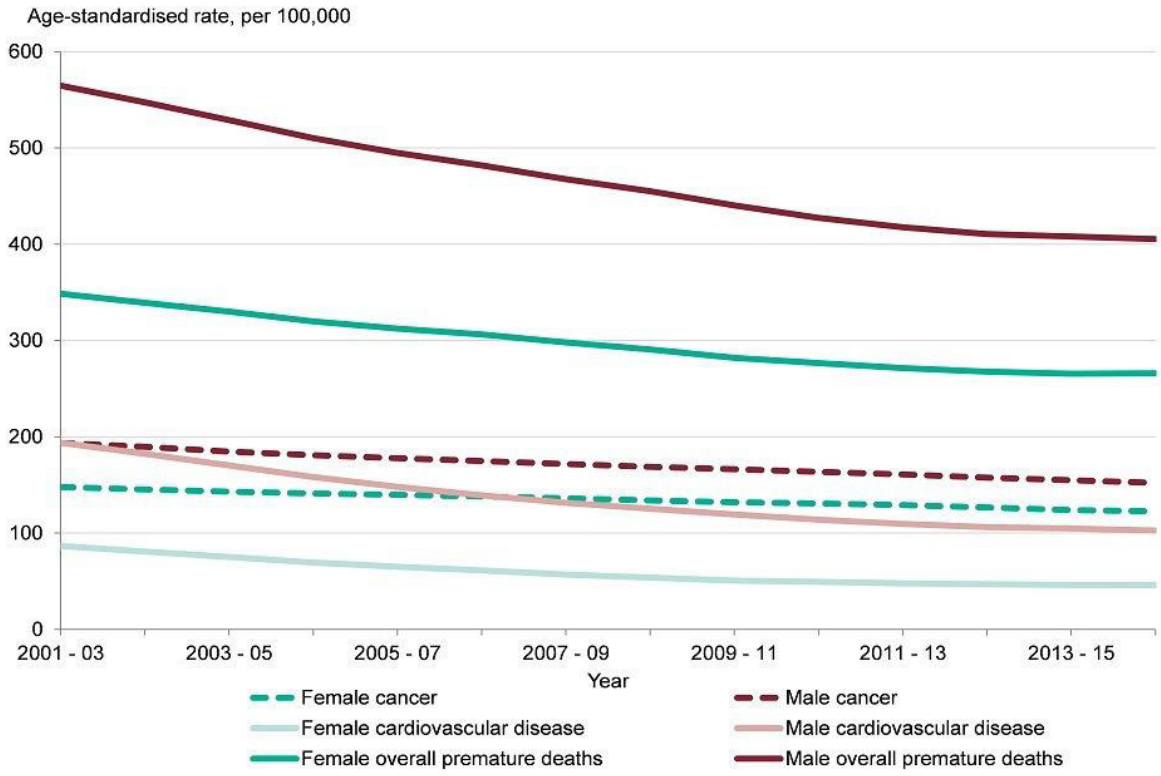
There was a steady reduction in the rate of deaths in those under 75 years. From the period 2001 to 2003, rates for overall premature mortality reduced by 28% for males and 24% for females by 2014 to 2016. Reductions in overall premature mortality, however, slowed down from 2011 to 2013 for both sexes (Figure 11).

Mortality rates from cardiovascular disease in those under 75 have almost halved from 2001 to 2003 (Figure 9). However, from 2014 to 2016, over 100,000 people under 75 years died from cardiovascular disease which accounted for around 22% of all premature deaths[7].

The Health Profile for England 2017 reported that behavioural risk factors such as poor diet, smoking and low physical activity, along with high blood pressure, high body mass index and high cholesterol are the main risk factors for cardiovascular disease. Therefore a large proportion of these premature deaths are preventable[8],[9]. Chapter 3presents information on trends in these risk factors.

Mortality rates from cancer in the under 75s have been falling year on year in both sexes and have reduced by 21% in males and 17% in females since the period 2001 to 2003. When all cancers are combined, they were the largest cause of death in persons under 75, responsible for nearly 187,500 deaths in the period 2014 to 2016. Like cardiovascular disease, behavioural risk factors contribute significantly to the risk of cancer, the largest contributor being smoking[9].

Figure 11: trend in the age-standardised mortality rate in people aged under 75 years, males and females, 2001 to 2003 to 2014 to 2016, England



Source: Public Health Outcomes Framework

See how your area compares:

Premature mortality

Premature mortality from cardiovascular disease

Premature mortality from cancer

9. Premature mortality among people with serious mental illness (SMI)

Premature mortality rates among people with an SMI such as bipolar disorder or schizophrenia were 3.7 times higher than the general population in the financial year 2014 to 2015[10]. This gap has widened in recent years (from 3.3 in the financial year 2009 to 2010)[10], largely due to increases in the mortality rate in those with an SMI[10].

Premature mortality rates in people with an SMI were higher than the general population for many of the leading causes of death, including cardiovascular disease, cancer, respiratory disease and liver diseases. In 2014 to 2015, the gap was wider for deaths from respiratory disease and liver disease mortality. The premature mortality rates were 4.7 and 5.0 times greater in those with an SMI respectively[10]. However, as with the general population, there were more premature deaths among people with SMIfrom cardiovascular disease and cancer than the other causes[10].

These findings in part reflect the higher levels of smoking and substance misuse including alcohol[11] in those with an SMI.

10. Drug misuse deaths

The number and rate of drug misuse deaths have risen sharply in recent years. In England, there were almost 2,400 drug misuse deaths in 2016, an increase of 3.6% on the previous year, and an increase of 60% since 2012[12] (Figure 12).

The rise has been linked to heroin and opioid use, and heroin-related deaths doubled between 2012 and 2016. Two factors have been identified that may be responsible for the increase: the increased availability and purity of heroin, alongside an ageing population of heroin users in poorer health. In addition, spikes in deaths related to the use of illicit fentanyl have also been identified[12]. PHE has published guidance to support local areas in tackling this[13]. New data for 2017 shows that the number and rate of drug misuse deaths fell slightly from 2016, the first fall in 5 years[14].

Drug misuse can increase the likelihood of individuals developing mental illness or make symptoms of mental illness worse[11]. For some conditions the relationship is bi-directional, where poor mental health can lead to drug misuse and vice versa. Around 70% of people accessing drug services have experienced mental health problems and more than half (54%) of suicides among patients accessing mental health services occurred among those with a history of either drug or alcohol misuse[15] .

Figure 12: trend in the number of deaths and age-standardised mortality rate for deaths related to drug misuse, persons, England, 2001 to 2016

Source: ONS

See the full data source

See how your area compares

11. Deaths from neurological conditions

Neurological conditions result from damage to the brain, spinal column or nerves, caused by illness or injury[16]. In 2014, there were nearly 32,000 deaths of people aged 20 years and over with a mention of a neurological condition on their death certificate. This represented 7% of all deaths in England. The specific conditions included are listed in the Methods, data and definitions section. Only half of these deaths had a neurological condition listed as the underlying cause of death, the remainder had one listed as a contributory cause of death.

The number of deaths with a neurological condition as an underlying or contributory factor increased by 39% between 2001 and 2014.

There is likely to have been a number of factors contributing to this increase. This includes a reduction in mortality from other leading causes (leading to population ageing) and more neurological conditions being identified in an ageing population. However, improvements in the detection and diagnosis

practices and a greater awareness of neurological conditions among healthcare professionals will also have contributed.

In addition to the increase in the number of deaths, the resulting death rate for any mention of a neurological condition also increased from 71.0 per 100,000 population in - 2003 to 2005, to 79.8 per 100,000 population in - 2012 to 2014), a rise of 12%.

12. European comparisons

The Global Burden of Disease study (GBD) 2016[9] uses the age-standardised rate of years of life lost (YLL) to measure the burden of premature death across a population. It gives an indication of the effect a disease has on lifespan. This chapter provides an update on the analysis presented in the Health Profile for England 2017.

Among the 28 countries of the European Union (EU), in 2016, the male burden of premature death in the UK was 18% higher than the country with the lowest burden, Luxembourg. The UK was ranked 10th lowest burden out of the 28 EU countries, the same as in 2015, and the burden was significantly lower than the EU average (Figure 13).

The female burden of premature death in the UK was 42% higher than for Spain, the country with the lowest burden. The UK ranked 18th lowest out of the EU countries, no change from 2015, and the burden was significantly higher than the EU average (Figure 14).

In 2016 over half of the burden of premature deaths in EU countries was due to cancers and cardiovascular diseases (heart disease and stroke) (Figures 13 and 14).

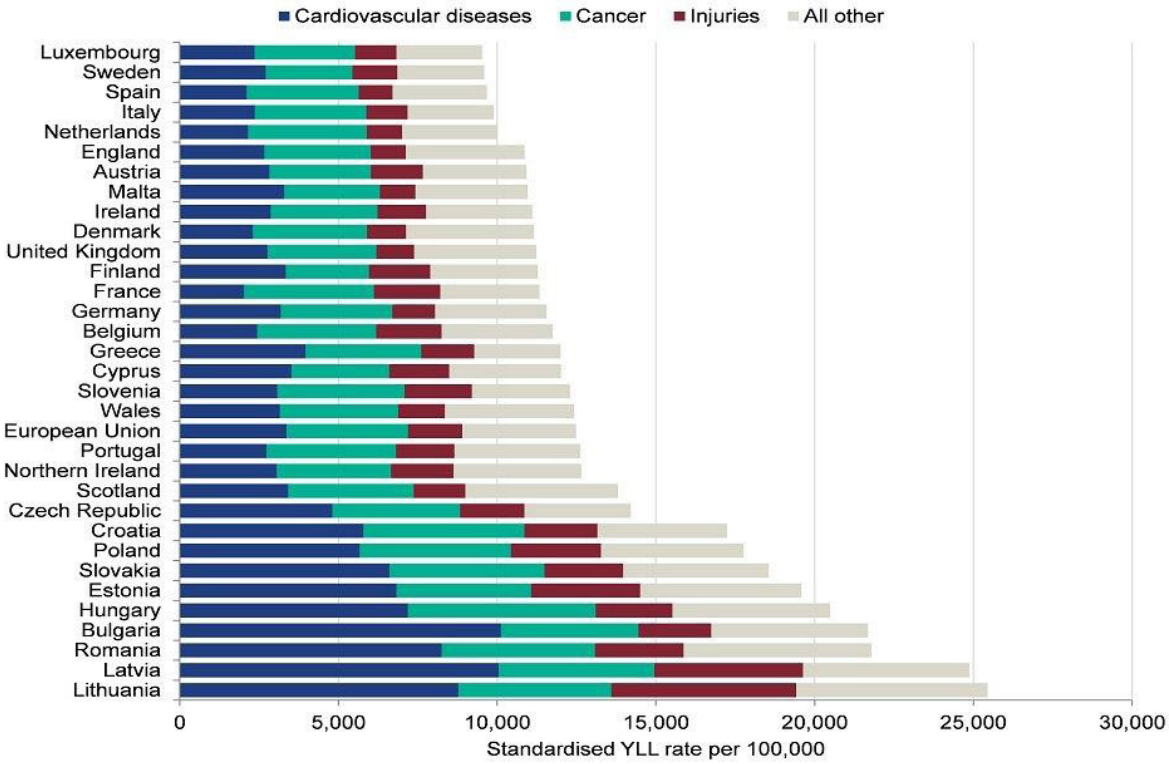
For the male burden of cardiovascular disease, the UK was ranked 10th lowest. The burden was significantly lower than the EU average but 36% higher than the country with the lowest burden, France. For male cancer burden, the UK was ranked 8th. The burden was significantly lower than the EU average but 31% higher than Finland, the country which had the lowest burden (Figure 13).

For females in the UK, the burden of cardiovascular disease was ranked 9th lowest out of the EU countries, was significantly lower than the EU average but 49% higher than France, which had the lowest burden. However, for the cancer burden, the UK was ranked 23rd, the burden was significantly higher than the EU average and 42% higher than Spain, which had the lowest cancer burden (Figure 14).

UK females ranked lower than UK males across the EU for a wide range of causes. However, for premature cancer mortality, the UK was ranked 8th lowest for males and 23rd lowest for females in 2016, a difference in rankings of 15 places. Although the burden from cancer was greater in UK males than females, cancer made a substantial contribution to the overall poorer relative position of UK females compared to males across the EU.

Compared with other countries of the UK, England had the lowest burden of premature mortality from all causes, cardiovascular disease and cancer in both males and females, however, the majority of these differences were not statistically significant.

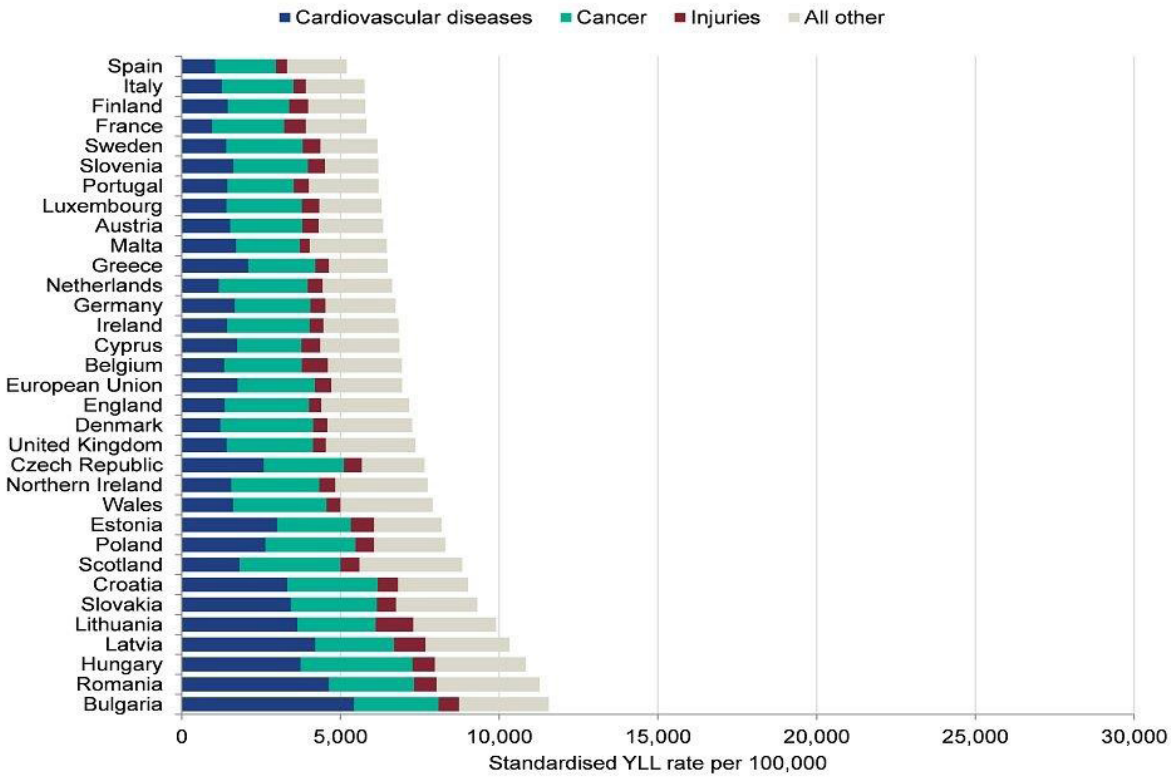
Figure 13: age-standardised years of life lost rate, males, EU and UK countries, 2016



Source: Global Burden of Disease study 2016

See the full data source

Figure 14: age-standardised years of life lost rate, females, EU and UK countries, 2016



Source: Global Burden of Disease study 2016

See the full data source

13. Further information

This chapter focused on trends in mortality by age, sex and cause in England. However, mortality rates vary within England across different populations. There are differences in mortality relating to socioeconomic status, ethnicity, geographical area and other social factors. Mortality rates tend to be higher in more deprived areas and Chapter 5looks closely at the relationship between health outcomes and deprivation.

Trends and causes of death in the population are also influenced by a broad range of risk factors. The Global Burden of Disease (GBD) model[9] identifies the behavioural, metabolic and environmental risk factors contributing to deaths in each age group and by each cause. The risk factors contributing to the highest proportion of overall deaths outlined in the Health Profile for England 2017 were obesity and tobacco smoking. Chapter 3 discusses these risk factors in more detail.

14. References

1. ONS (2017) Causes of death over 100 years. Accessed 13 June 2018.
2. Baillie L, Hawe E (2012) Causes of Death: A Study of a Century of Change in England and Wales. Office of Health Economics. Accessed 10 May 2018.
3. Baker A, Ege F and others. (2018) Response to articles on mortality in England and Wales. Journal of the Royal Society of Medicine. Accessed 9 July 2018.
4. NHS England (2014) Enhanced Service Specification Dementia Identification Scheme. NHS England. Accessed 6 June 2018
5. PHE (2017) Influenza: the green book, Chapter 19. Accessed 9 July 2018.
6. Public Health England (2015) Surveillance of influenza and other respiratory viruses in the United Kingdom: winter 2014 to 2015. Accessed 9 July 2018.
7. PHE analysis of NOMIS data. Full data source
8. BHF (2017) BHF CVD Statistics Factsheet England. British Heart Foundation. Accessed 26 April 2018.
9. Institute of Health Metrics and Evaluation (2018) Global Burden of Disease Study 2016
10. NHS Digital (2016) NHS Outcomes Framework - Indicator 1.5.i, Excess under 75 mortality rate in adults with serious mental illnes. Accessed 6 June 2018.
11. Turning Point (2016) Duel Dilemma. The impact of living with mental health issues combined with drug and alcohol misuse. Accessed 11 May 2018.
12. ONS (2017) Deaths related to drug poisoning in England and Wales: 2016 registrations. Office for National Statistics. Accessed 11 May 2018.
13. PHE (2017) Public health matters: Fentanyl: What's being done to mitigate future problems. Accessed 13 June 2018.
14. ONS (2018) Deaths related to drug poisoning in England and Wales. Accessed 5 September 2018.
15. Health Quality Improvement Partnership (2016) The National Confidential inquiry into Suicide and Homicide by People with Mental Illness. Making Mental Health Care Safer: Annual Report and 20-year Review. Accessed 11 May 2018.
16. The neurological alliance (2018) What is a neurological condition? Accessed 9 July 2018.

Chapter 3: trends in morbidity and risk factors

Published 11 September 2018

1. Main messages

Overall population health in England has improved in recent decades. The age-standardised morbidity rate in England (rate of ill health), reduced by 2.1% between 1990 and 2016.

Older people experience higher rates of morbidity than younger people. In 2016, people aged in their 80s had almost twice the morbidity rate of people in their 60s, who had almost twice that of people in their 20s. However, age-specific morbidity rates decreased for all age groups between 1990 and 2016. The largest reductions were for those aged 70 to 89 years.

The population has been increasing and ageing (Chapter 1), so despite the population being healthier at every age group, the total burden of morbidity has increased between 1990 and 2016.

Musculoskeletal (MSK) conditions, mental and substance use disorders, and a group of other non-communicable diseases (skin diseases, oral disorders, hearing and sight loss) accounted for over 60% of the total morbidity burden in 2016. Low back and neck pain and skin diseases (mainly dermatitis, acne and psoriasis) remained the two leading specific causes, for both males and females.

Having any long-term health condition can reduce quality of life, and those with a long-term MSK condition or a long-term mental health condition had the lowest quality of life scores in financial year 2016 to 2017. In addition, mental and physical health conditions are closely linked, people with long-term MSK conditions were almost twice as likely to report feeling anxious or depressed on a given day than the general population (24.1% compared with 13.7%).

In 2014, it is estimated that 18.9% of adults aged 16 to 64 years in England had at least one common mental health disorder (CMD), which includes depression and anxiety. Since 1993, the prevalence of CMDs in England have increased.

As the population continues to age, the number of people with many chronic conditions is expected to increase. For example, the number of people with diabetes, is expected to increase in the next two decades from 3.9 million people in 2017 to 4.9 million in 2035. Obesity is a major risk factor for diabetes and this number will increase further if the prevalence of obesity also increases.

In 2016, obesity and smoking were the leading risk factors for morbidity. These are associated with many of the common causes of morbidity including cardiovascular disease, MSK conditions, respiratory diseases, diabetes and most cancers.

The prevalence of many risk factors among adults, including smoking, illicit drug use, high blood pressure and high cholesterol have continued to decline. The prevalence of smoking in adults has declined from 19.9% to 14.9% in the last 7 years and time series analysis suggests that, if this trend continues, it will reduce to between 8.5% and 11.7% by 2023. However, the trends in other risk factors have been less favourable; there has been a slight upward trend in obesity since 2007.

2. Introduction

Chapter 1 shows that, in England, life expectancy has generally increased in recent decades and has reached 79.6 years for males and 83.2 years for females. It also shows that, at the same time, the population has been ageing. In England in 2017, the proportion of the population aged 85 years and over was 2.7 times greater than it was in 1971.

More recently there has been little change in healthy life expectancy (the number of years spent in good health) (Chapter 1). Therefore, as people live longer, the years spent in poor health have increased. However, data on healthy life expectancy do not give an indication of the severity of poor health or the types of conditions that are prevalent in each age group.

This chapter provides an update on data included in the Health Profile for England 2017but also examines some leading causes of morbidity, including musculoskeletal (MSK) conditions, mental health and diabetes in more detail. It draws on data from the Global Burden of Disease study 2016 (GBD) and other sources.

This chapter also reports on the leading risk factors associated with morbidity and trends in these over time.

3. Trends in the burden of morbidity

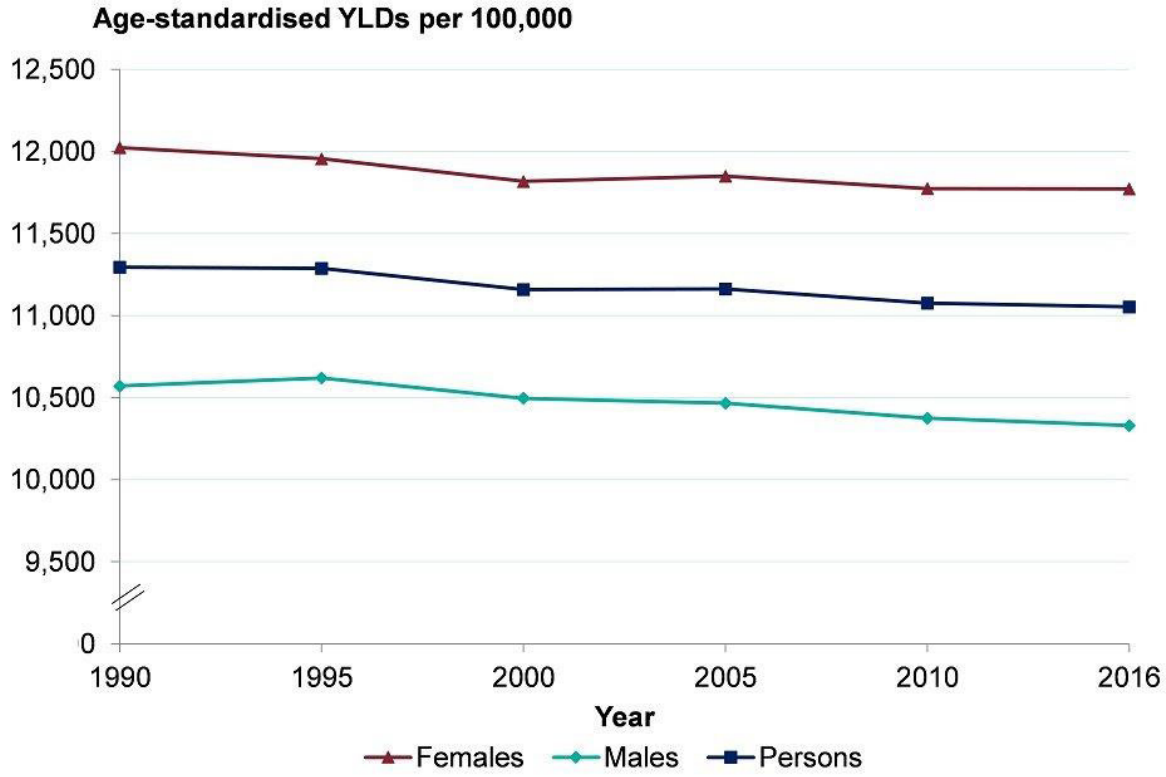
Years lived with disability (YLDs) is a measure of morbidity used in the Global Burden of Disease study (GBD) that combines the prevalence of each disease with a rating of the severity of its symptoms (excluding death itself), to give an overall measure of the loss of quality of life. Condition specific morbidity data is reported in this chapter for both broad conditions (level 2 disease groups), and more specific conditions (level 3 disease groups).
Further information on how YLDs are calculated and the disease hierarchy levels can be found in the Methods, data and definitions section.

The total burden of morbidity, measured by the total number of YLDs in the population in a given year, increased by over a sixth between 1990 and 2016, from around 6 million to over 7 million.

However, after adjusting for population size and age, the age-standardised rate of morbidity has reduced by 2.1% (Figure 1). This indicates that the increase in the total burden of morbidity is accounted for by increases in population size and population ageing.

Similar trends were seen for males and females. The age-standardised rate for males during this period decreased by 2.3% compared with 2.1% for females. In general, the overall morbidity burden for males was lower than for females (Figure 1).

Figure 1: trend in the age-standardised morbidity rate, England, 1990 to 2016



Source: Global Burden of Disease Study 2016 (GBD 2016) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2016

See the full data source

4. Trends in morbidity by disease group

As reported in the Health Profile for England 2017, there has been little change in the leading causes of morbidity in recent years. MSK conditions, mental and substance use disorders and a group of other non-communicable diseases still make up the 3 largest broad groups (level 2) of conditions. Together, these 3 broad groups contributed over 60% of total YLD burden in 2016. This percentage contribution has been consistent since 1990.

MSK conditions include low back and neck pain, osteoarthritis and rheumatoid arthritis and by themselves, they account for 22.1% of the YLD burden. These MSK causes of morbidity are often long-term debilitating conditions that individuals live with and manage for many years. MSK conditions are discussed in further detail later in this chapter.

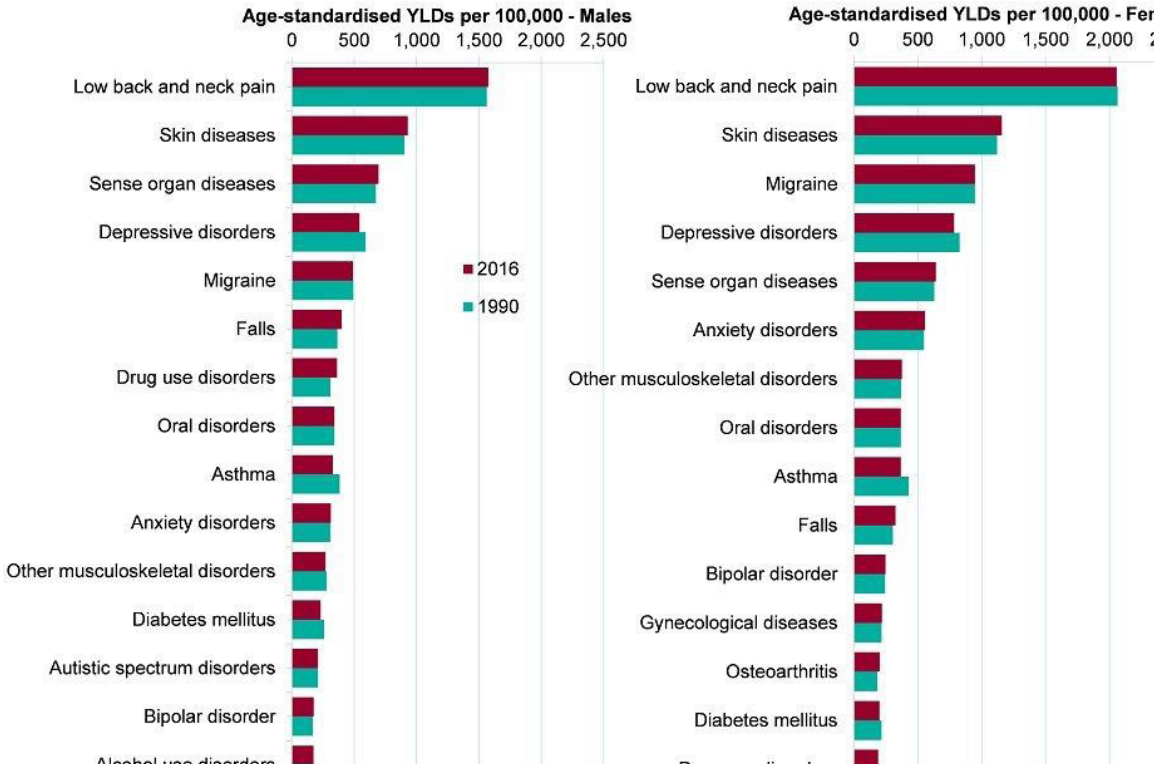
Mental health and substance disorders include anxiety and depression, and alcohol and drug misuse. These account for 21.3% of the YLD burden. Mental health is discussed in further detail later in this chapter.

Other non-communicable diseases include skin diseases, oral problems and sense organ diseases such as hearing and sight loss. These account for 19.7% of the YLDburden. The specific condition contributing most to this category was age-related hearing loss, which contributes 3.6% of the total YLD burden and has increased by 9.4% between 1990 and 2016.

Figure 2 shows the top 15 specific conditions (level 3) in 2016. The top 15 conditions in GBD 2013, reported in the Health Profile for England 2017, were different, for both males and females. These differences are mostly due to changes in methods used between the GBD 2013 and the GBD 2016 study, rather than real changes in the leading causes of morbidity over 3 years.

In 2016, just over 70% of all morbidity was accounted for by the top 15 specific conditions (level 3). Low back and neck pain was the leading cause of level 3 morbidity for males and females. It accounted for more than one and half times the morbidity of skin diseases, the second placed condition for both sexes (Figure 2).

Figure 2: age-standardised morbidity rate for leading causes of morbidity (level 3 disease groups), males and females, England, 1990 and 2016



Source: Global Burden of Disease Study 2016 (GBD 2016) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2016

See the full data source

Among the leading causes of morbidity in 2016 (both sexes combined), the largest percentage increases in morbidity were seen in falls (7.2%), as well as an increase in drug use disorders (8.8%). During the same period from 1990 to 2016 the morbidity due to asthma declined by 14.5%.

Although not among the top 15 specific causes of morbidity, there were large decreases in the morbidity burden of ischaemic heart disease (over 45% reduction) and almost a 20% reduction in stroke between 1990 and 2016. This is consistent with the large decline in mortality from these causes (Chapter 2). Cardiovascular conditions accounted for 4.4% of the overall YLD burden in 2016, compared with 6.2% in 1990.

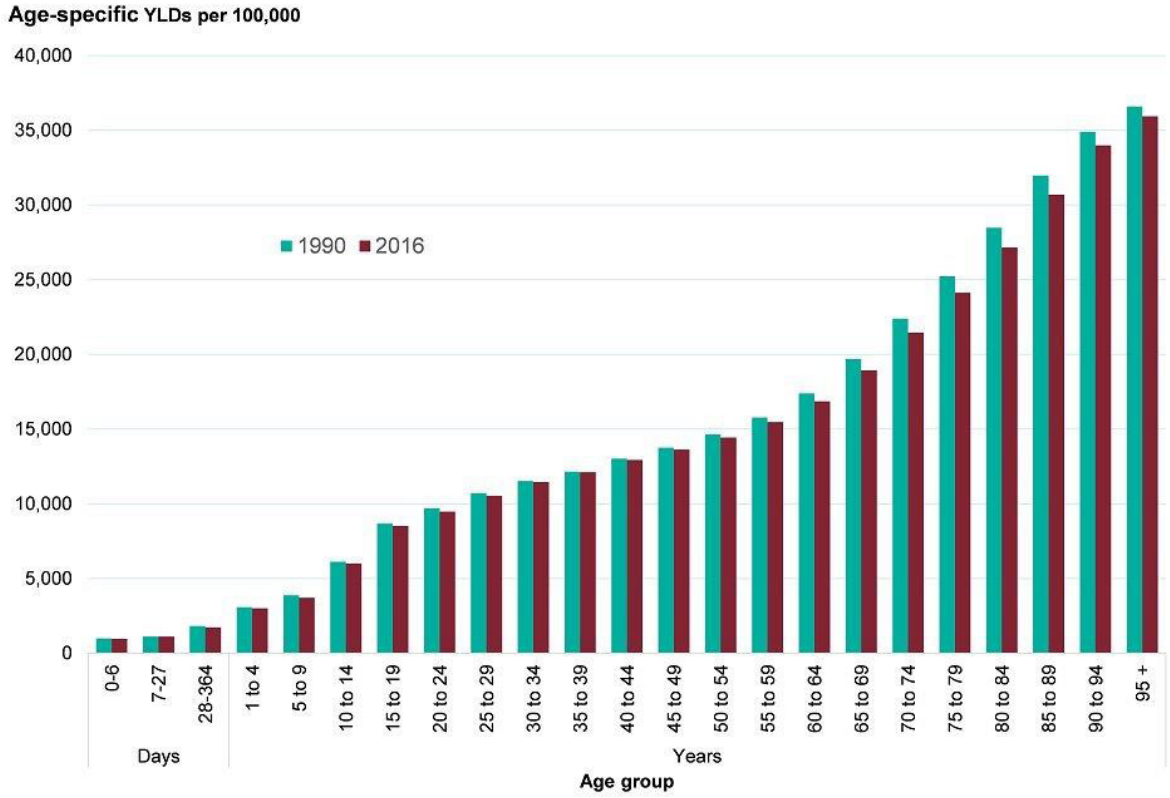
Road traffic accident morbidity burden has also decreased by 22.1% over the same time period. This decrease is related to a reduction in reported road casualties.

Although communicable diseases accounted for less than 5% of the total morbidity burden in 2016, there have been some changes over time. Morbidity from HIV has increased from 3.4 YLDs per 100,000 in 1990 to 16.9, a fourfold increase. The morbidity burden from tuberculosis has reduced by 29% from 2.6 YLDs per 100,000 to 1.8 in 2016. For more information on infectious diseases see Chapter 7.

5. Trends in morbidity by age

The population age-specific morbidity rate (YLDs per 100,000 population) increases steadily from birth through to the middle age groups, and then more rapidly into the older age groups. The morbidity rate for those in their late 80s in 2016 was almost double that of those in their early 60s (Figure 3). Age-specific morbidity rates decreased for all age groups between 1990 and 2016, but the largest reductions were for those aged 70 to 89 years.

Figure 3: age-specific morbidity rate, persons, England 1990 and 2016



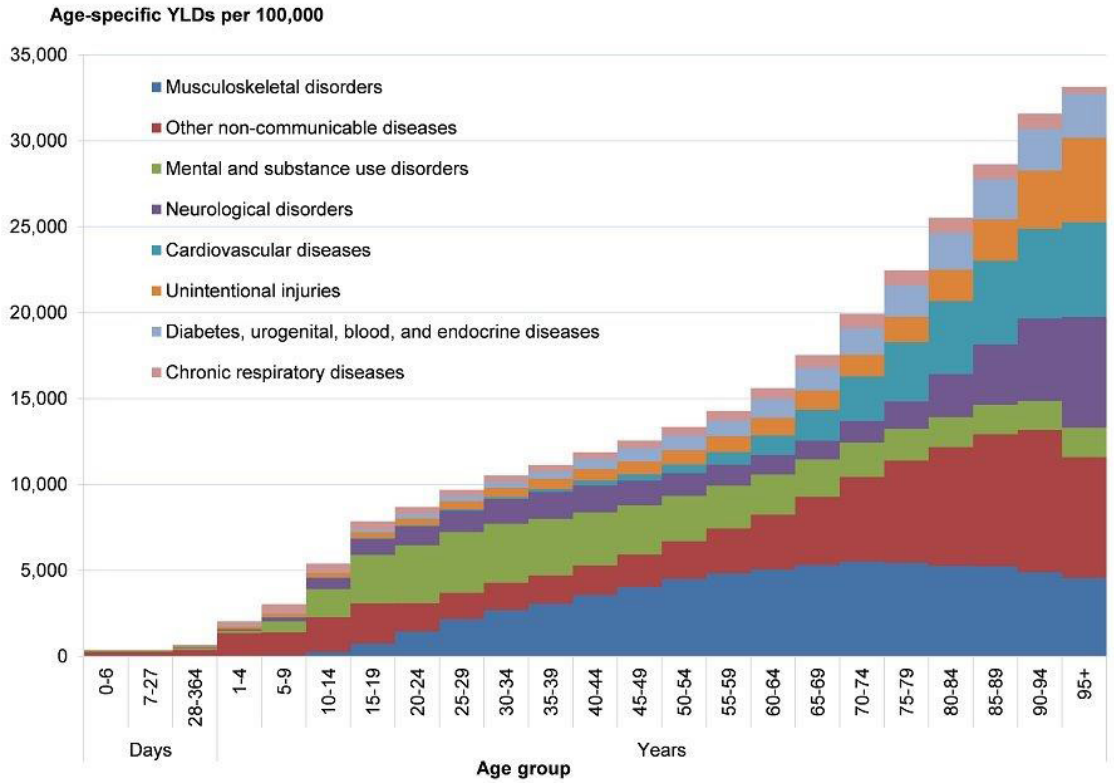
Source: Global Burden of Disease Study 2016 (GBD 2016) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2016

See the full data source

This age pattern reflects the fact that morbidity from many diseases increases with age, in particular, cardiovascular disease, neurological diseases (including Alzheimer's and other dementias), and diabetes (Figure 4). The figure shows no increase in morbidity from MSK conditions after age 70 to 74 years. Some MSK conditions (level 3 - such as low back pain) increase with age, peak around age 75 to 79 years, then decline, while osteoarthritis continues to increase with age[1].

Mental health and substance use disorders have a different pattern, as the greatest burden is in the younger ages. These conditions have the largest burden of morbidity in people between the ages of 15 and 39 years. They account for more than a third of all morbidity burden in the population between the ages of 15 and 29 years (Figure 4).

Figure 4: morbidity rate by age and top 8 broad causes (level 2 disease groups), persons, England, 2016



Source: Global Burden of Disease Study 2016 (GBD 2016) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2016

See the full data source

The leading causes of morbidity (level 3, specific conditions) at each age in 2016 are presented in Figures 5 and 6. The top 5 causes by age and sex in GBD 2013, reported in the Health Profile for England 2017 were different. These differences are mostly due to changes in methods used between the GBD 2013 and the GBD 2016 study, rather than real changes in the leading causes of morbidity over 3 years.

Low back and neck pain, and sense organ diseases (including hearing and sight loss) were ranked first or second as causes of morbidity in males and females aged 50 years and older (Figures 5 and 6).

For younger males aged 15 to 49 years, low back and neck pain was the leading cause, skin diseases were ranked second, followed by depressive disorders. For females aged 15 to 49 years, low back and neck pain was also the leading cause, followed by migraine and skin diseases.

Alzheimer's and other dementias was ranked third in females aged 70 years or older and fifth in males (Figure 6).

Figure 5: top 5 leading causes of morbidity* (level 3 disease groups) by age, males, England, 2016

Age	1st	2nd	3rd	4th	5th
15 to 49 year olds	Low back and neck pain	Skin diseases	Depressive disorders	Migraine	Drug use disorders
50 to 69 year olds	Low back and neck pain	Sense organ diseases	Oral disorders	Skin diseases	Depressive disorders
70 or older	Sense organ diseases	Low back and neck pain	Stroke	Oral disorders	Alzheimer's disease and other dementias
All ages (age-standardised)	Low back and neck pain	Skin diseases	Sense organ diseases	Depressive disorders	Migraine

Source: Global Burden of Disease Study 2016 (GBD 2016) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2016.

Figure 6: top 5 leading causes of morbidity* (level 3 disease groups) by age, females, England, 2016

Age	1st	2nd	3rd	4th	5th
15 to 49 year olds	Low back and neck pain	Migraine	Skin diseases	Depressive disorders	Anxiety disorders
50 to 69 year olds	Low back and neck pain	Sense organ diseases	Depressive disorders	Migraine	Skin diseases
70 or older	Low back and neck pain	Sense organ diseases	Alzheimer's disease and other dementias	Falls	Oral disorders
All ages (age-standardised)	Low back and neck pain	Skin diseases	Migraine	Depressive disorders	Sense organ diseases

Source: Global Burden of Disease Study 2016 (GBD 2016) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2016

*YLDs per 100,000 population

See the full data source

6. Musculoskeletal conditions

In GBD 2016, MSK conditions accounted for more than 22.1% of the total burden of morbidity in England, and low back and neck pain was the leading cause of morbidity. MSK conditions are injuries or pain that affect the joints, bones, muscles, nerves, ligaments or tendons and include several autoimmune diseases such as rheumatoid arthritis. One in 5 people (20%) consult a GP about a musculoskeletal problem every year[2].

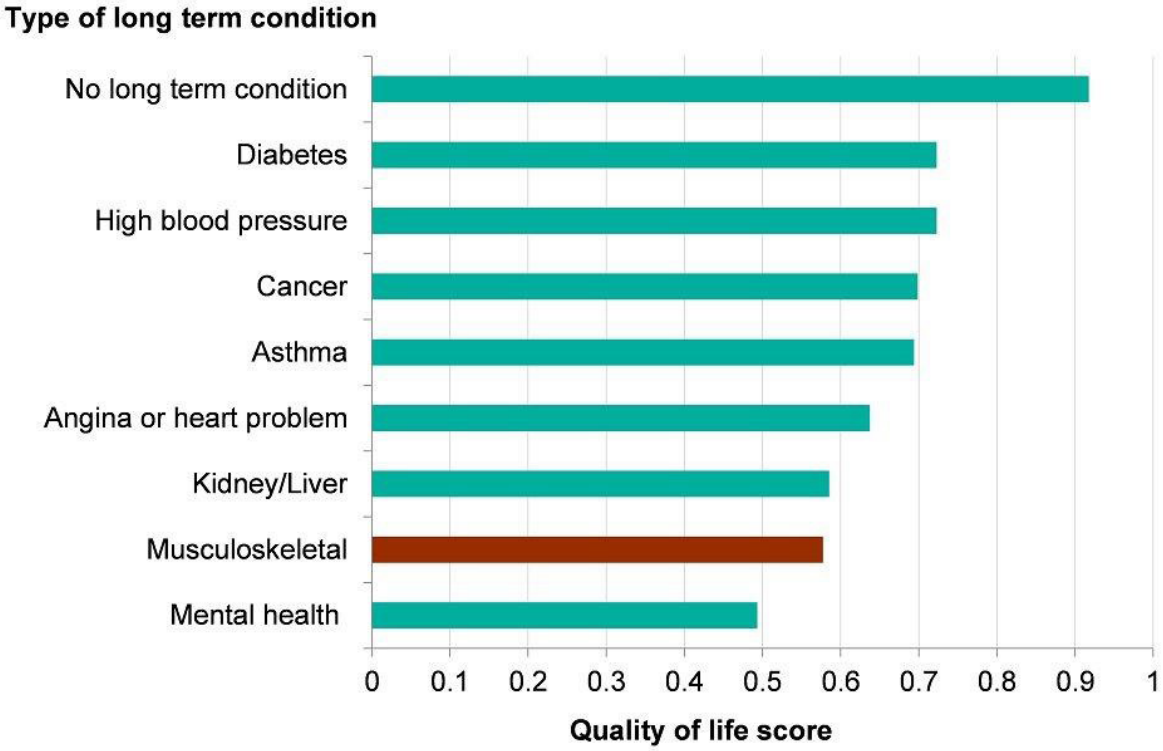
Analysis of indicators from the GP Patient Survey presented in the PHE MSK profilessuggests that the proportion of people reporting a long-term MSK problem has decreased from 17.2% in financial year 2014 to 2015, to 16.5% in 2016 to 2017. This is the case for both long-term back pain (9.9% to 9.4%) and long-term arthritis or joint pain (12.8% to 12.2%). It is not possible to say whether this is a real reduction in prevalence or a reduction in the reporting of these conditions[3].

In the financial year 2016 to 2017, the percentage of people reporting a long-term MSKproblem significantly increased with age, 3.4% of 18 to 24 year olds reported having an MSK condition compared with 42.0% of those aged 85 years and over. This pattern by age is slightly different from that presented in Section 5 using GBD data. Females reported a significantly higher prevalence of MSK conditions than males (18.5% compared with 14.4%)[4].

There are also inequalities in the prevalence of a long-term MSK condition by deprivation. People in the least deprived areas[3]. had a prevalence of 14.5% compared with 17.1% in the most deprived areas. This difference was true for long-term back pain and arthritis or a long-term joint pain[3].

Having a long-term condition can reduce quality of life, and those with a long-term MSKcondition had an average EQ-5D (a standardised instrument for measuring health status) score of 0.58 compared with those without a long-term condition who had a better score of 0.92[4]. The quality of life score for people with a long-term mental health condition was the lowest. (Figure 7).

Figure 7: average quality of life score for adults who live with a self-reported long term condition, England, financial year 2016 to 2017



Source: PHE Analysis of General Practitioner Patient Survey (GPPS)

See how your area compares for people with an MSK condition

MSK conditions are associated with a large number of co-morbidities, including diabetes, depression and obesity[5]. The percentage of people who reported a long-term MSK condition who also reported feeling anxious or depressed was 24.1% compared to 13.7% in the general GP Patient Survey population (GPPS)[4]. The question used in the survey reflects the mood of the individual on the day the survey is completed and may not be related to their long-term condition.

There were also significant inequalities in the prevalence of these feelings among people with an MSK condition. Those in the younger age bands who had an MSKcondition reported a significantly higher prevalence of depression or anxiety compared with those aged 65 years and over. In addition, the prevalence among people in more deprived areas was 30.5% compared with 17.0% in the least deprived areas[3].

7. Mental health

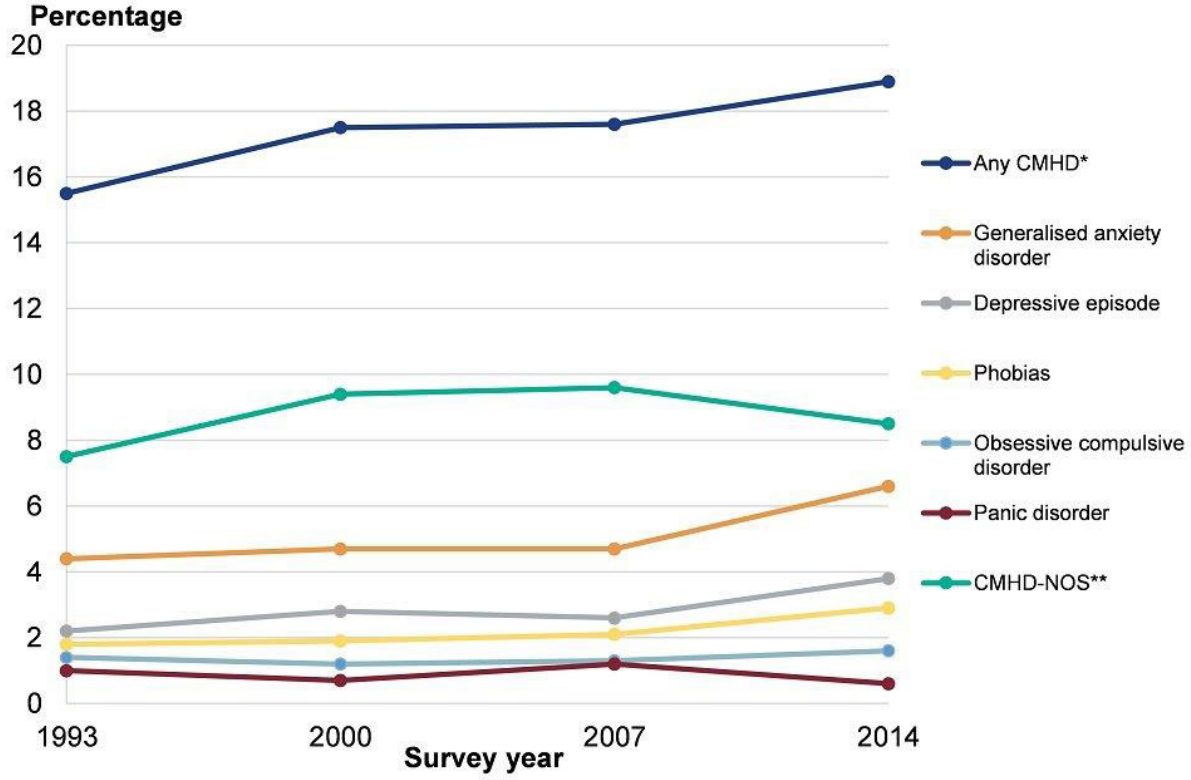
Data from GBD 2016 shows that all mental and substance misuse disorders grouped together account for 21.3% of the total morbidity burden in England. Taken separately, the following conditions; depression, drug use, anxiety, autistic spectrum disorders, schizophrenia and bipolar disorders were all ranked in the top 15 leading causes. It is likely that the total burden of mental health problems is an underestimate due to a number of reasons, including the overlap with neurological disorders and the grouping of self-harm as a separate category[6].

Half of all mental health problems emerge before the age of 14 and three quarters by age 25[7]. Poor social and emotional well-being in young children can lead to behaviour and developmental problems and, later in childhood, severe depression, anxiety, self-harm and other poor mental health outcomes[8]. Improving children and young peoples' mental wellbeing will have a positive effect on their cognitive development, learning, physical health, and their mental health, social and economic prospects in adulthood[9].

The Adult Psychiatric Morbidity Survey (APMS)[10] series provides data on the prevalence of both treated and untreated mental health disorders in the English adult population. In 2014, 17.0% of adults (aged 16 and over), in England met the diagnostic criteria for at least one common mental health disorder (CMD) in the week prior to being surveyed. CMDs include depression and anxiety, which can cause marked emotional distress and interfere with daily function but do not usually affect insight or cognition.

Since 1993, the prevalence of CMDs in England for those aged between 16 and 64 increased from 15.5% to 18.9% in 2014, although the pattern and general trend varies by specific condition (Figure 8)[10].

Figure 8: trend in the prevalence of experiencing common mental health disorders (CMDs) in their past week, adults (age 16 to 64), England, 1993 to 2014



Source: Adult Psychiatric Morbidity Survey 2014

*common mental health disorders **common mental health disorders not otherwise specified

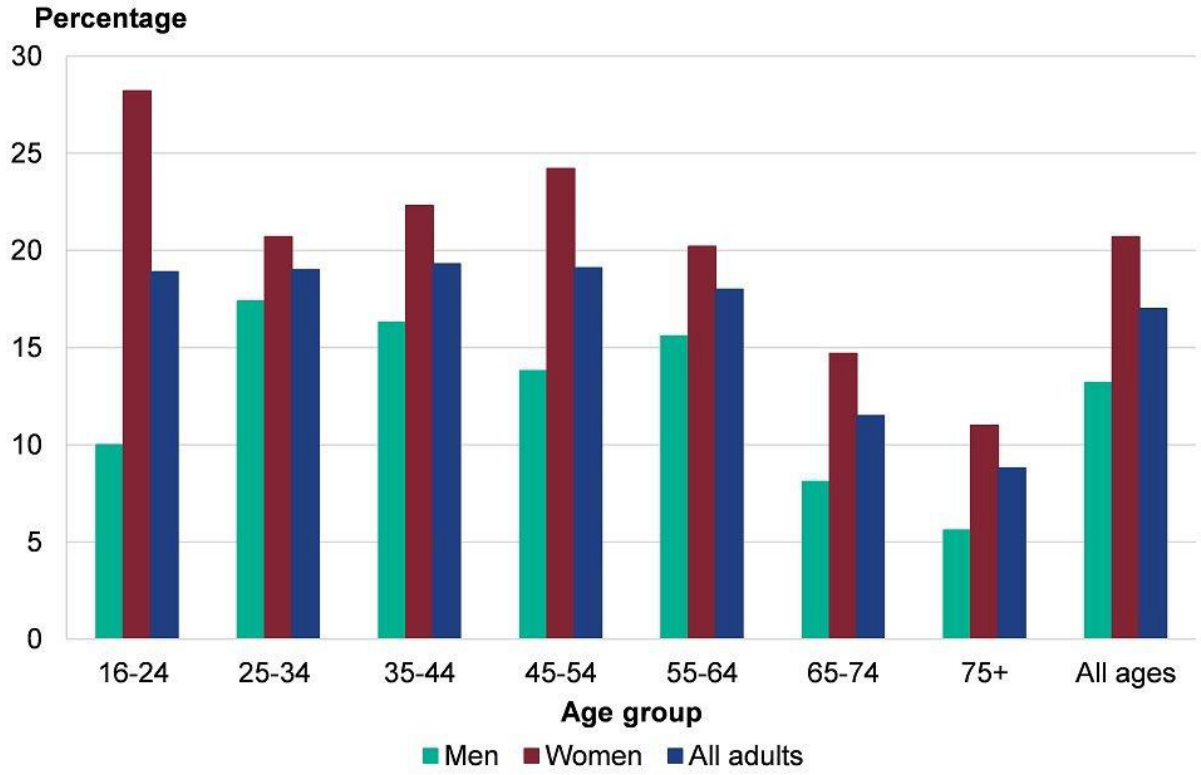
See the full data source
See how your area compares

Note: These profiles may use alternative data sources at a local level and may not be comparable with the data in the chart above.

There are also significant inequalities in the prevalence of CMD. In 2014, the prevalence among females was greater than males (20.7% compared with 13.2%). Overall, people of working age were most likely to have symptoms of CMD although the highest prevalence was among females aged 16 to 24 years (Figure 9). Unlike most physical health problems, prevalence was lowest among the oldest age groups

The gap in the prevalence of CMDs among males and females in the 16 to 24 age group has increased over time. Females aged 16 to 24 also had a high prevalence of self-harm, posttraumatic stress disorder (PTSD) and bipolar disorder, making them a high-risk group[10].

Figure 9: prevalence of experiencing any common mental health disorder (CMD) in the past week, by age, males and females, England, 2014



Source: Adult Psychiatric Morbidity Survey 2014

See the full data source

Mental and physical health are closely linked, As demonstrated in the section on MSKconditions, people with physical health problems, especially long-term conditions, were at increased risk of poor mental health, particularly depression and anxiety. Around 30% of people with any long-term physical health condition also have a mental health problem[11]. Poor mental health in turn exacerbates some long-term conditions, such as chronic pain[12].

8. Diabetes

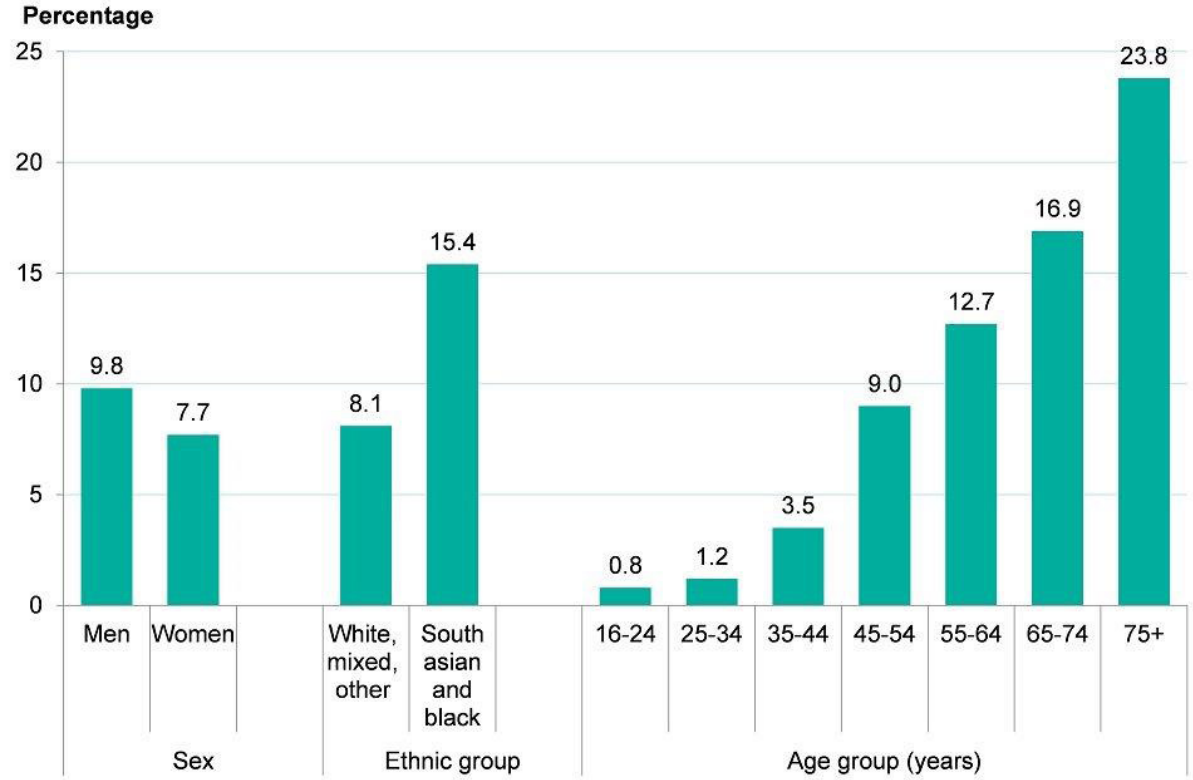
In GBD 2016, diabetes was the 12th highest specific (level 3) cause of morbidity. The World Health Organisation defines Diabetes mellitus as “a chronic disease caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced. Such a deficiency results in increased concentrations of glucose in the blood, which in turn damage many of the body’s systems, in particular, the blood vessels and nerves”. Approximately 90% of diabetes cases worldwide are type 2, caused by ineffectiveness of the insulin produced and this is largely preventable or manageable by lifestyle changes.

The prevalence of diabetes in England has increased over the last 20 years. The Health Survey for England recorded an increase in the prevalence of self-

reported ‘doctor diagnosed’ diabetes between 1995 and 2016, from 2.4% to 6.9%. It is also estimated that around 24% of people with type 2 diabetes in England remain undiagnosed and untreated[13].

Therefore, in 2017, 3.9 million people aged 16 years and over in England, were estimated to have diabetes (diagnosed or undiagnosed). This equates to 8.7% of the population of this age group, with prevalence higher in males (9.8%) compared with females (7.7%) (Figure 10). Prevalence was also higher in South Asian and Black ethnic groups (15.4%) compared with people from White, Mixed or Other ethnic groups (8.1%). The prevalence increased with age; 9.0% of those aged 45 to 54 years had diabetes compared with 23.8% in those aged 75 years and over.

Figure 10: diabetes prevalence (diagnosed and undiagnosed), by age, sex and ethnic group, England, 2016



Source: PHE diabetes prevalence model 2016

See the full data source

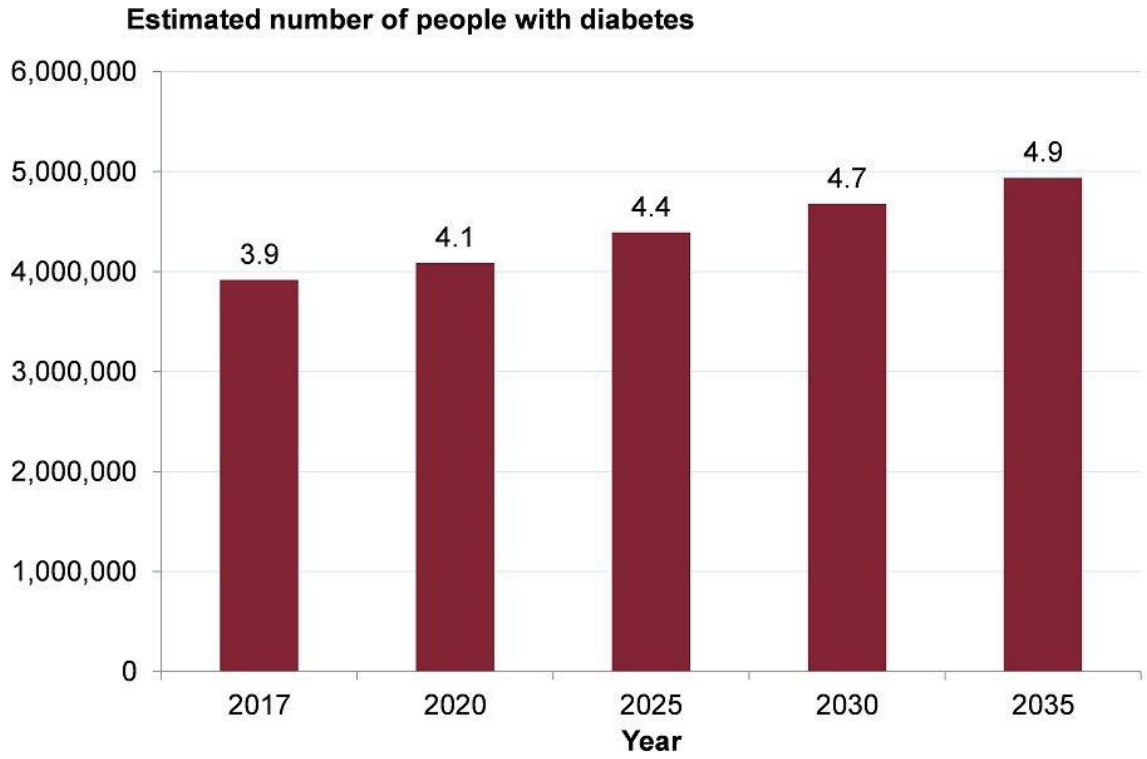
See how your area compares

See a local report for your clinical commissioning group

If the prevalence by ethnic group, age and sex remains constant, the number of people with diabetes (diagnosed or undiagnosed) is expected to increase in the next two decades from 3.9 million people in 2017, to 4.4 million in 2025, and to 4.9 million in 2035. This equates to an overall prevalence rate of around 9.7% of the adult population (Figure 11).

These estimates assume no change in the prevalence of diabetes risk factors, such as obesity. The increase in prevalence is related to the expected ageing of the population. However, as presented in section 10, the prevalence of obesity has increased slightly since 2007, and if this continues, the figures presented here could underestimate the expansion of diabetes.

Figure 11: projected number of people with diabetes (diagnosed and undiagnosed), England, 2017 to 2035



Source: PHE diabetes prevalence model 2016

See the full data source

9. Risk factors associated with morbidity

Risk factors play an important role in determining whether a person becomes ill, at which age, and the associated effect on quality of life. The GBD divides risk factors into 3 main groups: behavioural, metabolic, and environmental and occupational. GBD does not include the broader social and economic factors that shape people's lives[14]. such as education, income, work and social capital. Therefore it may not fully reflect the risk and protective factors associated with health, particularly mental health. These wider determinants of health are discussed in Chapter 6.

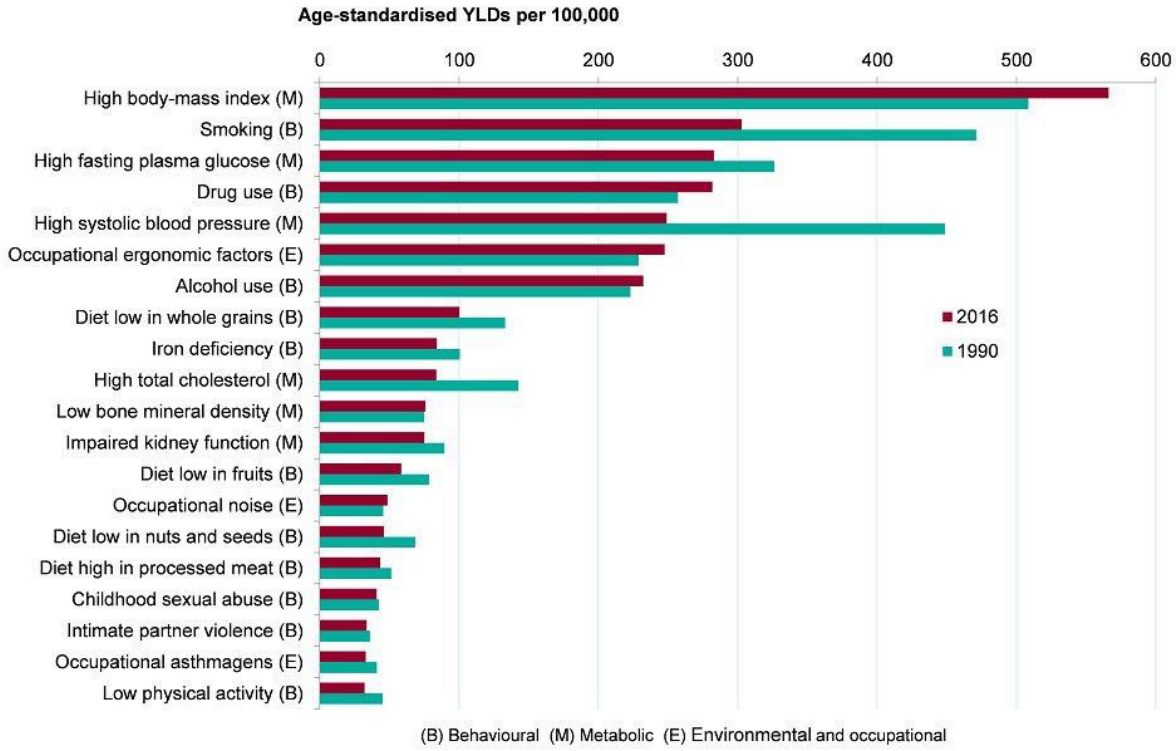
Figure 12 shows the top 20 risk factors associated with morbidity in England in GBD2016. The presence of these risk factors in the population continues to pose a challenge to the health of the nation.

The top behavioural risk factors were smoking, drug use, alcohol use, and aspects of diet and nutrition. The top metabolic risk factors include obesity (high BMI), high blood glucose levels, high blood pressure and high cholesterol. Section 10 discusses trends in these main risk factors, except high blood glucose levels. Diabetes is characterised by high blood glucose levels and is discussed earlier in this chapter.

Environmental and occupational risks include air pollution, unsafe water and other risks due to the working or living environment. The highest ranked environmental risk in 2016 was occupational ergonomic factors, which is particularly associated with MSKconditions.

In GBD 2016, obesity and smoking were the leading risk factors for morbidity. GBDanalysis demonstrates that these are associated with many of the most common causes of morbidity including cardiovascular disease, MSK conditions, respiratory disease, diabetes and most cancers.

Figure 12: morbidity rate attributed to risk factors, England, 1990 and 2016



Source: Global Burden of Disease Study 2016 (GBD 2016) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2016

Note: Disease burden attributable to specific risks are independently calculated for each risk factor. Risk factors attributed to YLDs cannot be summed together.

See the full dataset

10. Trends in risk factors

This section looks at trends in the main behavioural or metabolic risk factors associated with morbidity. The prevalence of smoking in England has continued to decline over the past 7 years to 14.9% of adults in 2017. Time series analysis suggests that if this trend continues it will reduce to between 8.5% and 11.7% by 2023 (Figure 13).

There has also been a downward trend in the prevalence of high blood pressure in adults from 30.2% in 2010 to 28.3% in 2016. Time series analysis suggests that this figure is likely to continue to decline up to 2023, but the rate of decline is uncertain (Figure 13). These figures include adults with blood

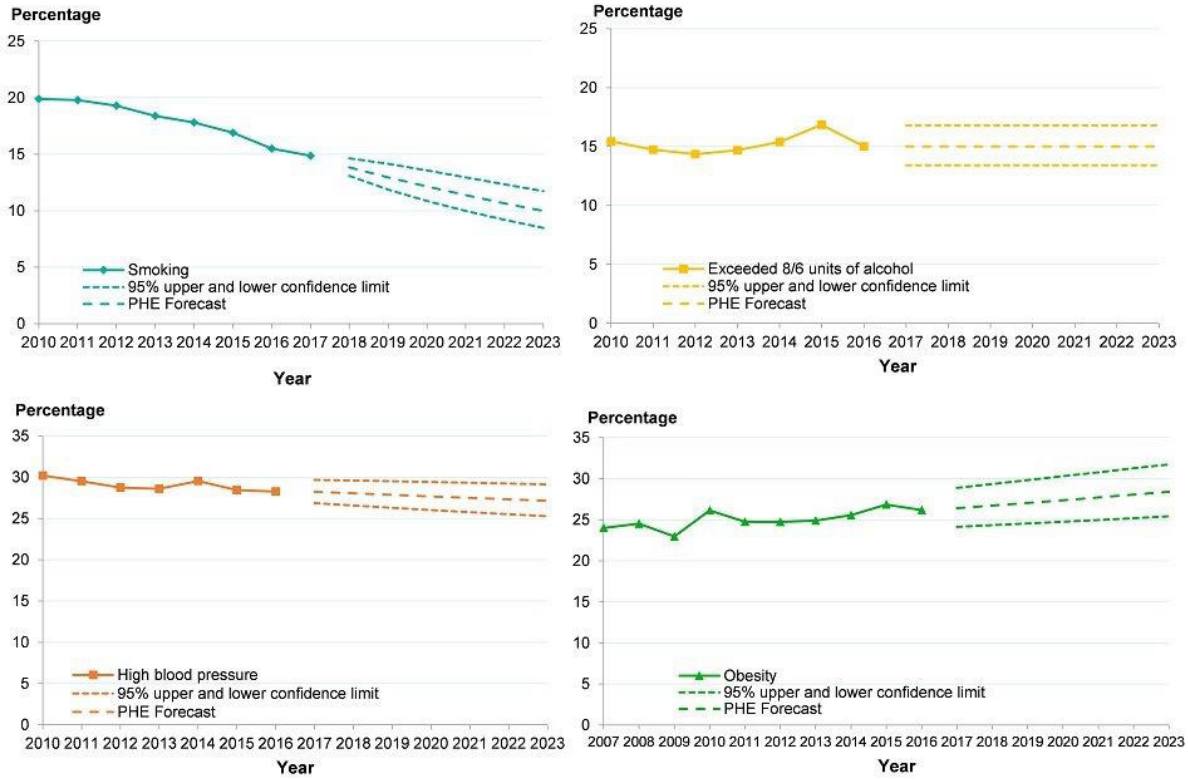
pressure higher than 140/90 mmHg and also those with blood pressure below this limit who take medication to lower their blood pressure.

There has been an overall reduction in average total cholesterol in the population between 2003 and 2016, although there have been some fluctuations over time. For males, average total cholesterol has dropped from 5.5mmol/L in 2003 to 5.0mmol/L in 2016, and the drop over the same period for females was from 5.6mmol/L to 5.2mmol/ L[15]. These figures include people who take lipid-lowering drugs such as statins; in 2017 over 72 million prescriptions for such drugs were issued in England and the number has increased by 53.2% since 2007[16].

In England, in 2016, 26.2% of adults were obese. Although there has been a slight upward trend in obesity since 2007, and it is forecast that levels of obesity may increase by 2023, there is uncertainty around this forecast due to fluctuations in prevalence over this time period (Figure 13).

Similarly, although there have been fluctuations in prevalence, there has been little change in levels of alcohol consumption (as measured by the percentage of the population drinking more than 8 (men) or 6 (women) units on the heaviest drinking day in the last week) between 2010 and 2016 and the forecasts on the data reflect the uncertainty in the trend (Figure 13).

Figure 13: trend in prevalence of smoking, high blood pressure, obesity and alcohol consumption, adults, England, 2010 to 2016*, and forecasts to 2023



Source: PHE analysis of Annual Population Survey, Health Survey for England and Opinions and Lifestyle Survey

*trend in smoking prevalence data is for 2010 to 2017, trend in obesity prevalence data is for 2007 to 2016. Smoking data is for adults 18+, all other measures are for adults 16+.

See the full data sources:

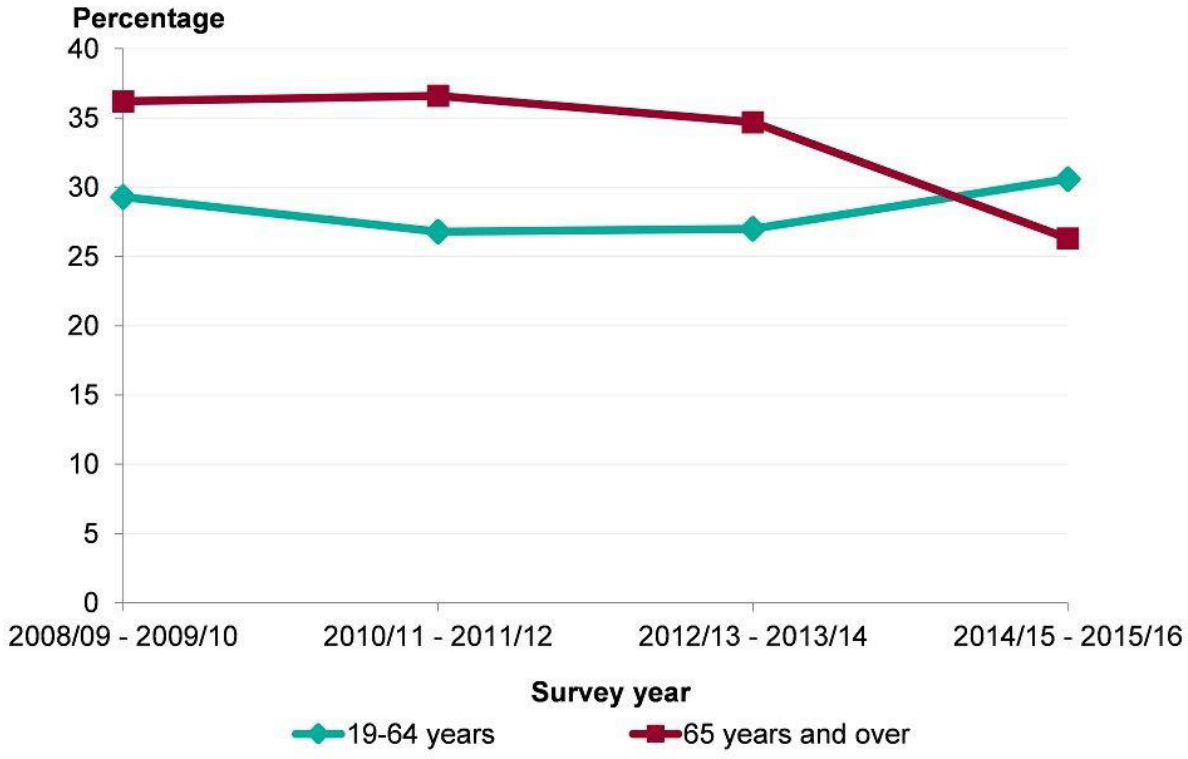
Prevalence of current smokers
See how your area compares
Prevalence of high blood pressure
See how your area compares
Prevalence of obesity
See how your area compares
Alcohol consumption
See how your area compares

Note: These profiles may use alternative data sources at a local level and may not be comparable with the data in the chart above.
There has been a reduction in illicit drug use among adults aged 16 to 59 years in England and Wales compared with a decade ago, from 10.5% using illegal drugs in the last year in financial year 2005 to 2006, to 8.5% in 2016 to

2017. The most commonly used drugs were cannabis and powder cocaine, used by 6.6% and 2.3% of adults respectively. Over the same period, the proportion using drugs in the last month has fallen from 6.3% to 4.0%
In terms of use of specific drugs, there were an estimated 257,476 opiate users in England in the financial year 2014 to 2015, this figure is similar to the estimate in 2011 to 2012. The estimated number of crack users has increased by 10% over this time period, from 166,640 to 182,828.

In 2016, just over one in four people aged 65 years and over consumed the recommended 5 portions of fruit or vegetables each day (5 A Day), and this proportion has fallen significantly in recent years. The proportion of younger adults aged 19 to 64 years who consumed 5 A Day increased slightly over time, but was still less than one in three in 2016 (Figure 14).

Figure 14: trend in the percentage of the population consuming the recommended 5 A Day fruit and vegetable portions, by age, England, survey year 2008 to 2009 up to 2015 to 2016



Source: National Diet and Nutrition Survey
See the full data source
See how your area compares

Note: These profiles may use alternative data sources at a local level and may not be comparable with the data in the chart above.
Physically active adults are those who report doing at least 150 moderate

intensity equivalent minutes of physical activity per week and in the financial year 2016 to 2017 two in three adults met this recommendation. However, 22.2% of adults did less than 30 mins of such activity per week
See how your area compares
The prevalence of risk factors also varies across England and is higher in some population groups than others. See Chapter 5 for a discussion on inequalities in the main behavioural risk factors.

11. Further information

The Global Burden of Disease 2016 study is used in this chapter to identify those conditions that contribute most to morbidity in England and their associated risk factors. Morbidity measures are very important for understanding the demand for health and social care services. The major causes of death and changes over time are discussed in Chapter 2.
More information on the GBD study is available from the Institute of Health Metrics and Evaluation website

12. References

1. Global Burden of Disease Study (2016) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME). Accessed 13 July 2018.
2. Arthritis UK (2018) State of Musculoskeletal Health 2018. Accessed 13 July 2018.
3. Public Health England (2017) Musculoskeletal diseases profile: a short commentary, November 2017. Accessed 13 July 2018.
4. Public Health England (2018) Musculoskeletal diseases profile: a short commentary, June 2018. Accessed 13 July 2018.
5. Arthritis UK (2013) Musculoskeletal Health – A Public Health Approach. Accessed 27 June 2018.
6. Vigo D, Thornicroft G, Atun R (2016) Estimating the true global burden of mental illness. The Lancet Psychiatry, 3(2):171 to 178.
7. Kessler RC, Berglund P, Demler O et al. (2005) Lifetime prevalence and age-of-onset distributions of dsm-iv disorders in the national comorbidity survey replication. Archives of General Psychiatry, 62(6):593 to 602.
8. NICE (2016) Early years: promoting health and wellbeing in under 5s. Quality standard QS128. Accessed 13 July 2018.
9. Public Health England (2015) Promoting children and young people's emotional health and wellbeing. A whole school and college approach, March 2015. Accessed 24 July 2018.

10. McManus S, Bebbington P, Jenkins R, Brugha T (eds.) (2016) Mental health and wellbeing in England: Adult Psychiatric Morbidity Survey 2014. Accessed 13 July 2018.
11. Naylor C, Parsonage M, McDaid D and others. (2012) Long term conditions and mental health – the cost of co-morbidities. Accessed 20 July 2018.
12. Arnow BA, Hunkeler EM, Blasey CM and others. (2016) Comorbid depression, chronic pain, and disability in primary care. Pschosom Med 68(2): 262 to 268. Accessed 20 July 2018.
13. Holman N, Forouhi NG, Goyder E and others. (2011) The Association of Public Health Observatories (APHO) Diabetes Prevalence Model: estimates of total diabetes prevalence for England, 2010 to 2030. Diabetic Medicine, 28(5):575 to 582.
14. The Marmot Review Team (2010) The Marmot Review: Fair Society, Healthy lives. Accessed 13 July 2018.
15. PHE analysis of Health Survey for England data (2016) Health Survey for England - Health, social care and lifestyles.. Accessed 13 July 2018.
16. NHS Digital (2018) Prescriptions dispensed in the Community, England 2007-2017. Accessed 20 July 2018.

Chapter 4: health of children in the early years

Published 11 September 2018

1. Main messages

What happens during pregnancy and the first few years of life influences physical, cognitive and emotional development in childhood and may have an effect on health and wellbeing outcomes in later life. Overall, child health in England has continued to get better, with many indicators of health and development outcomes showing sustained improvements in recent years.

The percentage of women who smoke throughout pregnancy has fallen over time to 10.8% in the financial year 2017 to 2018. Data from the new Maternity Services Dataset shows that 21% of women were classified as obese during the early stages of pregnancy in December 2017. Smoking and obesity during pregnancy increase the risk of poor outcomes such as stillbirth, low birthweight and infant death, and are important areas for public health action.

There were 3.9 infant deaths per 1,000 live births in England in the period 2014 to 2016. Among babies born at full term, 2.8% had a low birthweight in 2016. Both of these indicators have shown improvement in recent years.

Breastfeeding provides the best nutritional start in life for a baby. In England, 74.5% of all babies received breast milk for their first feed in the financial year 2016 to 2017, but by 6 to 8 weeks this fell to 44.4%.

Teenage pregnancy rates have fallen since the early 2000s, but this still carries a number of risks for both mother and child. The most recent data available showed that younger mothers (under the age of 25), were more likely to smoke during pregnancy and not to breastfeed.

By age 5 years, 22.6% of children were overweight and 23.3% had tooth decay in the academic year 2016 to 2017; both of which are preventable. In

addition, 29.3% of children at this age were not ready for school, having not reached expected levels of development. However, although there have been sustained improvements in the percentage of children who had reached a good level of development at age 5 years, considerable inequalities between population groups remain.

In the academic year 2016 to 2017, 34.2% of 10 to 11 year olds in England were overweight or obese, a statistically significant increase over the last eight years, up from 32.6% in the academic year 2008 to 2009. Time series analysis suggests that this percentage is likely to continue to rise in the next few years.

Children who live in more deprived areas were more likely to be exposed to avoidable risks before birth, to get off to a less healthy start from birth and to experience poor outcomes by the time they start school, compared with children who live in less deprived areas. Health inequalities are seen across all indicators presented, including recently published evidence of a social gradient in early child development at age 2 to 2 and a half years, an emerging inequality which is especially noticeable in the development of communication skills.

2. Introduction

Ensuring that everyone gets the best start in life is important for a range of health and well-being outcomes for children and young people, the implications of which persist into adulthood [1] [2] [3]. This is influenced by background demographic factors such as the age and ethnicity of the mother, as well as socioeconomic factors including educational status and economic prosperity. A mother's general health is also important, as are her lifestyle choices leading up to and during pregnancy.

Many factors contribute to achieving the best start in life. This chapter covers some of the factors which may be present during pregnancy and early infancy, their effect on early child health, how these are changing over time and how they are distributed among the population. It concentrates on some of the factors which can be changed from a health perspective at policy, practice and individual level. The importance of vaccination in controlling disease, including those in childhood, is not discussed here, it is discussed in Chapter 7.

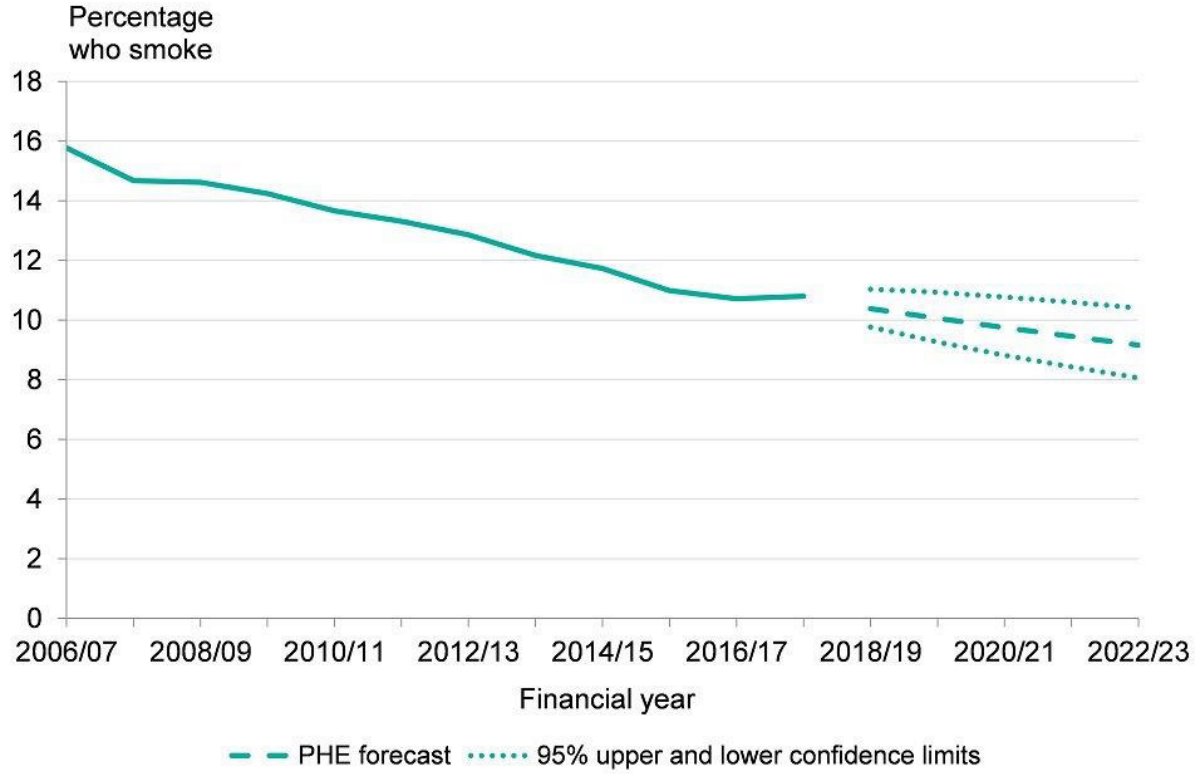
3. Smoking in pregnancy

Smoking during pregnancy is associated with the foetus growing at a slower rate in the womb and can result in babies being small for gestational age (small given the number of weeks of pregnancy) and having a low birth weight at term. Smoking during pregnancy is also associated with higher rates of stillbirth and infant mortality [4] [5] [6] [7].

In England, smoking status is routinely recorded at the time of delivery and it is assumed that pregnant women smoking at this stage have smoked throughout their pregnancy. Smoking at the time of delivery has declined in recent years, with 13.6% of women smoking at the time of delivery in the financial year 2010 to 2011, falling to 10.8% in the financial year 2017 to 2018 (Figure 1). The time series analysis forecasting presented suggests that if this trend continues it will reduce to between 8.1% and 10.4% by 2022 to 2023.

This overall percentage of women smoking at time of delivery hides large variations both across the geographic areas of the country and by deprivation of the area in which the individual women live. In the financial year 2016 to 2017, across local authority areas, smoking at the time of delivery ranged from 2.3% to 28.1%, and from 7.2% in the least deprived areas to 12.2% in the most deprived areas

Figure 1: trend in smoking at time of delivery, England, financial year 2010 to 2011 up to 2016 to 2017, forecasts up to financial year 2022 to 2023



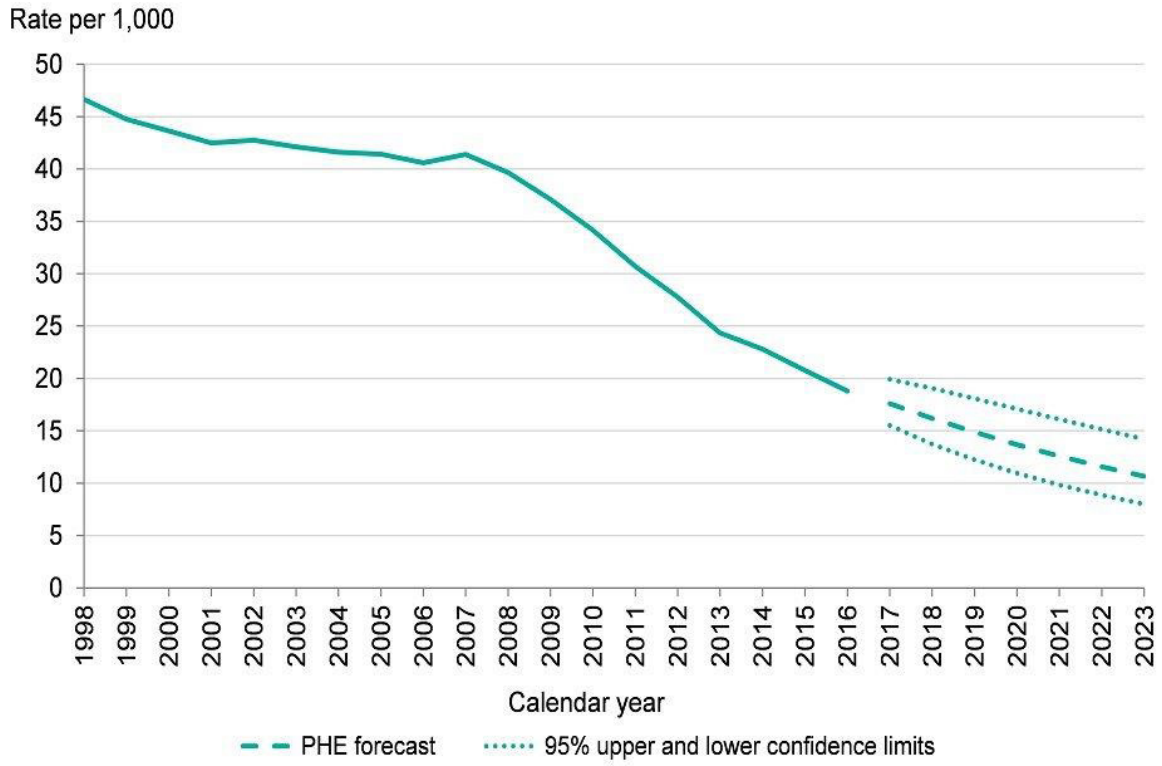
Source: Public health Outcomes Framework

See Methods, data and definitions
See how your area compares
More recently it has also been possible to measure maternal smoking rates at the first antenatal appointment (booking appointment, usually before 13 weeks of pregnancy - see smoking at time of booking). This is reported on a monthly basis by NHS Digital from the Maternity Services Dataset (MSDS) as experimental statistics. Of the women who had their booking appointment during December 2017, 12% were recorded as current smokers.
More detailed analysis of the MSDS [8] revealed, among those who had their booking appointment during 2016, more than one in 5 women (28%) aged under 25 years smoked at the time of their booking appointment. In addition, rates of smoking at booking in the most deprived areas of England were 5 times those in the least deprived areas (20% and 4% respectively). White women and women of Mixed ethnicity were more likely to smoke than women from other ethnic groups.
This first appointment with midwifery services presents an opportunity to intervene during this early stage of pregnancy, providing carbon monoxide monitoring, information on healthy pregnancy, brief advice and a route for onward referral to smoking cessation services [9].

4. Teenage pregnancy

Early parenthood carries a number of risks for both mother and child. The baby is more likely to have a low birth weight at term and has a higher risk of infant mortality. Due to parenting responsibilities, young mothers are less likely to complete education and may be further economically disadvantaged by a failure to enter employment. Younger mothers are also more likely to smoke during pregnancy than older mothers [10],[11].
Figure 2 shows that the rate of teenage conceptions (females aged less than 18 years) has fallen from 34.2 per 1,000 in 2010 to 18.8 per 1,000 in 2016. This has been achieved through a long-term evidence-based teenage pregnancy strategy, delivered with a concerted effort by local government and their health partners [10] [11]. Time series analysis suggests that if this trend continues the rate will reduce to between 8.0 and 14.2 per 1,000 by 2023 (Figure 2).

Figure 2: trend in under 18 conception rate, England, 1998 to 2016, forecasts up to 2023



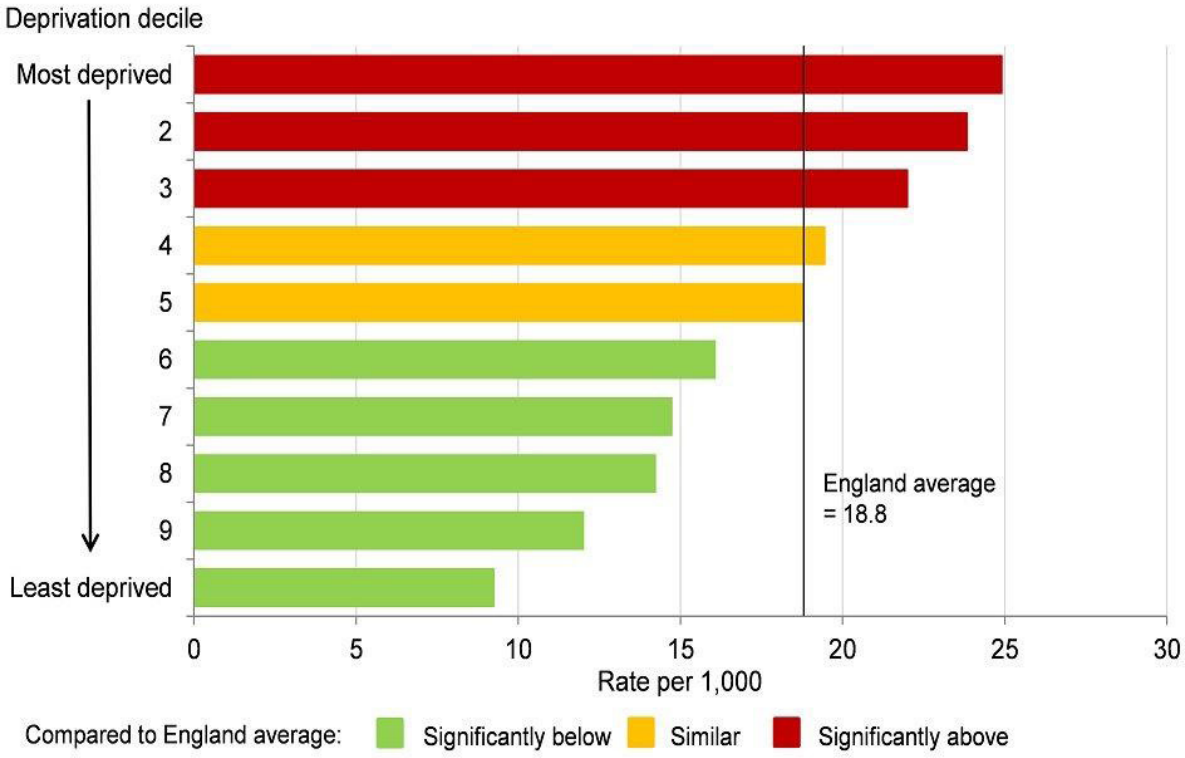
Source: Public Health Outcomes Framework

See Methods, data and definitions

See how your area compares

In 2016 the local authority teenage conception rates ranged from 4.6 per 1,000 to 36.5, and inequalities by deprivation level ranged from 9.2 per 1,000 in the least deprived areas to 24.9 in the most deprived areas (Figure 3). Teenage pregnancy is more prevalent in areas of higher deprivation.

Figure 3: under 18 conception rates by deprivation decile*, England, 2016



Source: Public Health Outcomes Framework

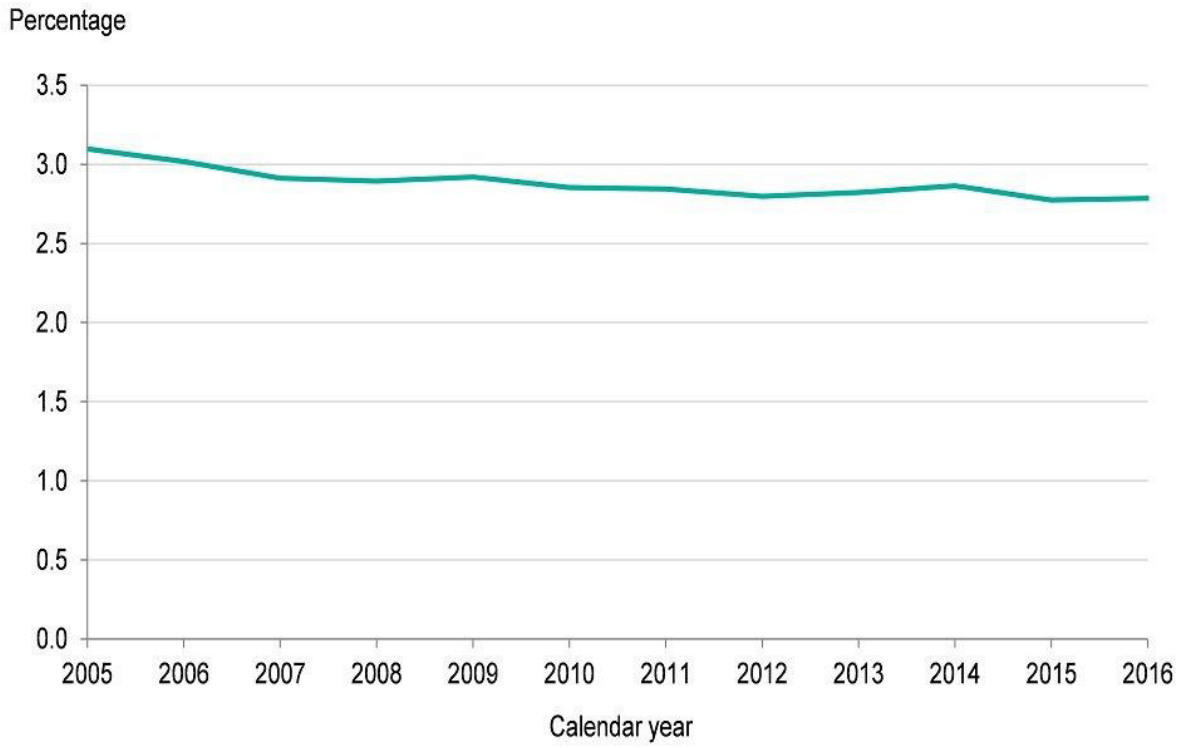
*deprivation deciles based on groups of district and unitary authorities in England (Index of Multiple Deprivation 2015)

See inequality data

5. Low birthweight

Low birthweight at full term of pregnancy is an important public health measure as it indicates whether the baby was able to grow as expected while in the womb. Considering only those babies which reach full term enables the pregnancy outcome to be considered, irrespective of prematurity and pre-term birth, which would otherwise dominate these statistics. Low birthweight can be associated with the ethnicity of mothers, smoking during pregnancy, younger maternal age and some medical complications such as maternal diabetes or hypertension (more prevalent at older maternal ages) [2],[4],[10]. Being born at low birthweight is an important marker along the trajectory of early child development, indicating an increased risk of poor health outcomes from birth onwards [1],[2]. The percentage of low birthweight babies at term in England has fallen slightly from 3.1% in 2005 to 2.8% in 2016 (Figure 4).

Figure 4: trend in percentage of low birthweight babies at term, England, 2005 to 2016



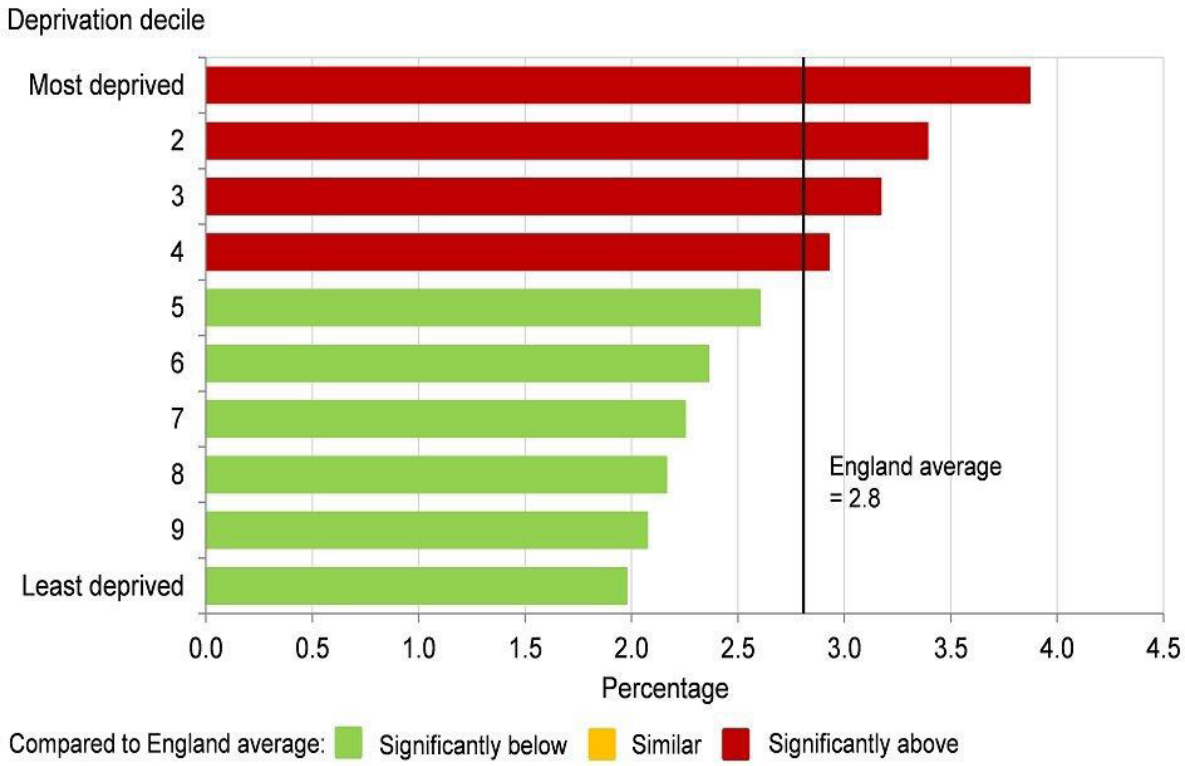
Source: Public Health Outcomes Framework

See Methods, data and definitions

See how your area compares

At a local authority level, low birthweight at term ranged from 1.3% to 5.2% in 2016. In addition, there are wide inequalities by deprivation, the values ranged from 2.0% in the least deprived areas to 3.9% in the most deprived areas in 2014 to 2016 (see Figure 5). Chapter 5 discusses recent trends in inequalities in low birthweight.

Figure 5: percentage of low birthweight babies at term by deprivation decile*, England, 2014 to 2016



Source: Public Health England analysis based on birth and population data from ONS and the Index of Multiple Deprivation 2015 (Department for Communities and Local Government)
*deprivation deciles based on groups of lower super output areas in England (Index of Multiple Deprivation 2015).

6. Breastfeeding

Breastfeeding provides the best possible nutritional start in life for a baby, protecting the baby from infection and offering important health benefits for the mother. The government's advice is that infants should be exclusively breastfed, receiving only breastmilk for the first 6 months of life. Following this, other drinks and foodstuffs can be introduced [1],[2],[12],[13].

An important precursor for breastfeeding is skin-to-skin contact, which also helps to establish a nurturing bond between mother and baby [14]. Data published by NHS Digital from the MSDS for maternity services delivered in England during December 2017 shows that of women who gave birth at 37 weeks gestation or later, 80% had skin-to-skin contact with their baby within one hour of birth. It also shows that 75% of babies received maternal or donor breast milk as their first feed, which is a proxy for initiation of breastfeeding.

Many mothers find it challenging to sustain breastfeeding. Data for the financial year 2016 to 2017 show that at 6 to 8 weeks of age the prevalence of either exclusive or partial (when formula milk has also been introduced) breastfeeding of an infant was only 44.4%. When considered at local authority

level a very wide variation was observed, the highest rate of breastfeeding at 6 to 8 weeks was 75.6%, almost 4 times higher than the lowest rate of 19.3% Further information on infant feeding is available from the Infant Feeding Survey which showed that in England in 2010, younger mothers under the age of 25 years, mothers of White ethnicity and those living in deprived areas had a low incidence of breastfeeding.

See data for your area on breastfeeding at 6 to 8 weeks

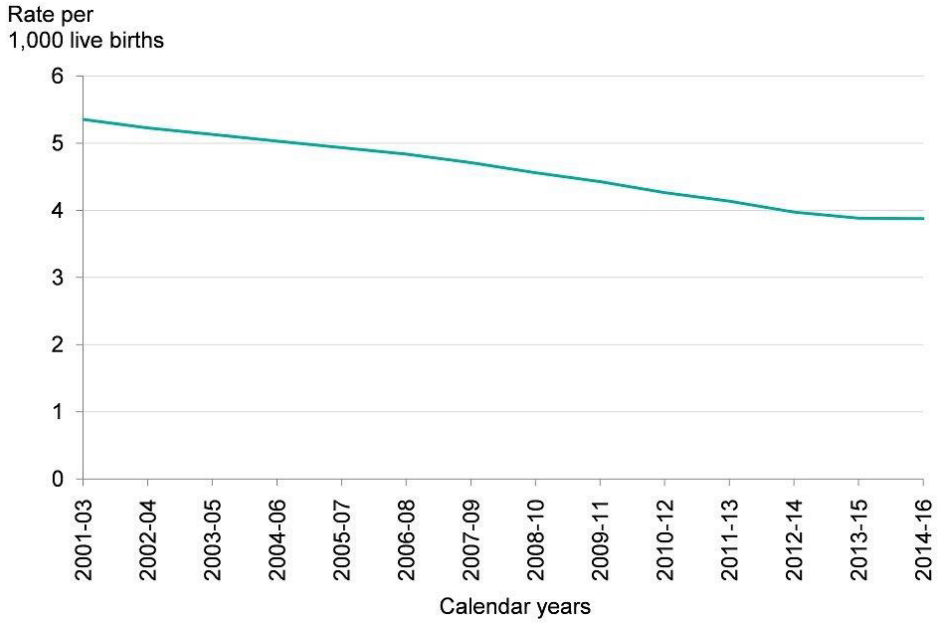
7. Infant mortality

Infant mortality covers all deaths within the first year of life. The majority of these are neonatal deaths which occur during the first month and the main cause is related to prematurity and preterm birth, followed closely by congenital abnormalities [15].

In England, the number of infants who die is relatively small and subject to considerable variation from year to year. As a result, the data are often considered on a three-year rolling average basis. The infant mortality rate fell from 5.4 per 1,000 live births in 2001 to 2003 to 3.9 in 2014 to 2016 (Figure 6). However, there was no decline between the latest 2 periods.

There is also wide variation across the country, in 2014 to 2016 the highest rate of 7.9 per 1,000 live births for any local authority area was almost 5 times higher than the lowest rate of 1.6.

Figure 6: trend in infant mortality rate, England, 2001 to 2003 up to 2014 to 2016



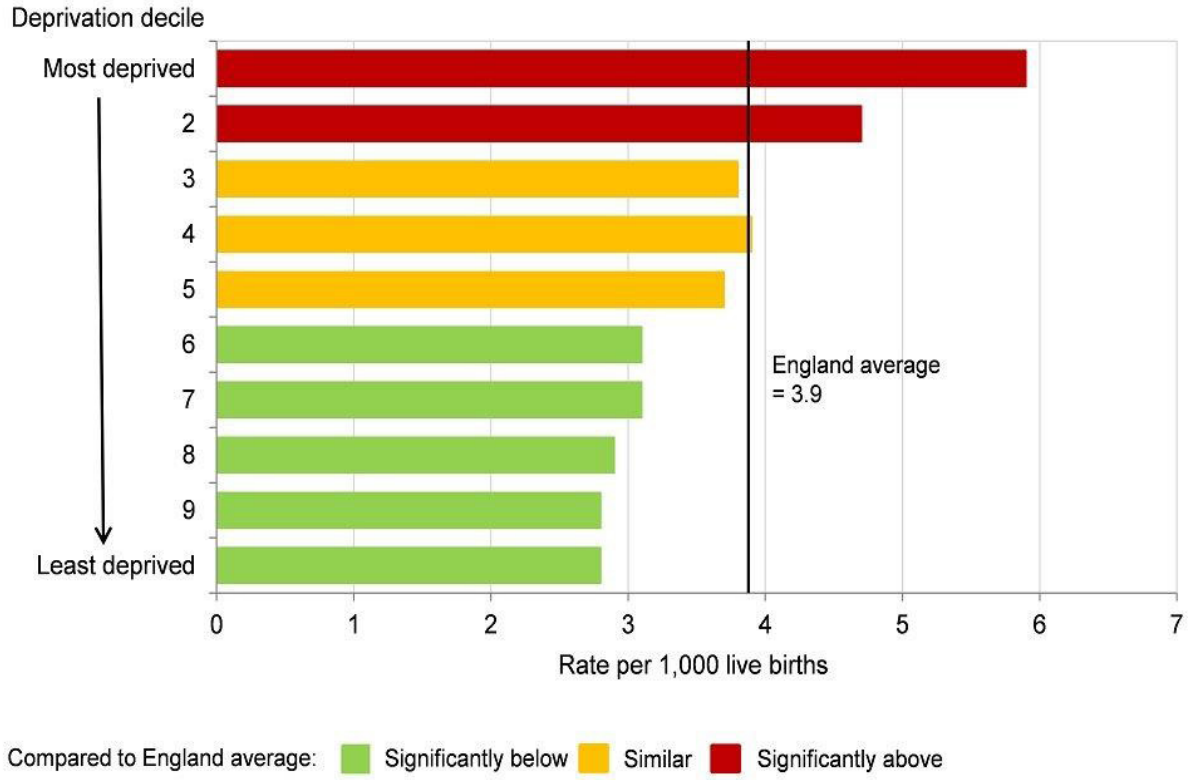
Source: Public Health Outcomes Framework

See Methods, data and definitions

See how your area compares

Inequalities by deprivation level are also large. The infant mortality rate ranged from 2.8 per 1,000 live births in the least deprived areas to 5.9 in the most deprived areas in 2014 to 2016 (Figure 7). Chapter 5 discusses recent trends in inequalities in infant mortality.

Figure 7: infant mortality rate by deprivation decile*, England, 2014 to 2016



Source: Analysis by Public Health England based on mortality, births and population data from ONS and the Index of Multiple Deprivation 2015 (DCLG)

*deprivation deciles based on groups of lower super output areas in England (Index of Multiple Deprivation 2015).

See inequality data

Infant mortality rates are higher in deprived areas. Smoking in pregnancy and adult smoking prevalence is also higher among those living in deprived areas. In addition, there is evidence that smoking in pregnancy harms foetal development, is associated with infant mortality and that smoking, alongside genetic factors, can be relevant to the causal pathway behind deaths as a result of congenital abnormalities [2,4].

8. Child obesity

The Healthy Child Programme provides opportunities for health visitors to assess the healthy growth of infants and children. In England, the height and weight of children (Reception and Year 6) is measured in school settings (and the body mass index [BMI] calculated via the National Child Measurement Programme (NCMP).

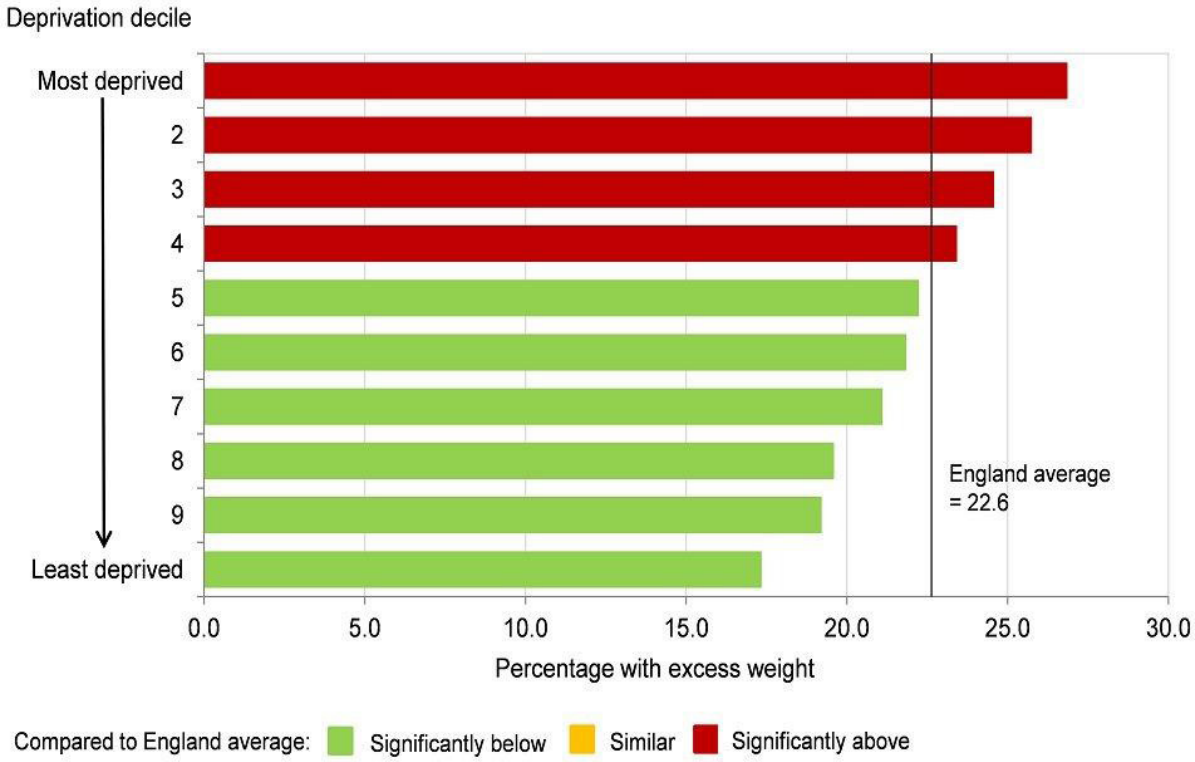
In the academic year, 2016 to 2017, 22.6% of 4 and 5 year olds (Reception year children) were either overweight or obese. This level has not changed much in recent years and although the causes are complex not all children have a diet [16] or undertake physical activity at levels which reflect national recommendations[17].

Children are more likely to be obese if their mother was obese during the early stages of pregnancy [18]. In addition, researchers have found increased risk of poor outcomes including stillbirth and infant mortality where maternal obesity is higher [19],[20].

Maternal obesity at the first antenatal appointment (booking appointment usually before 13 weeks of pregnancy) is reported on a monthly basis by NHS Digital from the Maternity Services Dataset (MSDS) as experimental statistics. Of the women who had their booking appointment during December 2017, 21% were recorded as obese.

Excess weight (overweight or obese) in 4 to 5 year olds also varies widely between local authorities, it ranged from 15.0% to 28.2% in academic year 2016 to 2017. Like many other indicators relating to early child health, children living in more deprived areas of the country are more likely to have poor outcomes. In the academic year 2016 to 2017, excess weight in 4 to 5 year olds varied from 17.3% in the least deprived areas to 26.8% in the most deprived areas (Figure 8).

Figure 8: excess weight in 4 to 5 year olds by deprivation decile*, England, academic year 2016 to 2017



Source: Public Health Outcomes Framework.

*deprivation deciles based on groups of lower super output areas in England (Index of Multiple Deprivation 2015).

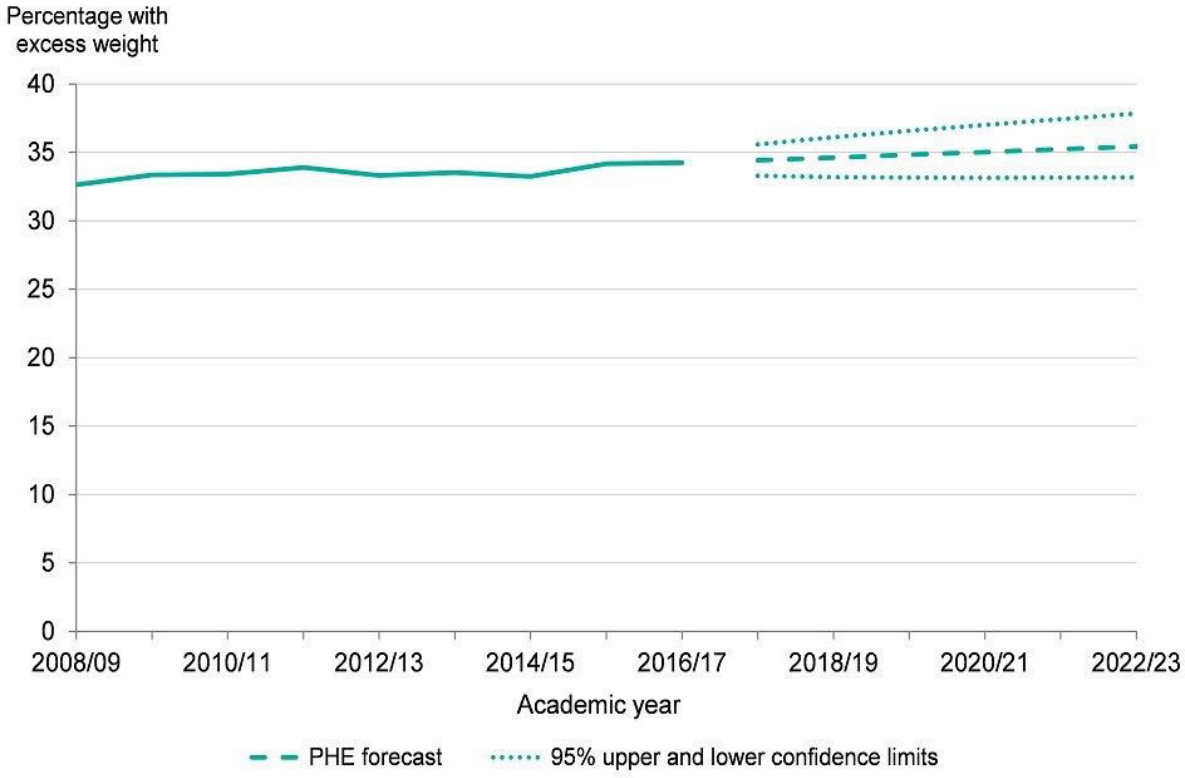
See Methods, data and definitions

See inequality data

Linked data shows that children who were overweight or obese in Reception year (aged 4 and 5 years) were also more likely to be overweight or obese in Year 6 (age 10 to 11 years) and then again more likely to go on to be overweight or obese adults [21],[22].

In the academic year 2016 to 2017, 34.2% of 10 to 11 year olds in England were overweight or obese, which was a statistically significant increase over the last 8 years, up from 32.6% in the academic year 2008 to 2009 (Figure 9). Time series analysis suggests that this percentage is likely to continue to rise in the next few years (Figure 9).

Figure 9: trend in excess weight in 10 to 11 year olds, England, academic year 2008 to 2009 up to 2016 to 2017, forecasts up to academic year 2023 to 2023



Source: Public Health Outcomes Framework

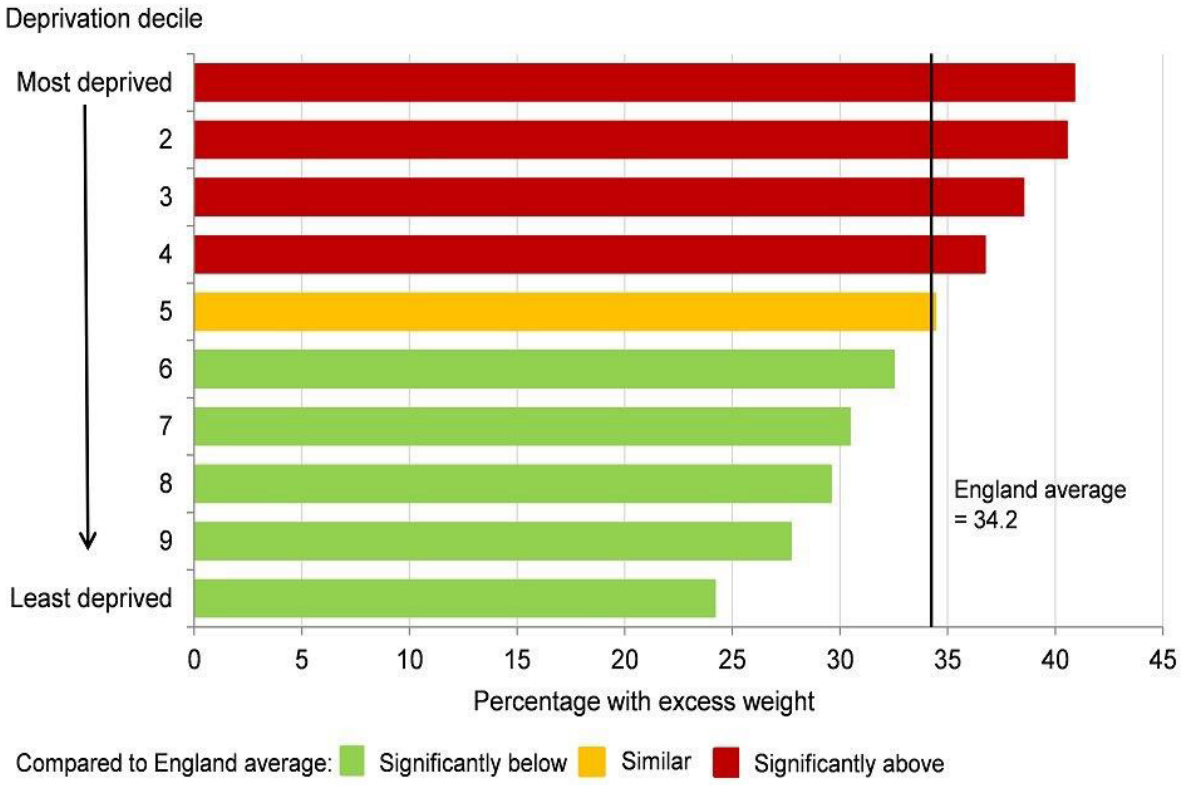
See Methods, data and definitions

See how your area compares

Excess weight (overweight and obese) in 10 to 11 year olds varies widely between local authorities, it ranged from 25.3% to 43.9% in academic year 2016 to 2017, and also varied by level of deprivation. Excess weight in 10 to 11 year olds ranged from 24.2% in the least deprived areas to 40.9% in the most deprived areas (Figure 10).

See Chapter 5 for information on trends in inequalities in excess weight during childhood and inequalities by ethnic group.

Figure 10: excess weight in 10 to 11 year olds by deprivation decile*, England, academic year 2016 to 2017



Source: Public Health Outcomes Framework

*deprivation deciles based on groups of lower super output areas in England (Index of Multiple Deprivation 2015).

See Methods, data and definitions

See inequality data

As discussed in Chapter 3, obesity throughout the life course carries implications for poor health including contributing to higher rates of diabetes, cardiovascular disease, most cancers and therefore a higher risk of premature mortality. See Chapter 3 for further information on adult obesity.

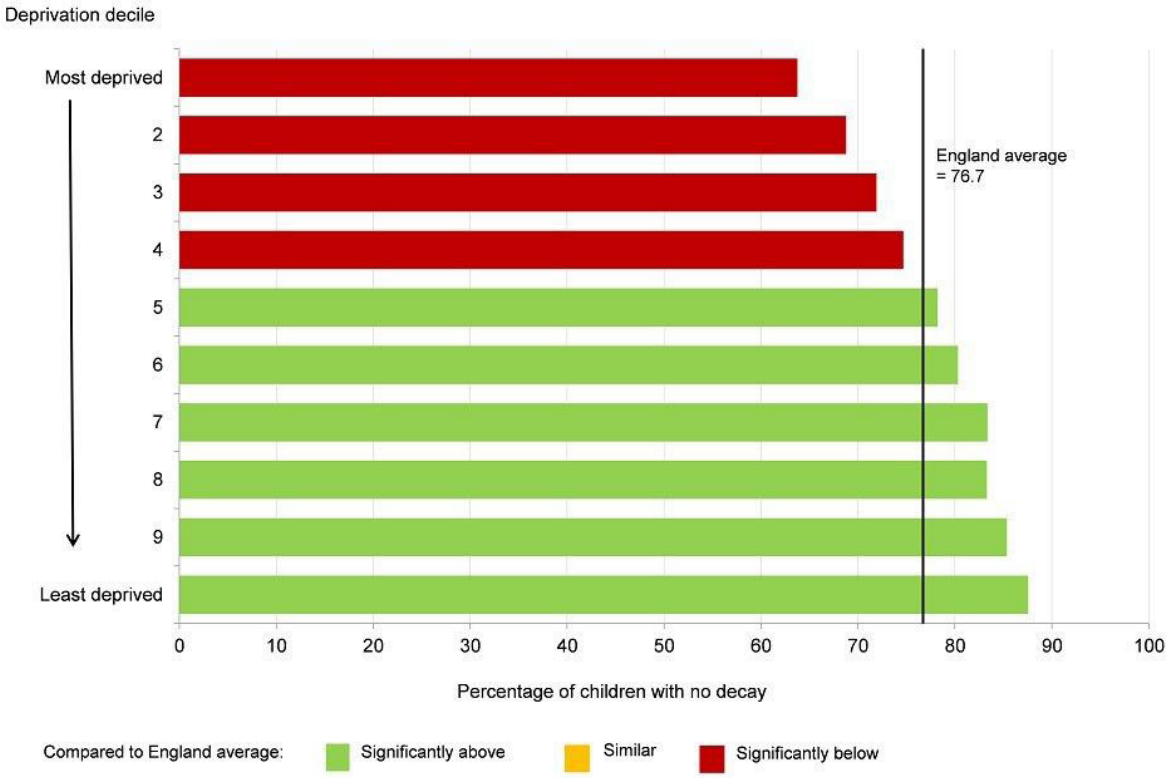
9. Oral health

Current health advice for good oral health includes tooth brushing with fluoride toothpaste twice a day, a visit to the dentist when a child's first tooth erupts and a healthy diet with limitations on sugary snacks and drinks [23], [24]. Fluoridation of water supply which is effective in improving overall dental health and reducing inequalities is also recommended as a population level intervention.

Despite this broad approach, oral health in some groups of children can be poor with the main cause of hospital admissions in young children aged 5 to 9 years being for dental extractions under general anaesthetic [25]. Data from the oral health survey of 5 year old children for the academic year 2016 to

2017 shows that 76.7% were free from any dental decay, which means that 23.3%, or almost one in every four children, had preventable dental decay [26]. Again, a wide variation across local authority areas exists, the proportion of 5 years olds without dental decay ranged from 52.9% to 87.1% in the academic year 2016 to 2017. In some local authority areas almost half of all 5 year olds suffer from dental decay when this decay could have been prevented. In the most deprived areas of England 63.7% of 5 year olds were free from dental decay, and this increased to 87.5% in the least deprived areas (Figure 11).

Figure 11: percentage of 5 year old children free from dental decay by deprivation decile*, England, academic year 2016 to 2017



Source: Public Health Outcomes Framework

*deprivation deciles based on groups of lower super output areas in England (Index of Multiple Deprivation 2015).

See Methods, data and definitions

See how your area compares

See inequality data

10. School readiness

School readiness is an important marker on the life course trajectory. Measured by applying the early years foundation stage profile (EYFSP) to children in a school setting at the end of the Reception year (age 4 to 5 years). It generates an outcome indicator based on a rounded assessment of physical, behavioural, cognitive and social development. It tells us something about outcomes from a healthy pregnancy, infancy and early childhood, which includes the effectiveness of early years' services and the opportunity for early intervention [27]. (See Methods, data and definitions)

Looking forward, school readiness can also be considered as a social determinant of health in that better development at this early age improves a child's ability to make the most of his or her learning opportunities, achieving higher grades and better employment prospects. These are then associated with economic prosperity and better health outcomes in the longer term [3] [28].

Data on school readiness, including trends and inequalities, is discussed in Chapter 6 on the wider determinants of health.

Child development outcomes at the end of the Reception year vary by the sex of the child, when exactly in the school year they were born (noting that some children in Reception can be almost a whole year older than some of their peers when this assessment is undertaken) and whether or not their first language is English [29]. The trajectory of early child development is now being monitored in more detail with the introduction of an interim indicator of child development outcomes aged 2 to 2 and a half years. This uses the results from the health visitor review undertaken at this age from the Ages and Stages Questionnaire (ASQ-3 ™).

The ASQ-3 ™ assessment, which covers the development of gross and fine motor skills, communication, problem solving and personal-social skills, is less sensitive to the exact age of the child as questionnaires are available at 24, 27 and 30 months. Early results and a study into the feasibility of introducing these indicators into the Public Health Outcomes Framework show the same variation with sex of the child as the EYFSP. It also shows that the development outcomes are socially distributed (vary by deprivation) and that this distribution is most noticeable in the development of communication skills [30],[31].

These measures are outcome indicators in their own right, measures of the benefits arising from early year's services and very early intervention in child health, secure bonding between parent and child, managing transition to parenthood and encouraging a rich home learning environment. In addition, the indicators can be placed on a continuum of early child development, as a milestone, which provides a secure foundation and baseline for further development including readiness for school (using the EYFSP at the end of

Reception) and ongoing educational attainment.

See how your area compares

11. Further information

Public Health England wants to increase the proportion of children ready to learn at age 2 years and ready for school at age 5 years. The resource Health Matters: Giving every child the best start in life for health professionals and local authorities provides further information about investing in early years services from pregnancy to age 2 years.
Further information on the health of children in the early years can be found in the Child and Maternal Health Profiles Information on the wider determinants of health is presented in Chapter 6. More detailed information on trends in inequalities in child health in presented in Chapter 5.

12. References

1. Public Health England (2016) Health Matters: Giving every child the best start in life.. Accessed 15 June 2018.
2. Department of Health (2013) Annual Report of the Chief Medical Officer 2012: Our children deserve better: prevention pays.. Accessed 18 June 2018.
3. Institute of Health Equity (2010) Fair society, healthy lives: The Marmot Review.. Accessed 18 June 2018.
4. Bell R et al (2017) Evaluation of a complex healthcare intervention to increases smoking cessation in pregnant women: interrupted time series analysis with economic evaluation. Tobacco Control 0:1-9.
5. Royal College of Physicians (2010) Passive smoking and children. Chapter 3: Effects of maternal active and passive smoking on fetal and reproductive health. Accessed 15 June 2018.
6. Smoking in Pregnancy Challenge Group (2015) Communication with Women Working Group: Shared key message. Accessed 18 June 2018.
7. Department of Health and Social Care (2017) Towards a smoke-free generation: tobacco control plan for England.
8. Public Health England (2018) Health of women before and during pregnancy: health behaviours, risk factors and inequalities. An initial analysis of the Maternity Services Dataset antenatal booking data. Accessed 27 July 2018.
9. NICE: Public Health guidance (PH26). Smoking: stopping in pregnancy and after childbirth, June 2010. Accessed 4 July 2018.

10. Public Health England (2018) Teenage pregnancy prevention framework. Accessed 18 June 2018.
11. Hadley A, Ingham R, Chandra-Mouli V (2016) Implementing the United Kingdom's 10-year teenage pregnancy strategy for England (1999-2010): How was this done and what did it achieve? Reproductive Health 13:139.
12. Public Health England (2016) Infant feeding: commissioning services. Accessed 18 June 2018.
13. The Lancet (2016): Breastfeeding series. Accessed 15 June 2018.
14. NICE (2015): Postnatal care up to 8 weeks after birth. Clinical guideline [CG37], updated February 2015. Accessed 18 June 2018.
15. ONS (2018) Statistical bulletin: Child mortality in England and Wales: 2016. Accessed 18 June 2018.
16. Public Health England (2017) The Eatwell Guide. Accessed 21 June 2018.
17. Chief Medical Officer (2011) UK physical activity guidelines. Accessed 21 June 2018.
18. Cabinet Office, Department of Health and Social Care, HM Treasury, and Prime Minister's Office (2017) Childhood obesity: a plan for action. Accessed 15 June 2018.
19. Sebire NJ and others (2001) Maternal obesity and pregnancy outcome: A study of 287,213 pregnancies in London. International Journal of Obesity 25: 1175 to 1182.
20. Dagfinn Anue MS and others (2014) Maternal body mass index and the risk of fetal death, stillbirth and infant mortality. Journal of American Medical Association 311(15):1536 to 1546.
21. Public Health England (2017) Weight change in primary school aged children. Accessed 15 June 2018.
22. Public Health England (2015) Childhood obesity: applying All Our Health. Accessed 18 June 2018.
23. Public Health England (2017) Health Matters: Child dental health. Accessed 18 June 2018.
24. Public Health England (2014) Delivering better oral health: an evidence-based toolkit for prevention, updated March 2017. Accessed 18 June 2018.
25. Public Health England (2018) Child oral health: applying All Our Health. Accessed 25 May 2018.
26. Public Health England (2018) Oral health survey of 5-year-old children 2017. Accessed 17 May 2018.
27. Standards and Testing Agency (2017) Early years foundation stage profile: 2018 handbook. Accessed 15 June 2018.
28. Social Mobility Commission (2017) State of the Nation 2017: Social

Mobility in Great Britain. Accessed 15 June 2018. ↩
29. Department for Education (2017) Early years foundation stage profile results: 2016 to 2017. Accessed 4 July 2018. ↩
30. Public Health England (2018) Child development outcomes at 2 to 2 and a half years: 2017 to 2018. Accessed 18 June 2018. ↩
31. Public Health England (2018) Population surveillance using child development outcome indicators. Accessed 18 June 2018. ↩

Chapter 5: inequalities in health

Published 11 September 2018

1. Main messages

Health inequalities are avoidable and unfair differences in health status between groups of people or communities. In 2014 to 2016, the level of inequality, or gap, in life expectancy between the most and least deprived areas of England was 9.3 years for males and 7.3 years for females.

Higher mortality rates in more deprived areas from heart disease, lung cancer, and chronic lower respiratory diseases account for around a third of the total gap in life expectancy for both sexes. Smoking and obesity are the main risk factors for these diseases (Chapter 3). Although smoking prevalence in England has declined, people in the more deprived areas are still more likely to smoke than people in the least deprived areas.

There is no evidence that inequalities in life expectancy have narrowed in recent years. Inequality in life expectancy for females has widened since 2001 to 2003, and for males, although inequality has fluctuated over time, it remains the same as that in 2001 to 2003.

The gap in healthy life expectancy (years lived in good health) between the most and least deprived areas of England was around 19 years for both males and females in 2014 to 2016. People living in the most deprived areas spend nearly a third of their lives in poor health, compared with only about a sixth for those in the least deprived areas. Inequality in healthy life expectancy has not changed since 2011 to 2013 for either sex.

This inequality in health begins early in life with wide inequalities in child health outcomes (Chapter 4). In 2014 to 2016, children in the most deprived areas were twice as likely to be born with low birthweight than children in the least deprived areas, and this inequality has not changed since 2010 to 2012. The latest data show that children in the most deprived areas were more than three times as likely to experience tooth decay than children in the least deprived areas, although inequality has narrowed in absolute terms since academic year 2014 to 2015.

The proportion of children aged 10 to 11 years who are overweight or obese has been increasing in England as a whole (Chapter 4). Alongside this, inequalities in child excess weight between the most and least deprived areas, and between ethnic groups, have also been widening.

There have been long-term improvements in infant mortality (Chapter 4) and rates of premature deaths from cancer and cardiovascular disease (Chapter 2). However, stark inequalities remain. In 2014 to 2016, people in the most deprived areas were more than twice as likely to die prematurely from cancer compared with those in the least deprived areas, and there has been no significant change in this inequality since 2010 to 2012. People in the most deprived areas were almost 4 times as likely to die prematurely from cardiovascular disease, and this inequality has significantly widened since 2010 to 2012.

There are inequalities in many behavioural risk factors among adults. In 2016, people in routine and manual occupations were more likely to smoke, and there were wide variations in smoking prevalence by sexual orientation. In addition, people living in the most deprived areas were more likely to be admitted to hospital for an alcohol related condition than those in the least deprived areas.

There are inequalities in the prevalence of mental health problems between population groups, and levels of smoking and indicators of alcohol misuse are higher for people with mental health problems.

2. Introduction

As described in previous chapters, there are differences in health outcomes between males and females, for different age groups and for different countries. There are also differences in outcomes relating to socioeconomic status, ethnicity, geographical area and other social factors. These health inequalities, avoidable and unfair differences in health status between groups of people or communities[1], reflect historic and present-day social inequalities in our population. Reducing inequalities should allow everyone to have the same opportunities to lead a healthy life.

This chapter provides an overview of inequality in health in England, concentrating primarily on inequalities by deprivation. A different approach has been taken for this chapter compared with the Health Profile for England 2017. This year, the chapter is based on the indicators selected by PHE's Health Equity Board to form part of the PHEHealth Equity Dashboard. The dashboard

and this chapter quantify inequalities in these indicators and, where possible, present trends over time to determine whether the level of inequality has increased or decreased.

The indicators are drawn from the Public Health Outcomes Framework and include indicators on life expectancy and mortality, and PHE priority areas including risk factors, child health and mental health. Inequalities in the wider determinants of health are covered in detail in Chapter 6.

Although the chapter focusses on inequalities within England as a whole, there are also considerable variations within and between the geographic areas of England. The Public Health Outcomes Framework provides data at local authority level, which can be used to examine these geographic inequalities.

3. Inequalities in life expectancy and healthy life expectancy

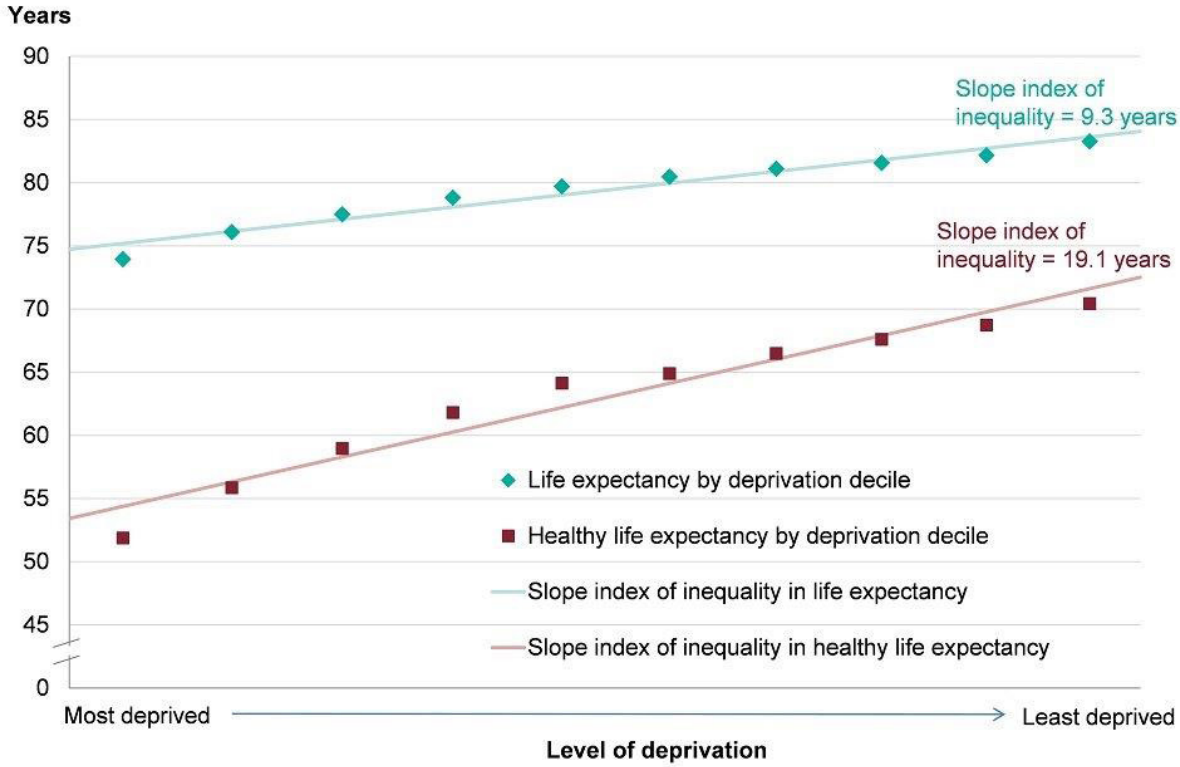
Life expectancy at birth in England has generally increased in recent decades and provisional data for 2017 show that it has reached 79.6 years for males and 83.2 years for females (Chapter 1). However, life expectancy is not uniform across England and inequalities exist.

If neighbourhood areas within England are ranked from most to least deprived and then organised into 10 groups, life expectancy increases in each group as the level of deprivation decreases (Figures 1 and 2). In other words, there is a 'social gradient' in health[2] (see Methods, data and definitions for further information on these 'deprivation decile' groups).

The slope index of inequality (SII) is a summary measure of this social gradient, which indicates how much life expectancy varies with deprivation. Between the most and least deprived areas of England, the level of inequality, or gap, in life expectancy is 9.3 years for males and 7.3 years for females (as measured by the SII).

The level of inequality in healthy life expectancy (years lived in good health) is larger than for life expectancy (Figures 1 and 2). The gap in healthy life expectancy between the most and least deprived areas of England is around 19 years for both males and females (as measured by the SII).

Figure 1: slope index of inequality in life expectancy and healthy life expectancy at birth, males, England, 2014 to 2016



Source: Public Health Outcomes Framework.

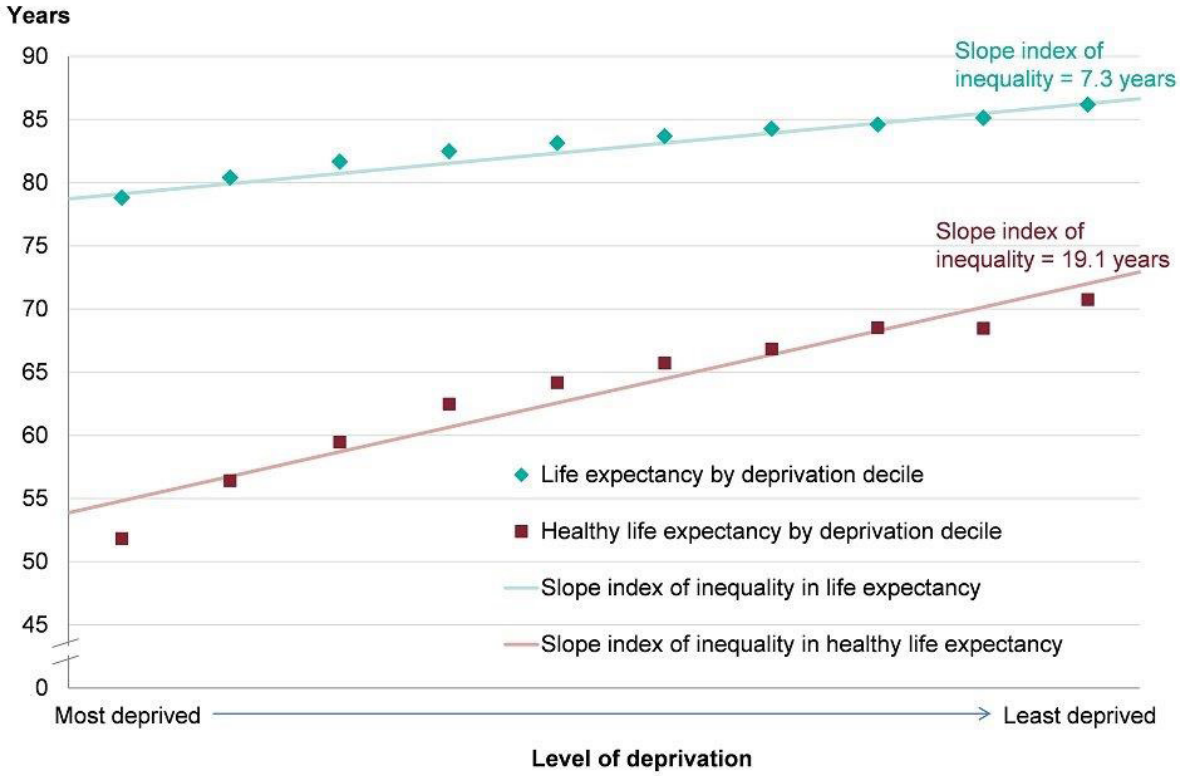
*deprivation deciles based on groups of lower super output areas in England (Index of Multiple Deprivation 2015).

See how your area compares:

Life expectancy

Healthy life expectancy

Figure 2: slope index of inequality in life expectancy and healthy life expectancy at birth, females, England, 2014 to 2016



Source: Public Health Outcomes Framework.

*deprivation deciles based on groups of lower super output areas in England (Index of Multiple Deprivation 2015).

See how your area compares: Life expectancy

Healthy life expectancy

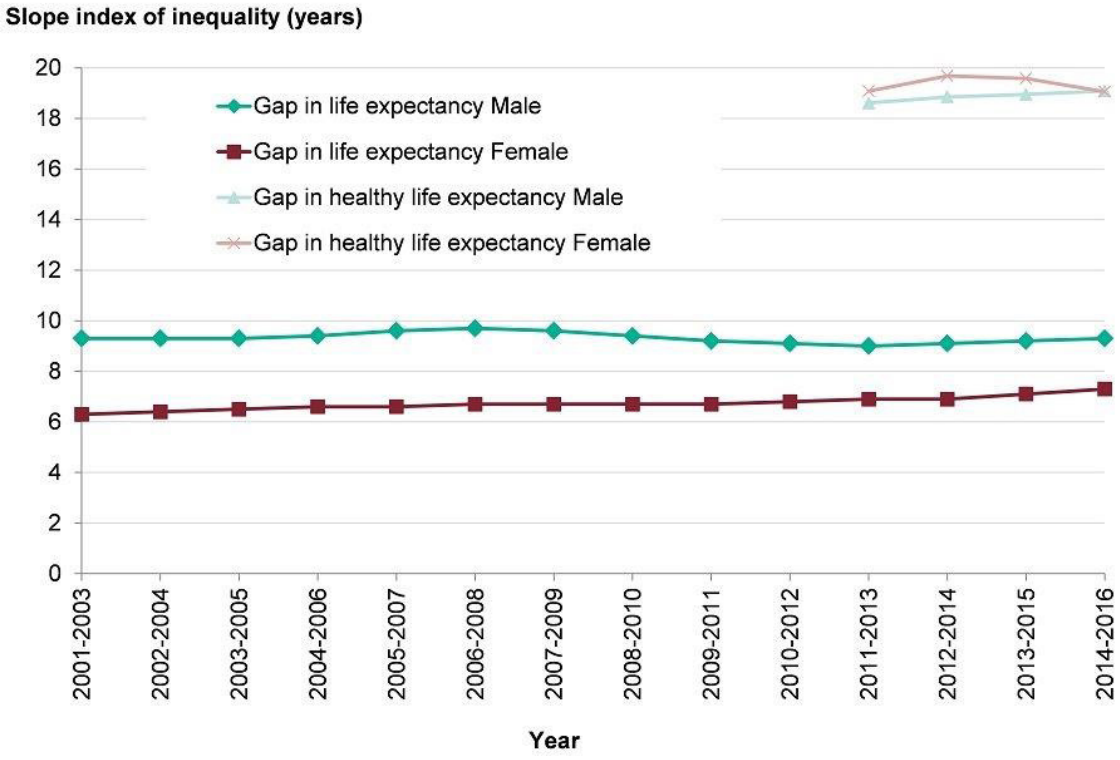
4. Trend in inequality in life expectancy and healthy life expectancy

Inequality in life expectancy between the most and least deprived areas in England has fluctuated over recent years for males. Between the periods 2001 to 2003 and 2006 to 2008 there was a statistically significant widening of the gap, to 9.7 years. This was followed by a narrowing of the gap to 9.0 years in 2011 to 2013. Between 2011 to 2013 and 2014 to 2016, the gap has significantly widened again, to 9.3 years, the same value as in 2001 to 2003 (Figure 3).

For females, there has been a gradual widening of inequality in life expectancy since 2001 to 2003. The gap has widened from 6.3 years in 2001 to 2003 to 7.3 years in 2014 to 2016. This change is statistically significant (Figure 3).

There has been no significant change in inequality in healthy life expectancy between 2011 to 2013 and 2014 to 2016 for either males or females. Due to changes in methodology, a longer term trend for inequality in healthy life expectancy is not available.

Figure 3: trend in inequality in life expectancy at birth and healthy life expectancy at birth, males and females, England, 2001 to 2003 up to 2014 to 2016



Source: Public Health Outcomes Framework based on Index of Multiple Deprivation 2010 (2001 to 2003 to 2009 to 2011) and Index of Multiple Deprivation 2015 (2010 to 2012 onwards)

See how life expectancy inequality in your area compares:

Males

Females

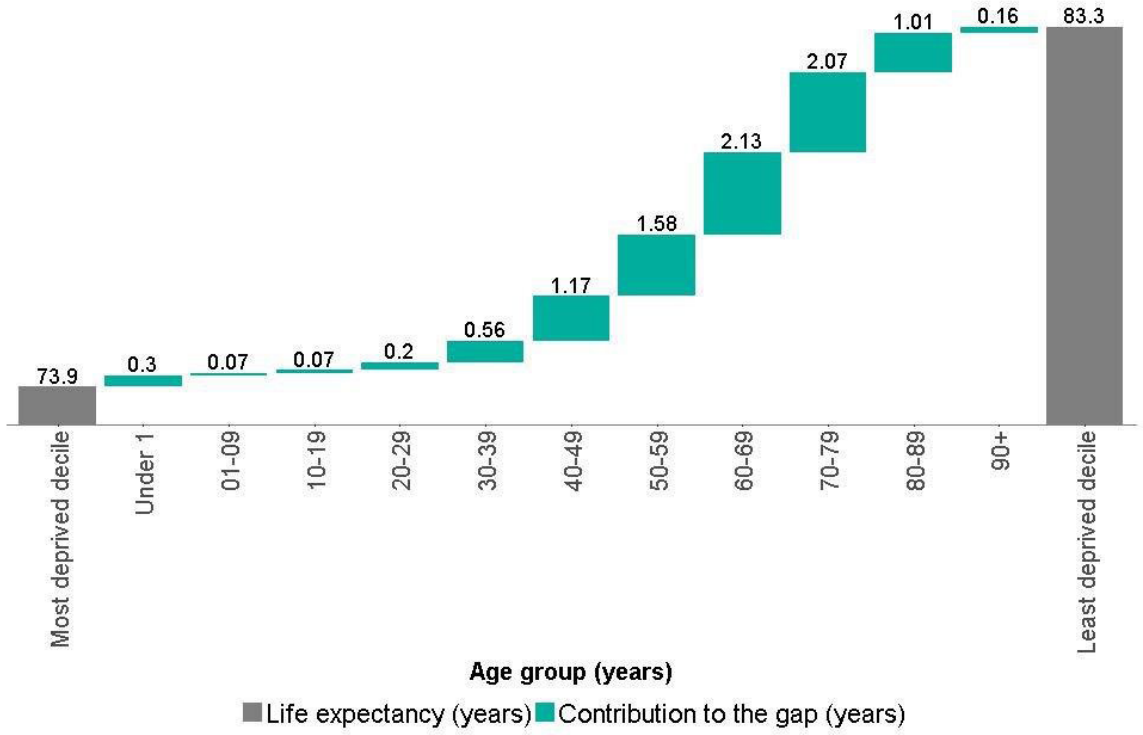
5. Contribution of age groups and causes of death to the gap in life expectancy

The contribution of different age groups to the gap in life expectancy between most and least deprived areas can be summarised using a method of 'life expectancy decomposition'(see Methods, data and definitions for further details).

From 2014 to 2016, mortality rates were higher in the most deprived decile for all age groups. For males, 8.0 years (85%) of the 9 year gap in life expectancy between the most and least deprived deciles could be accounted for by higher mortality rates among those aged between 40 and 89 in the most deprived decile (Figure 4). Higher mortality rates among males in the 60 to 69 age group in the most deprived decile made the biggest contribution of any age group, accounting for 2.1 years of the total gap.

Reducing higher mortality rates in the age groups making the biggest contributions will have the biggest effect on reducing the life expectancy gap.

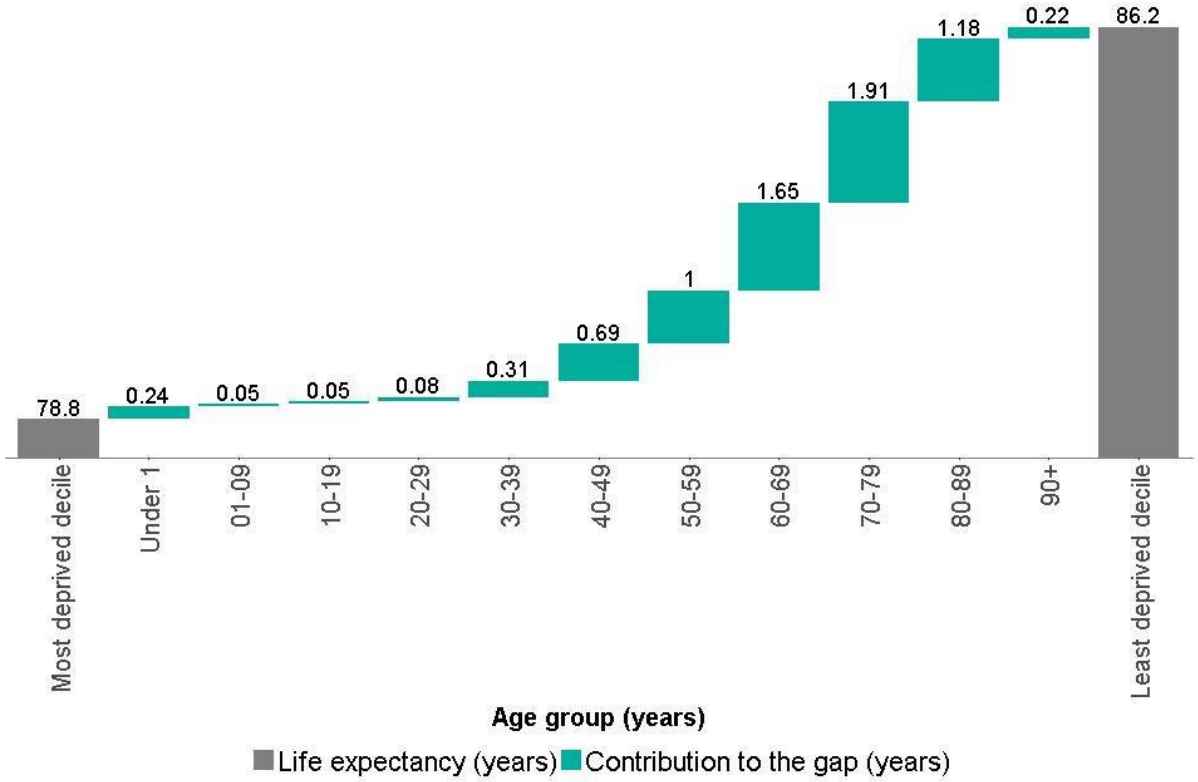
Figure 4: breakdown of the life expectancy inequality gap between the most and least deprived deciles, by age group, males, England, 2014 to 2016



Source: Public Health England analysis based on mortality and population data from ONS and Index of Multiple Deprivation 2015 from Ministry of Housing, Communities and Local Government

For females, there is a similar picture, with higher mortality rates among the older age groups in the most deprived decile accounting for most of the 7 year life expectancy gap. Higher mortality among females aged between 40 and 89 years accounts for 6.4 years (87%) of the total gap, with females aged between 70 and 79 years making the largest contribution of any age group, 1.9 years. (Figure 5).

Figure 5: breakdown of the life expectancy inequality gap between the most and least deprived deciles, females, England, 2014 to 2016



Source: Public Health England analysis based on mortality and population data from ONS and Index of Multiple Deprivation 2015 from Ministry of Housing, Communities and Local Government

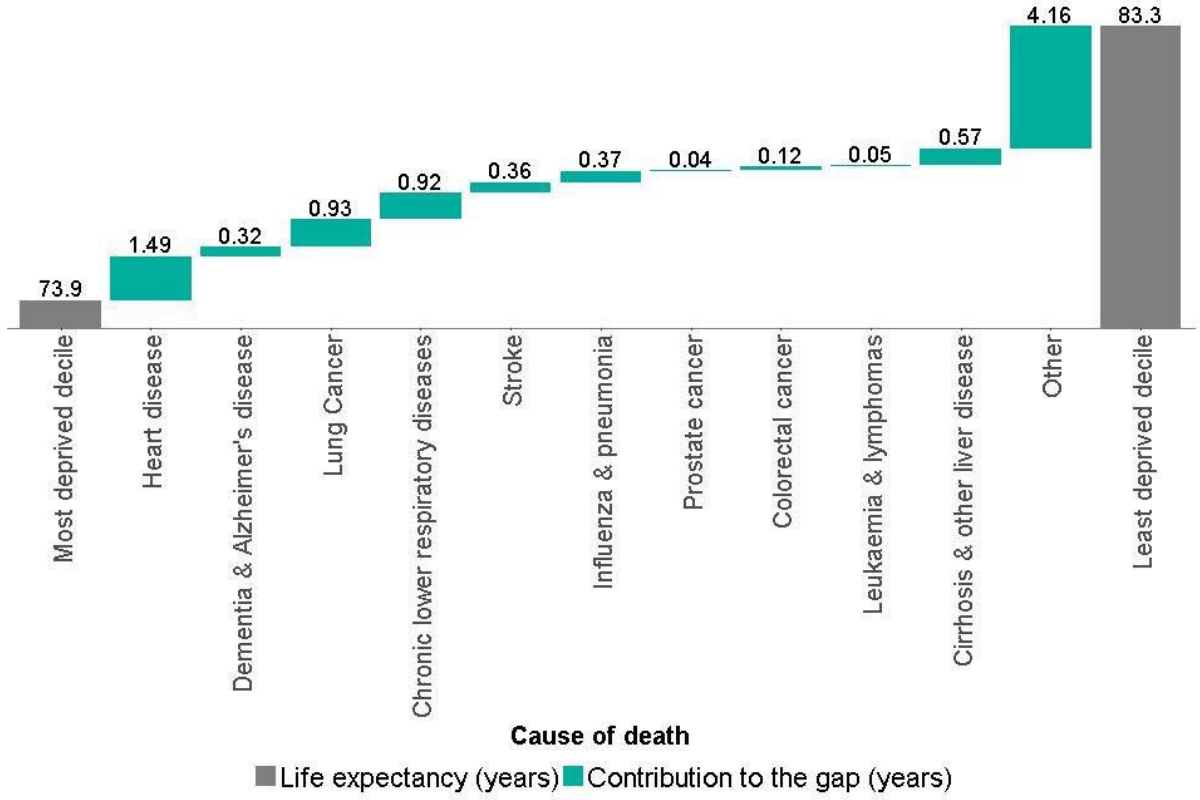
The contribution that different causes of death make to the gap in life expectancy between the most deprived and least deprived deciles can also be assessed. Figures 6 and 7 show these contributions for the 10 leading causes of death for males and females discussed in Chapter 2. These causes accounted for approximately 60% of all deaths in 2014 to 2016.

Higher mortality rates in the most deprived decile for heart disease, lung cancer, and chronic lower respiratory diseases contribute the most to the life expectancy gap in both sexes. Higher mortality rates from these causes of death account for around a third of the total gap. Smoking and obesity are the main risk factors for these diseases.

In males, 1.5 years of the 9 year life expectancy gap was accounted for by a higher mortality rate for heart disease in the most deprived decile, and for females, higher mortality for chronic lower respiratory diseases made the largest contribution (1.0 years of the 7 year gap) (Figures 6 and 7).

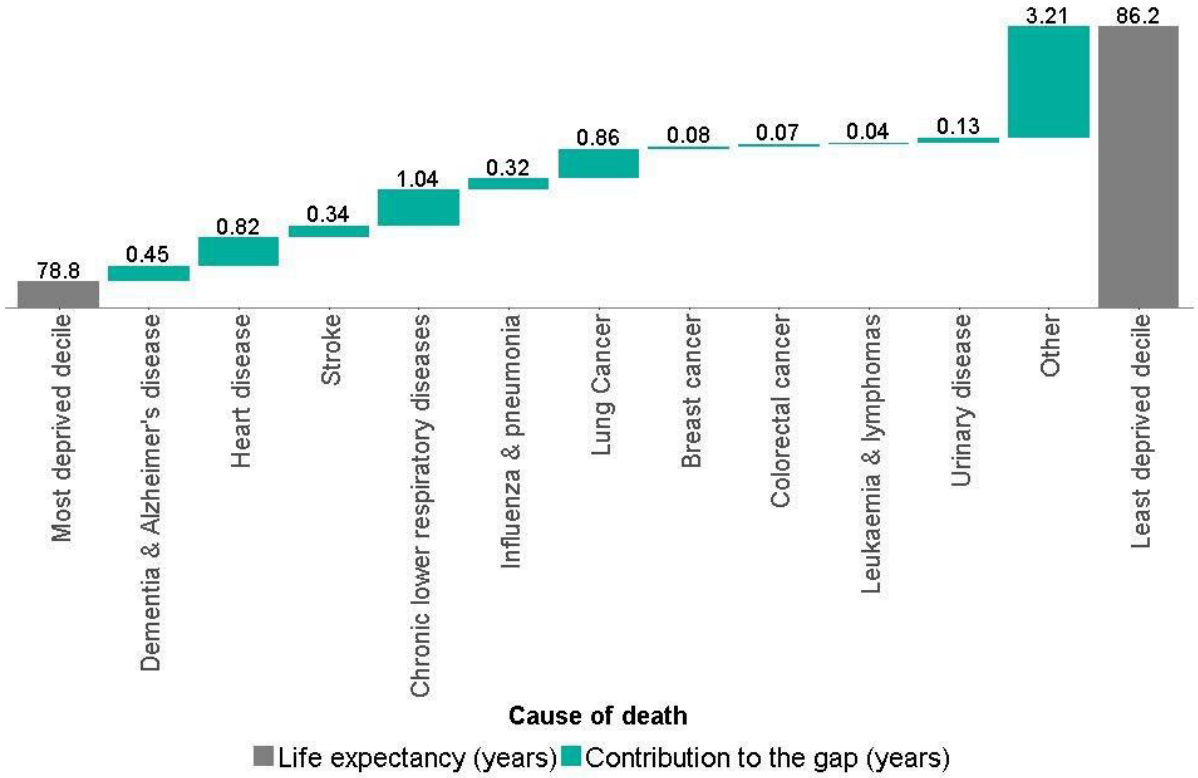
In both sexes, higher mortality in the most deprived decile from causes of death other than the 10 leading causes, accounted for just over 40% of the life expectancy gap. The 'other' group is comprised of deaths from a wide range of causes and further examination did not reveal a dominant cause contributing to the life expectancy gap. Among men, the largest contributions to the 'other' group were from higher mortality rates in the most deprived decile from accidental poisoning (contributing 0.5 years), and suicide (contributing 0.3 years). Among females, the largest contribution to the 'other' group was from higher mortality from cirrhosis and other liver disease (contributing 0.3 years).

Figure 6: breakdown of the life expectancy inequality gap between the most and least deprived deciles, males, England, 2014 to 2016



Source: Public Health England analysis based on mortality and population data from ONS and Index of Multiple Deprivation 2015 from Ministry of Housing, Communities and Local Government

Figure 7: breakdown of the life expectancy inequality gap between the most and least deprived deciles, females, England, 2014 to 2016



Source: Public Health England analysis based on mortality and population data from ONS and Index of Multiple Deprivation 2015 from Ministry of Housing, Communities and Local Government

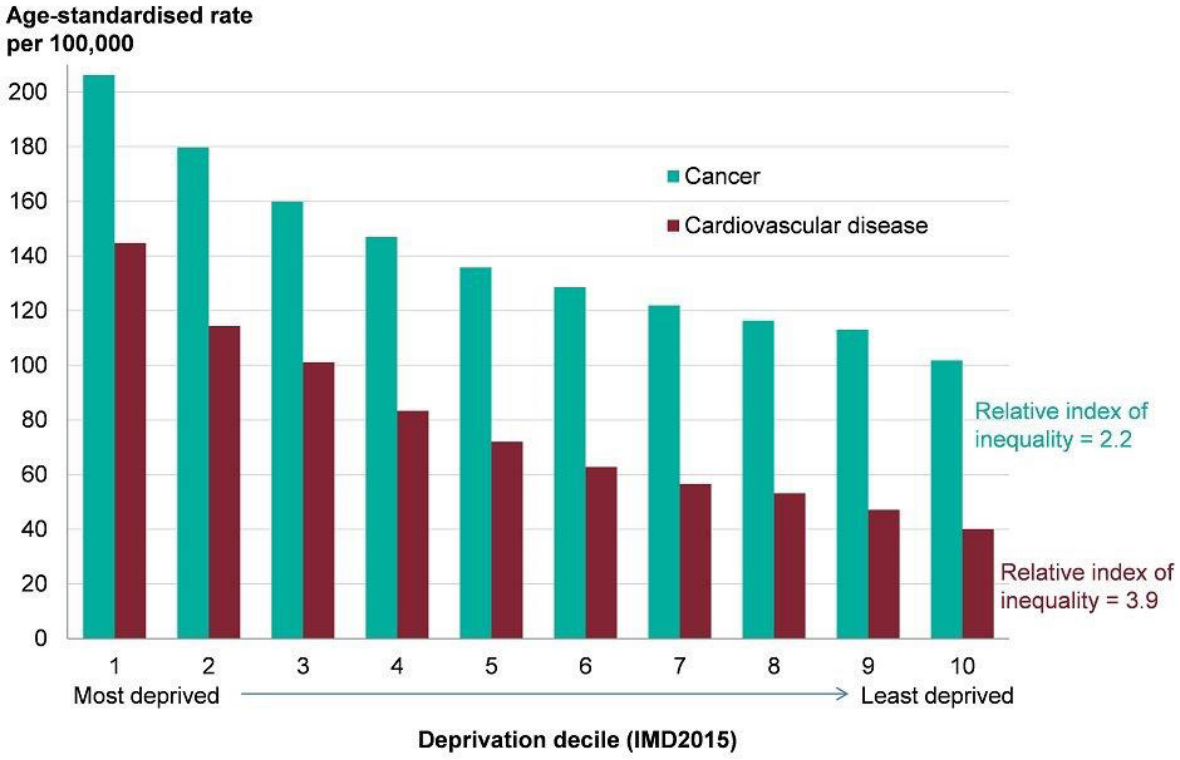
6. Inequalities in mortality from specific causes

The social gradient observed for life expectancy is also apparent for other priority health outcomes. Premature mortality rates in people (under 75 years) from cancer and cardiovascular disease (heart disease and stroke) have declined in recent years in England (Chapter 2), however, stark inequalities remain (Figure 8).

People in the most deprived areas are more than twice as likely to die prematurely from cancer (as measured by the relative index of inequality), and there has been no significant change in this inequality since 2010 to 2012.

People in the most deprived areas are almost 4 times as likely to die prematurely from cardiovascular disease compared with those in the least deprived areas (measured by the relative index of inequality), and this has significantly widened since 2010 to 2012.

Figure 8: age-standardised premature (aged <75) mortality rate for cancer and cardiovascular disease, by deprivation decile*, persons, England, 2014 to 2016



Source: Public Health England analysis based on mortality and population data from ONS and Index of Multiple Deprivation 2015 from Ministry of Housing, Communities and Local Government.

*deprivation deciles based on groups of lower super output areas in England (Index of Multiple Deprivation 2015).

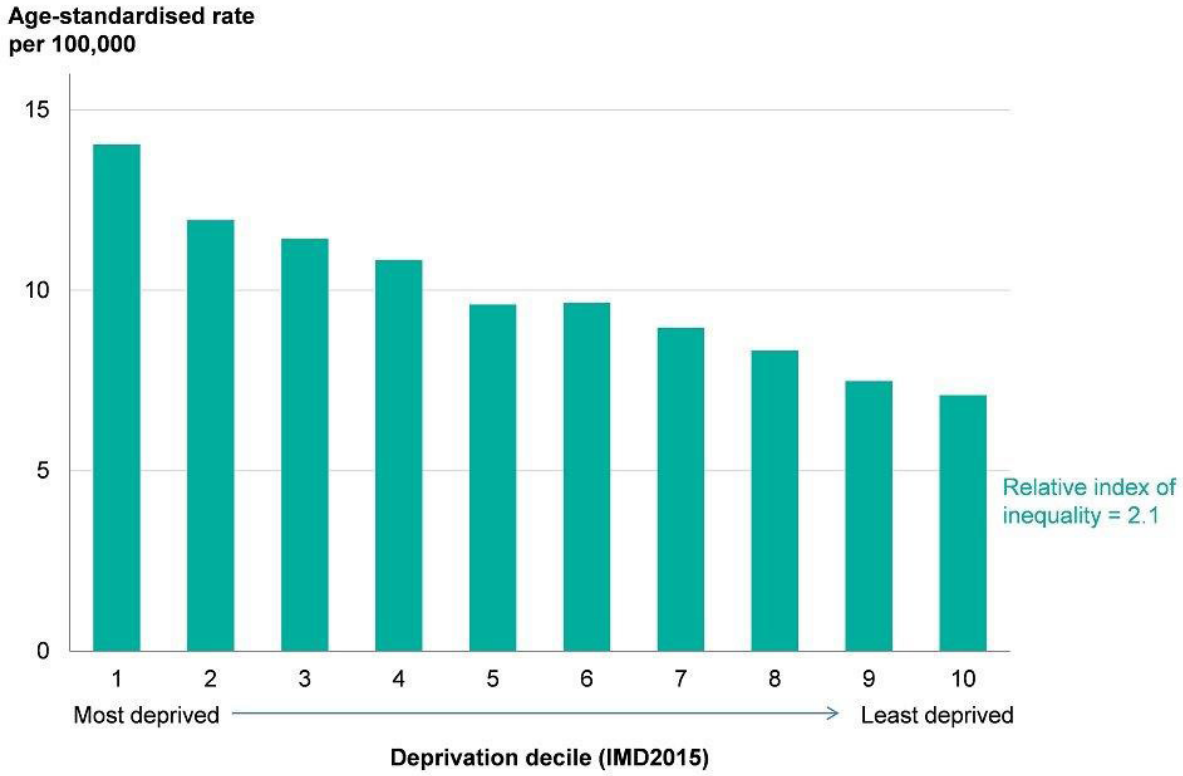
See inequality data:

Cancer

Cardiovascular disease

Suicide provides another example. The rate of suicide has gradually increased in England since 2006 to 2008, although there was a small fall in the rate in 2014 to 2016. The most deprived areas of England have the highest mortality from suicide (Figure 9). In 2014 to 2016, people in the most deprived areas were twice as likely to die from suicide compared with those in the least deprived areas (as measured by the relative index of inequality), and there has been no change in this inequality since 2010 to 2012.

Figure 9: age-standardised mortality rate for suicide, by deprivation decile*, persons, England, 2014 to 2016



Source: Public Health England analysis based on mortality and population data from ONS and Index of Multiple Deprivation 2015 from Ministry of Housing, Communities and Local Government.

*deprivation deciles based on groups of lower super output areas in England (Index of Multiple Deprivation 2015).

See how your area compares

7. Inequalities in child health

This section summarises inequalities in child health outcomes and builds on the analysis presented in Chapter 4. Inequality in health outcomes begins early in life. Chapter 4 presents inequalities in the percentage of babies born with a low birth weight, infant mortality rates, excess weight in children and the level of dental decay in children between different areas according to the level of deprivation.

This chapter quantifies the level of inequality using measures explained in the Methods, data and definitions section, and analyses trends in these measures over time. These measures and trends are presented in the PHE Health Equity Dashboard.

In the most deprived areas of England, in 2014 to 2016, the percentage of term babies born with a low birthweight was twice as high as in the least

deprived areas (as measured by the relative index of inequality), and there has been no change in this level of inequality since 2010 to 2012.

The infant mortality rate in the most deprived areas was over twice as high as the rate in the least deprived areas in 2014 to 2016 (as measured by the relative index of inequality), and there has been no change in this level of inequality since 2010 to 2012.

If the most deprived decile group had the same infant mortality rate as the least deprived, there would have been 873 fewer infant deaths in 2014 to 2016 in England. However, if all decile groups had the same infant mortality rate as the least deprived, there would have been 2,211 fewer infant deaths (see data pack).

In addition, large social gradients exist for other child health indicators. The percentage of children with dental decay was over three times higher in the most deprived areas than the least deprived areas (measured by the relative index of inequality). There has been a narrowing of inequality in absolute terms between academic years 2011 to 2012 and 2016 to 2017.

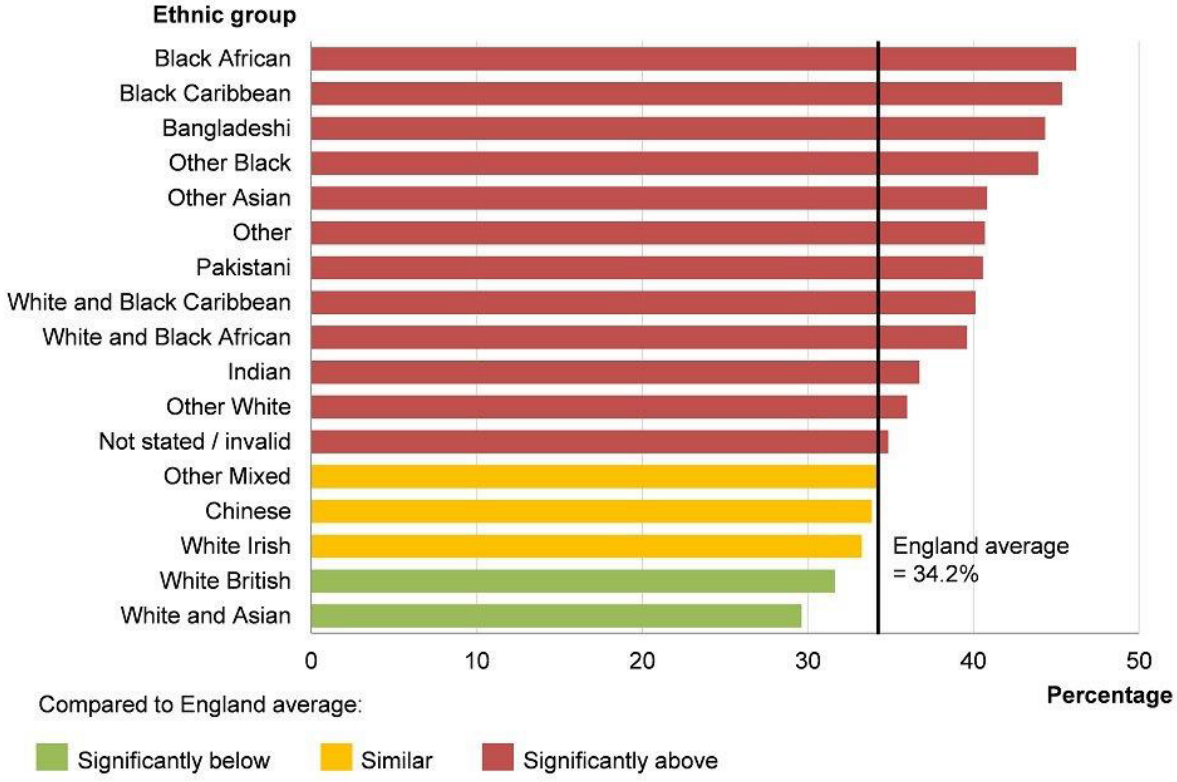
Among 10 to 11 year olds in the most deprived areas, 40.9% were overweight or obese in academic year 2016 to 2017 (Chapter 4). The proportion of children overweight or obese was 1.8 times higher in the most deprived areas compared with the least deprived areas (based on the relative index of inequality). There has been a significant widening of this inequality since academic year 2013 to 2014.

There are also large variations in the percentage of children who are overweight or obese by ethnic group. Among children aged 10 to 11 years, in the academic year 2016 to 2017, children in the Black African and Black Caribbean ethnic groups were most likely to be overweight or obese. However, almost all Black and Minority Ethnic (BME) groups had high percentages of 10 to 11 year olds with excess weight (Figure 10).

The level of inequality by ethnic group was 7.4 percentage points in the academic year 2016 to 2017, as measured by the mean deviation, and this inequality has widened since academic year 2013 to 2014. This analysis does not take into account the differences in the level of deprivation between ethnic groups.

Inequalities in the percentage of children aged 4 to 5 years who are overweight or obese also exist, although these inequalities are narrower than those at age 10 to 11 years.

Figure 10: percentage of 10 to 11 year old children classified as overweight or obese, by ethnic group, England, academic year 2016 to 2017



Source: Public Health Outcomes Framework

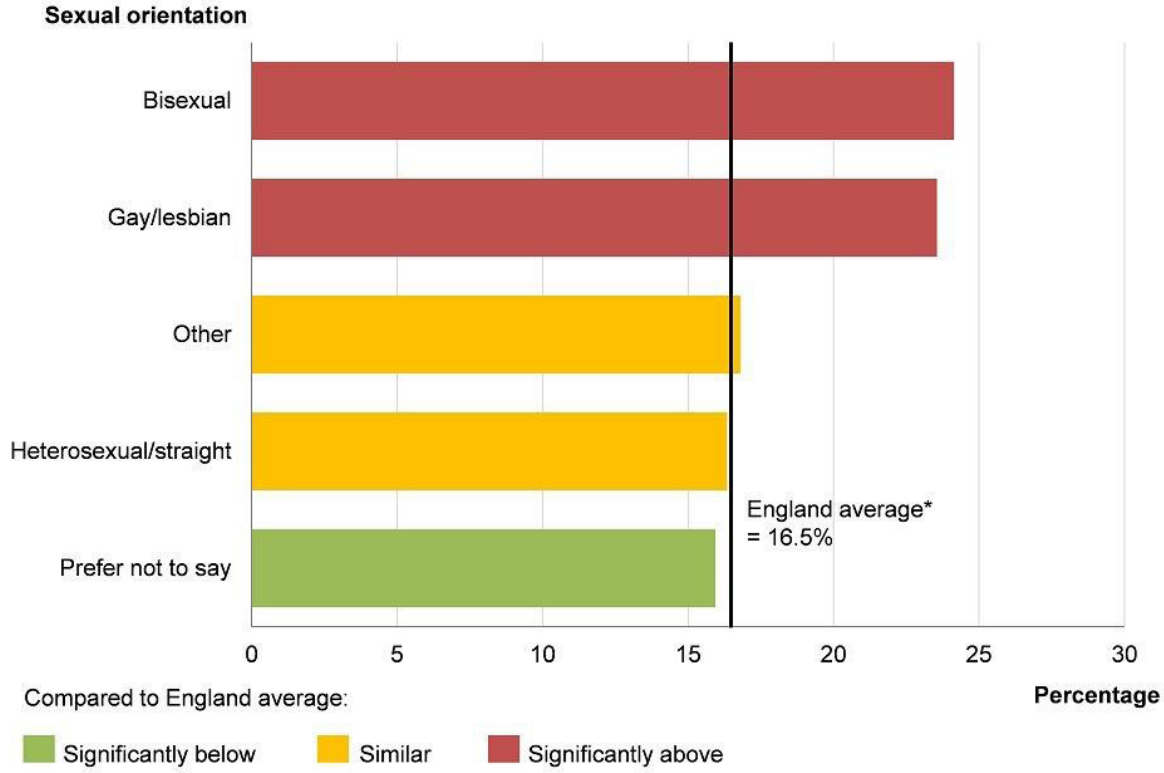
See inequality data

8. Behavioural risk factors

As well as differences in life expectancy, healthy life expectancy and mortality rates among adults, there are also differences in the prevalence of many behavioural risk factors between population groups.

For example, there is a clear social gradient in smoking prevalence. In 2016, 27.2% of adults in the most deprived decile smoked, compared with 7.9% of those in the least deprived decile. Prevalence of smoking is also higher among those who work in routine and manual occupations compared with those in managerial and professional occupations. Smoking prevalence also differs by sexual orientation, with a prevalence of 24.1% and 23.6% among those identifying as bisexual and gay/lesbian respectively, compared with 16.3% in the heterosexual group in 2016 (Figure 11).

Figure 11: smoking prevalence by sexual orientation, age 18+ years, England, 2016



Source: Public Health Outcomes Framework

*England average presented in this chart differs from the England smoking prevalence figure presented in the Public Health Outcomes Framework (see Methods, data and definitions).

See inequality data

As discussed in the Health Profile for England 2017, inequalities also exist for other behavioural risk factors including fruit and vegetable consumption and physical exercise. People who have multiple risk factors are likely to have the poorest health outcomes, and there is significant co-occurrence of smoking, drinking, physical inactivity and poor diet among individuals in England[3]. Data for these individual indicators can be accessed in the Public Health Outcomes Framework.

Admissions to hospital for alcohol related conditions also vary by level of deprivation. In financial year 2015 to 2016, the admission rate in the most deprived areas was more than twice as high as in the least deprived areas (as measured by the relative index of inequality).

9. Mental health and wellbeing

Mental health and wellbeing are important influences on health behaviours and physical health, as well as being health outcomes in their own right. Wellbeing is measured in a number of ways, including feeling worthwhile, anxious, happy, or satisfied with life.

Data in the Public Health Outcomes Framework shows that there has been a general improvement in the percentage of people reporting unfavourable levels on all these measures in recent years. However, there are inequalities between different groups of the population. For example, in financial year 2016 to 2017, females were more likely than males to report feeling anxious but males were more likely to feel their life is not worthwhile.

In financial year 2016 to 2017, 4.5% of the population reported low life satisfaction, but this varied considerably by employment status. Low life satisfaction among the unemployed was almost four times higher than among the employed, while for the economically inactive it was over twice as high. Inequality in life satisfaction between employment groups was 5.9 percentage points in financial year 2016 to 2017 as measured by the mean deviation (see Methods, data and definitions for further information), and this inequality has reduced since financial year 2013 to 2014.

The prevalence of mental health disorders varies considerably between population groups. Although the Adult Psychiatric Morbidity Survey 2014 does not describe the prevalence of mental health disorders in relation to deprivation directly, it considers some important factors that contribute. For example, rates of common mental health disorders and psychotic disorders were higher among those who are unemployed and economically inactive and were also higher among those in receipt of benefits. Chapter 3 discusses the prevalence of common mental health disorders by age and sex.

Among men, the prevalence of having a common mental health disorder (such as an anxiety disorder or depressive episode) does not vary greatly by ethnic group. In 2014, prevalence for White British males, in the week prior to being questioned, was 13.5% and levels were similar for the other main ethnic groups. However, Black or Black British females are more likely than White British females to report common mental health disorders (29.3%, compared with 20.9%) while females in the White Other ethnic group are least likely to report symptoms (15.6%). For psychotic disorders, prevalence is not available for all ethnic groups for females, but prevalence is higher in Black males (3.2%) than in males from the White (0.3%) and Asian (1.3%) ethnic groups.

It is very common for people to experience problems with their mental health

and alcohol or drug use at the same time. Research shows that the majority of drug users (70%) and alcohol users (86%) in community substance misuse treatment also experience mental health problems[4].

In England, smoking prevalence among adults with mental health conditions is higher than the general population, although the prevalence varies by specific condition[5]. In financial year 2014 to 2015, 40% of adults with a serious mental illness were reported to be smokers.

10. Wider determinants of health

In addition to behavioural risk factors and health outcomes, there are considerable variations in the wider determinants of health between population groups. These inequalities are covered in detail in Chapter 6.

11. Further information

The indicators presented in this chapter are taken from the Public Health Outcomes Framework. More detailed metadata about the indicators and how they are constructed is available from the data tool.

The 2018 PHE Health Equity Dashboard is an interactive tool which allows users to explore and visualise the data. A static version of the dashboard is also available which allows users to access the underlying data in Excel.

In 2017, the PHE Health Equity Dashboard was published as part of the Public Health Outcomes Framework: Health Equity Report - Focus on ethnicity. This report provides commentary for each of the indicators in the PHE Health Equity Dashboard, and additional breakdowns of inequality, in particular by ethnic group.

The Ethnicity facts and figures website was first published in 2017 and brought together indicators by ethnic group from across government departments. This forms part of the Government's Race Disparity Audit.

The purpose of the audit is to help to understand and assess differences between ethnic groups, and to identify those public services where disparities are diminishing and those where work is needed to develop effective strategies to reduce disparities between ethnic groups.

12. References

1. Public Health England (2017) Reducing health inequalities in local areas. Accessed 26 July 2018. ↩
2. The Marmot Review Team (2010) The Marmot Review: Fair Society, Healthy Lives. Accessed 9 May 2018. ↩
3. Kings Fund (2018) Tackling multiple unhealthy risk factors. Emerging lessons from practice. Accessed 11 June 2018. ↩
4. Public Health England (2017) Better care for people with co-occurring mental health, and alcohol and drug use conditions. Accessed 27 June 2018. ↩
5. Royal College of Physicians (2013) Smoking and mental health. Accessed 27 July 2018. ↩

Chapter 6: wider determinants of health

Published 11 September 2018

1. Main messages

The wider determinants of health are a diverse range of social, economic and environmental factors which influence people's mental and physical health. Systematic variation in these factors constitutes social inequality, an important driver of the health inequalities presented in Chapter 5.

The quality of the built and natural environment such as air quality, the quality of green spaces and housing quality also affect health. While the proportion of homes meeting the Decent Homes Standard has increased, homelessness has continued to rise, and housing has continued to become less affordable.

Educational attainment is linked to health behaviours and outcomes throughout a person's life and varies considerably by socioeconomic position. The gap in the percentage of children achieving 5 GCSEs at A*-C between those living in the most deprived local authorities and those in the least deprived local authorities remains substantial.

Income and health are strongly associated. The proportion of individuals in the UK falling below the Minimum Income Standard (MIS) increased between 2008 to 2009 and 2013 to 2014, followed by a small decline to 29.7% in 2015 to 2016. A higher proportion of children were in households living below this standard (44.3%) than working age adults (29.0%) and pensioners (15.4%).

The employment rate in England was at a record high at 74.4% in 2016 to 2017. However, in-work poverty has increased. In 2015 to 2016, 57% of people living in households with incomes below 60% of the median (after housing costs) were children or working age adults from households with someone in work, up from 35% in 1994 to 1995.

Access to employment, and the benefits this can bring is much lower for people with certain limiting health conditions. In 2016 to 2017, only 5.7% of people with a learning disability and 7.0% of people in contact with secondary

mental health services were in employment. The quality of work, and the health benefits work provides, also varies substantially.

Crime can have a wide ranging effect on people's health. The rate of first time entrants into the criminal justice system reduced in 2017. However, police recorded violent crimes and violent sexual offences continued to rise in 2016 to 2017, with a larger increase in the most deprived local authorities.

2. Introduction

Good or bad health is not simply the result of individual behaviours, genetics and medical care. A substantial part of the difference in health outcomes is down to the social, economic and environmental factors that shape people's lives[1]. These factors are collectively described as the wider determinants of health.

In this chapter, the wider determinants are grouped under the following headings: the built and natural environment, education, income, work and the labour market, crime and social capital. This chapter provides an update to the Health Profile for England 2017 but also presents some additional analysis.

Systematic variations in these factors are social inequalities. They determine the extent to which different individuals have the physical, social and personal resources to identify and achieve goals, meet their needs, and deal with changes to their circumstances[2]. These interactions of social factors with states of mind are known as psychosocial factors; they are an important mediator of the influence of the wider determinants of health outcomes[3].

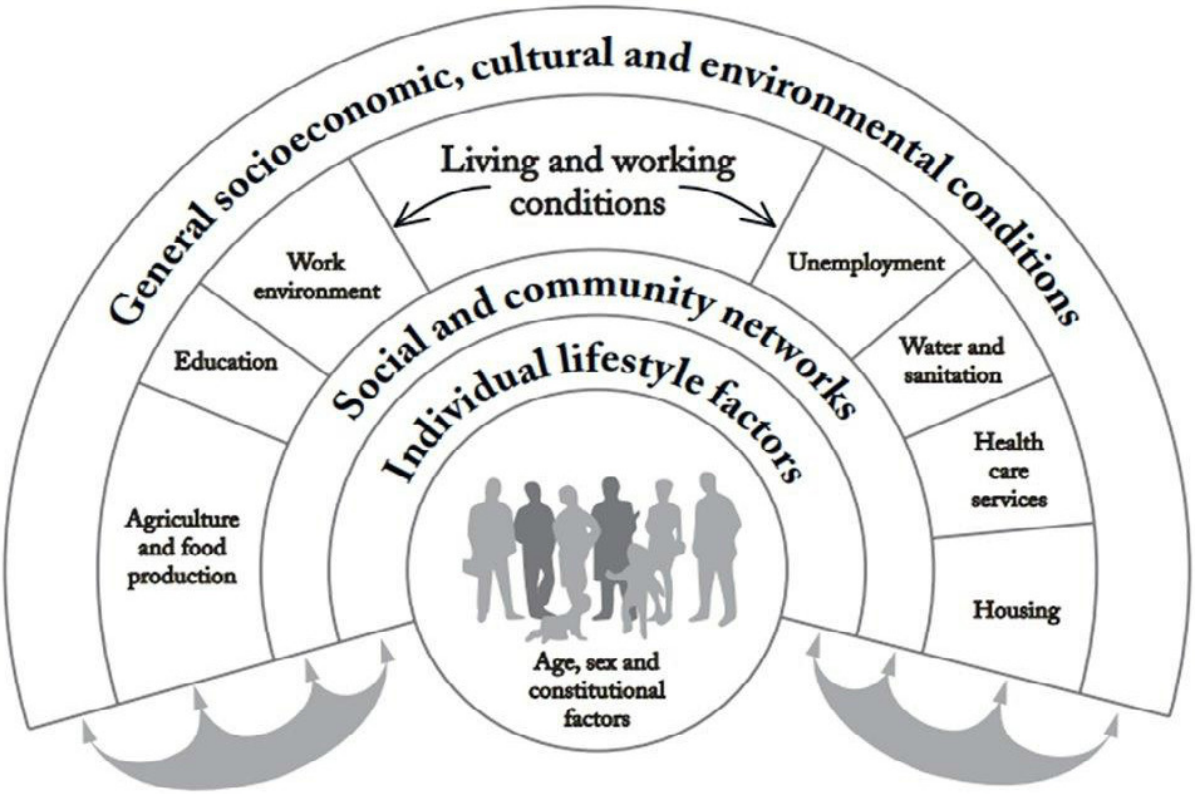
The link between social inequalities and differences in health outcomes is strong and persistent[4], as presented in Chapter 5. Addressing the wider determinants of health will help improve health equity as well as overall health.

The mechanisms by which the wider determinants influence both mental and physical health can be complex and inter-related, often acting over a long time. Figure 1 is a model of the main health determinants developed by Dahlgren and Whitehead[5]. It places the individual and their 'constitutional factors' such as age and genetics in the centre, surrounded by individual lifestyle factors.

Outside these individual factors are the wider determinants: the conditions of people's daily lives, and then the broader contextual socioeconomic, cultural and environmental conditions within which our lives take place. Crucially, the

different layers of the model are shown as interlinked, highlighting the complex processes which determine people's health.

Figure 1: the Dahlgren and Whitehead model of the main determinants of health[5]



Source: Dahlgren and Whitehead

3. The built and natural environment

In England, most people spend large amounts of their time in human-made or modified environments. Features such as neighbourhood design, housing, the food environment, transport, and natural and sustainable environments are all recognised as determinants of health and are described in detail in the Public Health England (PHE) document Spatial Planning for Health.

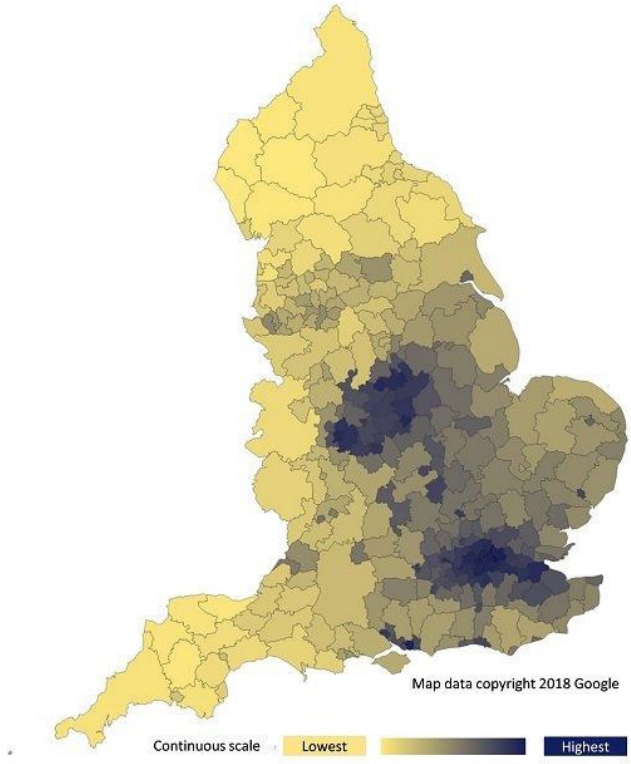
Air quality is a central feature of the environment. A number of air pollutants have adverse effects on health. Some of the strongest evidence is for effects of fine particulate matter (PM2.5). Exposure to PM2.5 increases mortality risk, particularly from heart and lung conditions[6,7].

The annual concentration of human-made fine particulate matter (adjusted to account for population exposure) varies across England, as seen in Figure 2. Higher concentrations were found close to specific sources of emissions (such as major ports) and more generally in larger urban areas with multiple

sources. They are also strongly influenced by weather patterns. Long-range transport from Europe contributes to high concentrations across the mid- and south east of England.

At a more local level, disadvantaged communities are often disproportionately exposed to poor air quality[8] because they tend to be concentrated in and around polluted spots, such as busy roads. For more detail on the effect of air pollution, see Chapter 7.

Figure 2: annual concentration of human-made population weighted fine particulate matter (PM2.5), by lower tier local authority, England, 2016



Source: Wider determinants of health profile

Notes: concentrations of PM2.5 vary from year to year due to a number of factors including changes in emissions and changes in weather. Variation due to weather is generally greater than the year to year variation due to changes in emissions. Population weighted concentrations are used to reflect population exposure.

See how your area compares

There is evidence to suggest that access to green spaces has a beneficial effect on physical and mental wellbeing through both physical access and use[9]. In England, the proportion of people who used outdoor space for health or exercise in a given weekincreased from 14.0% in survey year 2011 to

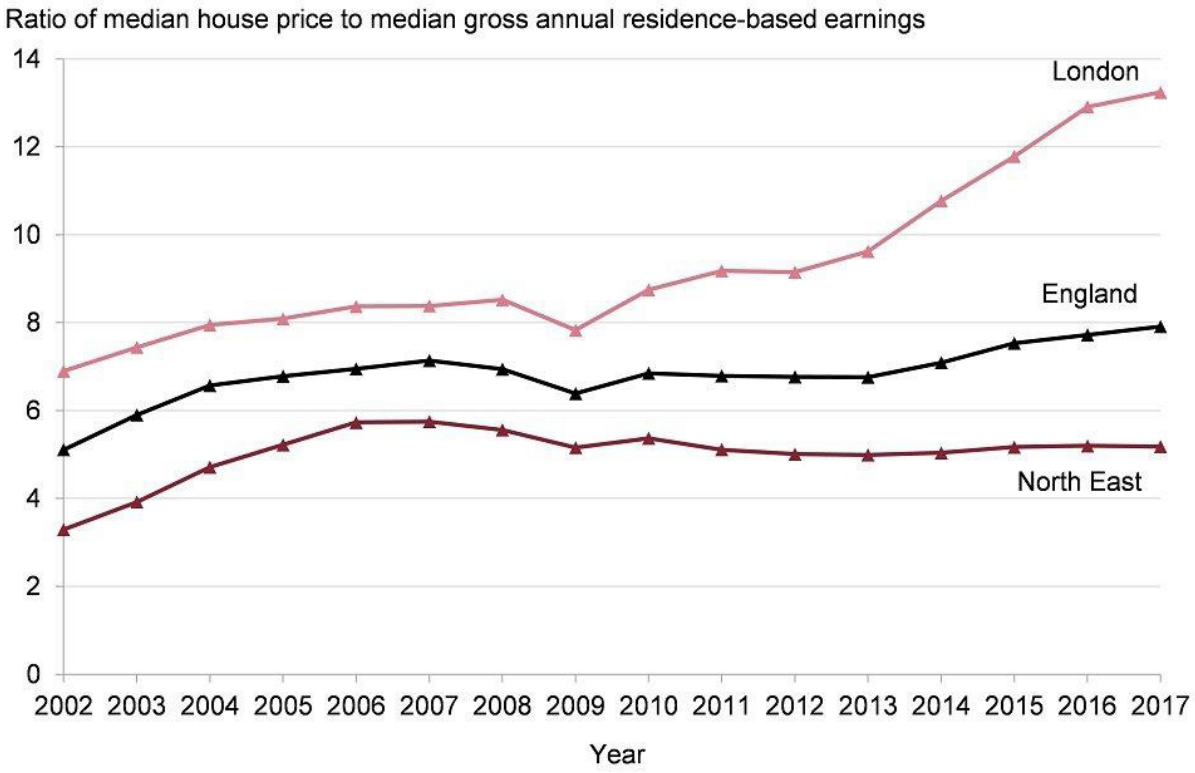
2012 to 17.9% in 2014 to 2015 and was unchanged in 2015 to 2016. Access to green space is unequally distributed, with poorer communities generally having less access[10].

Many aspects of housing can affect our health. The Decent Homes Standard is an assessment of multiple elements of a dwelling. In 2016 20% of dwellings in England (equates to 4.7 million homes) failed to meet the standard, down from 35% in 2006[11]. The private rented sector had the largest proportion of dwellings not meeting the standard at 27%, compared with 20% of owner-occupied homes and 13% of social rented homes.

Another important aspect of both rented and owned housing is affordability. This influences where people live and work and affects the quality of housing, poverty, community cohesion, and time spent commuting[11]. The affordability of home ownership in England has worsened since 2013, when the ratio of median house price to median gross annual earnings was 6.8, it was 7.9 in 2017.

Figure 3 shows the regions that are the most and least affordable compared with the England average. In 2017, London was the least affordable, with median house prices 13.2 times higher than median earnings, while the North East was the most affordable with a ratio of 5.2. The difference between these two regions was three times larger in 2017 than it was in 2007 (the year, in recent records, when the difference was lowest).

Figure 3: trend in ratio of median house price to median gross annual residence-based earnings, England, London and the North East, from 2002 to 2017



Source: Office for National Statistics, house price to residence-based earnings ratio

See how your area compares

Homelessness often results from a combination of individual and social issues. People who are homeless have poorer health on average than the general population and tend to die earlier[12]. Across England, the proportion of households in temporary accommodation due to statutory homelessness rose from 2.2 per 1,000 households in financial year 2010 to 2011 to 3.3 in 2016 to 2017. The annual Crisis homelessness monitor 2018 also reported an ongoing rise in rough sleeping[13].

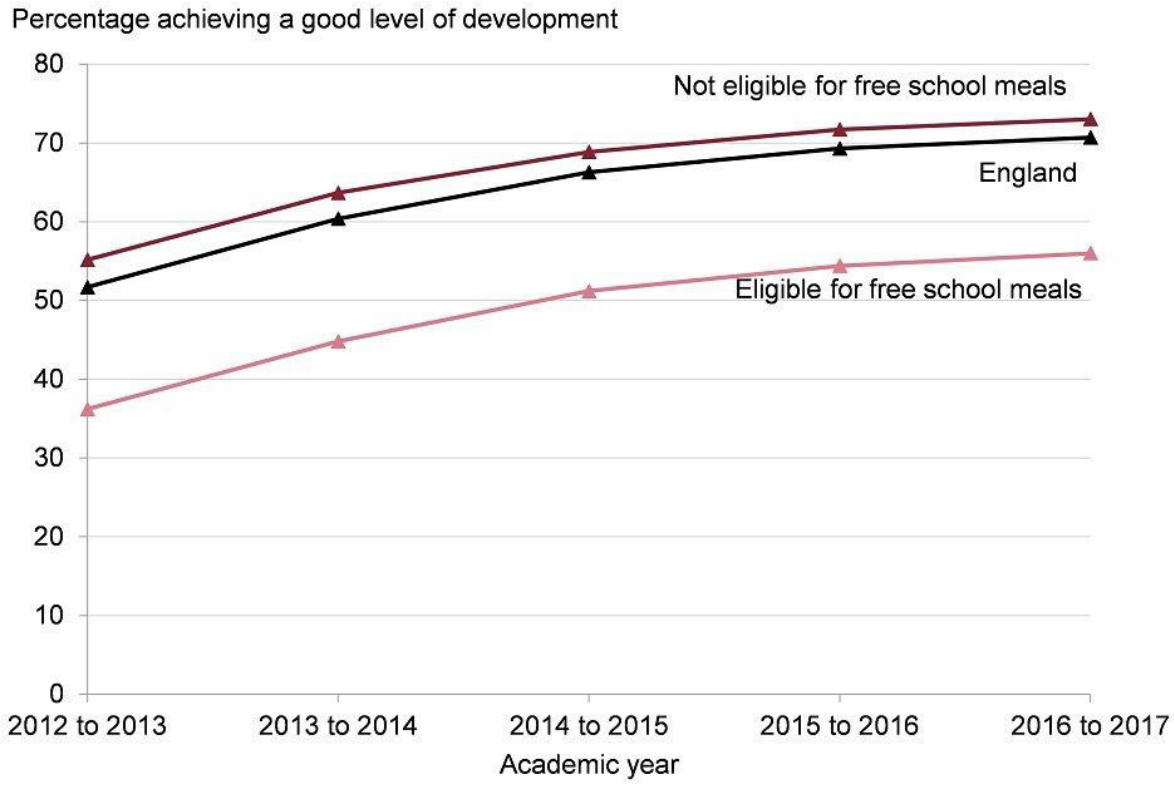
4. Education

Educational attainment is strongly linked with health behaviours and outcomes. Better-educated individuals are less likely to suffer from long term diseases, to report themselves in poor health, or to suffer from mental conditions such as depression or anxiety[14]. Education provides knowledge and capabilities that contribute to mental, physical, and social wellbeing. Educational qualifications are also a determinant of an individual's labour market position, which in turn influences income, housing and other material resources associated with health.

Children are assessed for ‘school readiness’ upon completion of the Reception year in school at around 5 years of age, as discussed in Chapter 4. To achieve a ‘good level of development’ a child needs to have reached expected levels in early learning goals relating to communication and language, physical development, and personal, social and emotional development[15]. The proportion of children in England assessed as achieving a good level of development has increased from 51.7% in academic year 2012 to 2013 to 70.7% in 2016 to 2017.

There are inequalities in school readiness: among children who are eligible for free school meals (indicative of low household income) the proportion was 56.0% in academic year 2016 to 2017, compared with 73.0% for children not eligible for free school meals. The gap has narrowed a small amount over the period since academic year 2012 to 2013, though remains substantial (Figure 4). See the Health Equity Dashboard for further information.

Figure 4: trend in the percentage of children achieving a good level of development at the end of reception, by free school meals status, England, academic year 2012 to 2013 up to 2016 to 2017



Source: Department for Education, EYFS Profile statistical series

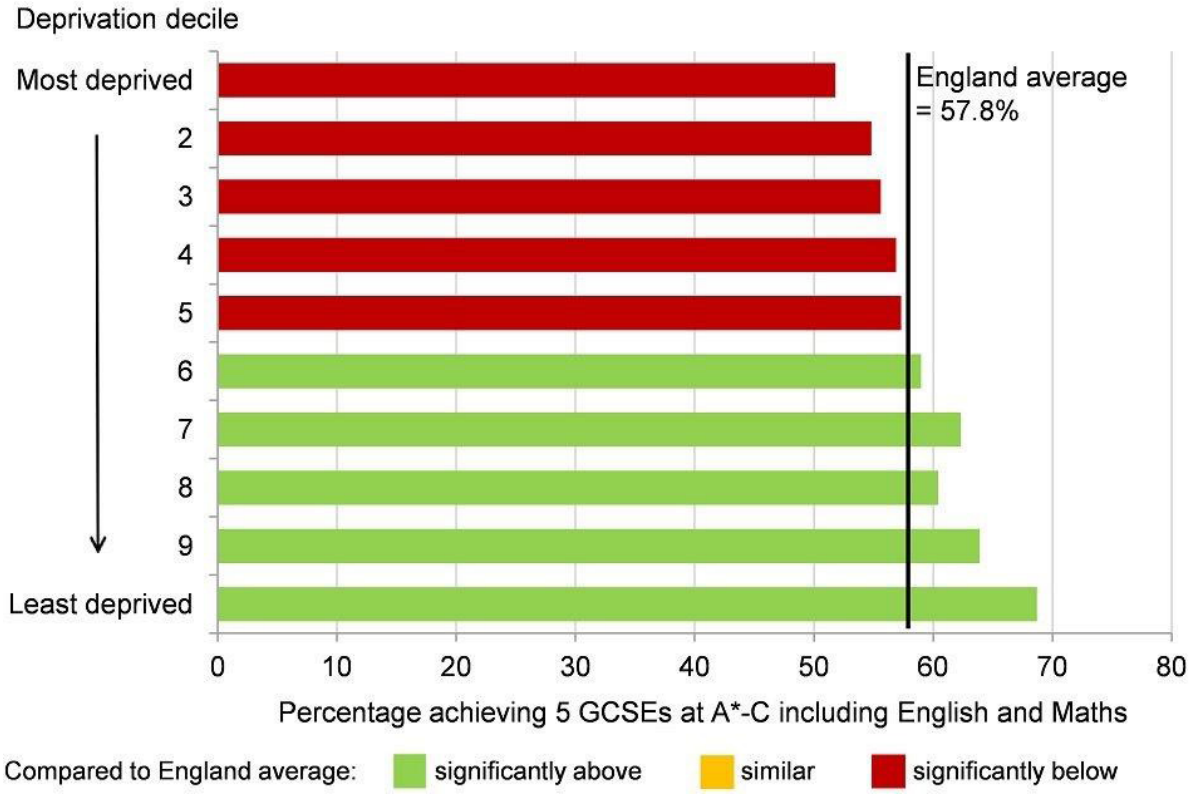
See how your area compares:

All children

Children with free school meal status

Unequal attainment patterns are evident from early years and entrench through the education system. Attainment at key stage 4 split by deprivation decile highlights this inequality (Figure 5). In academic year 2015 to 2016, 57.8% of children in England achieved 5 GCSEs at A*-C including English and maths. However, in the most deprived decile of areas, 51.8% of children achieved this benchmark compared with 68.7% in the least deprived decile.

Figure 5: percentage of children achieving 5 GCSEs at A-C including English and Maths, by deprivation decile, England, academic year 2015 to 2016



Source: Department for Education, Revised GCSE and equivalent results in England: 2015 to 2016

*district and unitary authority deprivation deciles in England (Index of Multiple Deprivation 2015).

See how your area compares

See inequality data

Remaining in education, employment or training after school is associated with a reduced risk of a range of negative mental and physical health outcomes, as well as better employment prospects[16]. In 2016, 6.0% of 16 to 17 year olds in England were not in education, employment or training, or their activity was not known.

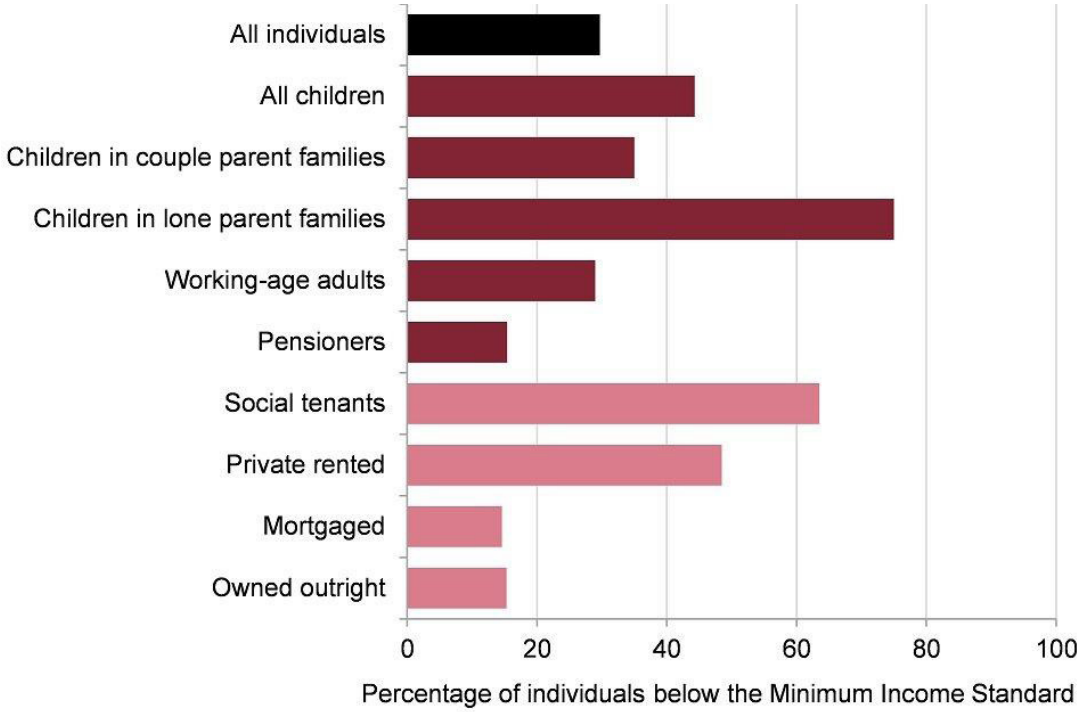
5. Income

Many physical and mental health outcomes improve incrementally as income rises[17]. Income is related to life expectancy, disability free life expectancy[4], self-reported health and a range of biomarkers (objective indicators linked to diseases/conditions)[18]. The relationship operates through a variety of mechanisms. Financial resources determine the extent to which a person can both invest in goods and services which improve health and purchase goods and services which are bad for health. Low incomes can also prevent active participation in social life and day to day activities, affecting feelings of self-worth and status[19].

The Minimum Income Standard (MIS) is defined as not having enough income to afford a 'minimum acceptable standard of living', based on what members of the public think is enough money to live on[20]. The proportion of individuals in the UK not reaching the MIS rose from 25.8% in financial year 2008 to 2009 (when the measure began) to 31.4% in 2013 to 2014, then fell slightly to 29.7% in 2015 to 2016[20].

Figure 6 shows that people in social or private rented accommodation were more likely to be below the MIS in financial year 2015 to 2016 compared with owner occupiers, as were children compared with adults. Children in lone parent households (75.0%) were more at risk of falling below the MIS than those in couple parent families (35.0%).

Figure 6: percentage of individuals below the Minimum Income Standard, by household characteristics, UK, financial year 2015 to 2016



Source: Joseph Rowntree Foundation, Households below a Minimum Income Standard: 2008/09 - 2015/16 [See Methods, data and definitions - Minimum Income Standard]

See the full data source

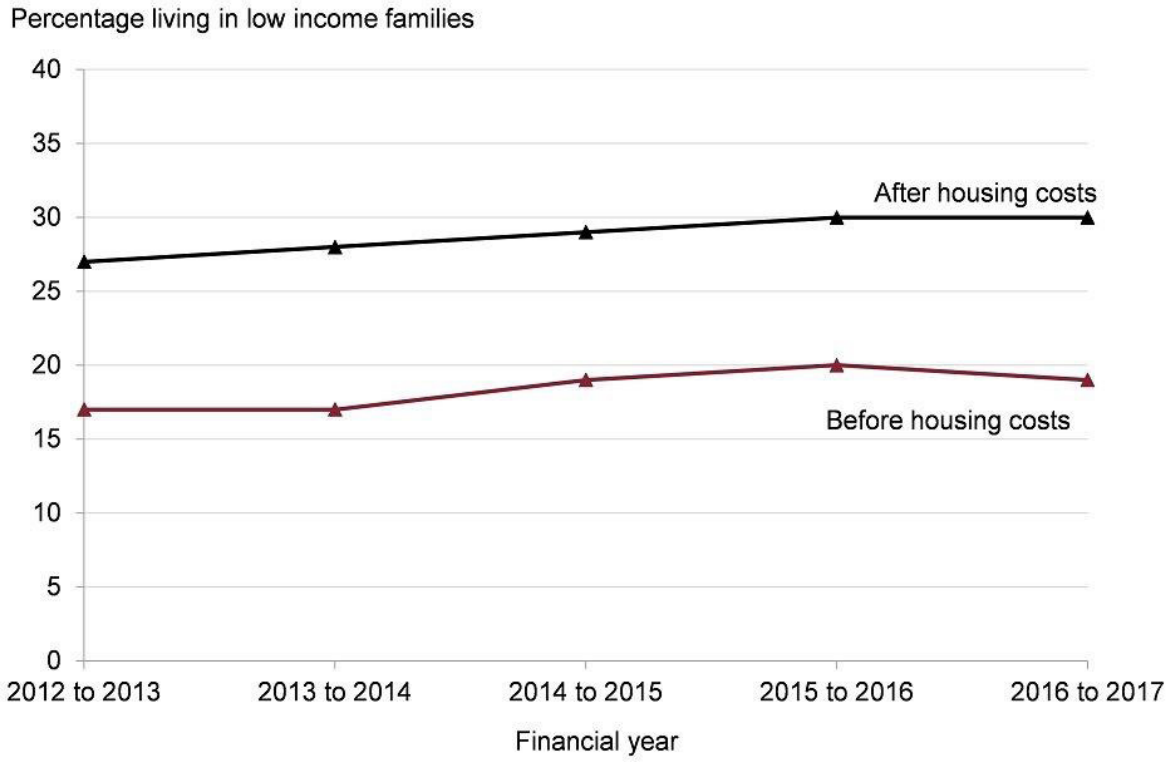
See how your area compares

Child poverty is an important issue for public health, with evidence suggesting it can lead to premature mortality and poor health outcomes in subsequent adulthood[4].

Child poverty measures from the 'households below average income' analysis for the UK[21] show no significant change between the financial years 2015 to 2016 and 2016 to 2017. Unlike the MIS measure presented above which is based on public opinions of standard of living, these child poverty measures are based on people living in households below 60% of median income. Before housing costs, the percentage of children in relative low income households was 19%, while after housing costs the proportion remained steady at 30% in financial year 2016 to 2017 (Figure 7).

These levels were higher than the proportion of pensioners in low income households over the same period (17% before housing costs and 16% after housing costs)[21]. The available data mostly predates the higher levels of inflation seen during 2017 however, so the picture may be changing.

Figure 7: trend in percentage of children aged under 16 years living in relative low-income households, UK, financial year 2012 to 2013 up to 2016 to 2017



Source: Department of Work and Pensions (2018) HBAI: an analysis of the UK income distribution 1994/95 to 2016/17

Notes: relative low income is household income below 60% of contemporary median income.

See the full data set

The proportion of children and working age adults living in workless households has fallen over the past two decades but being in work does not necessarily protect against low income. Analysis by the Institute of Fiscal Studies shows that in financial year 2015 to 2016, 57% of people in poverty (people living in households with incomes below 60% of the median after housing costs) were children or working age adults living in a household where someone was in work, up from 35% in 1994 to 1995[22].

Fuel poverty is the condition of being unable to afford to keep one's home adequately heated for comfort and is associated with a reduced quality of health and excess winter deaths[23]. In England, 11% of all households were fuel poor in 2015. People living in the private rented sector were most vulnerable to fuel poverty, 21.3% of households experienced fuel poverty, compared with 7.4% of owner-occupiers.

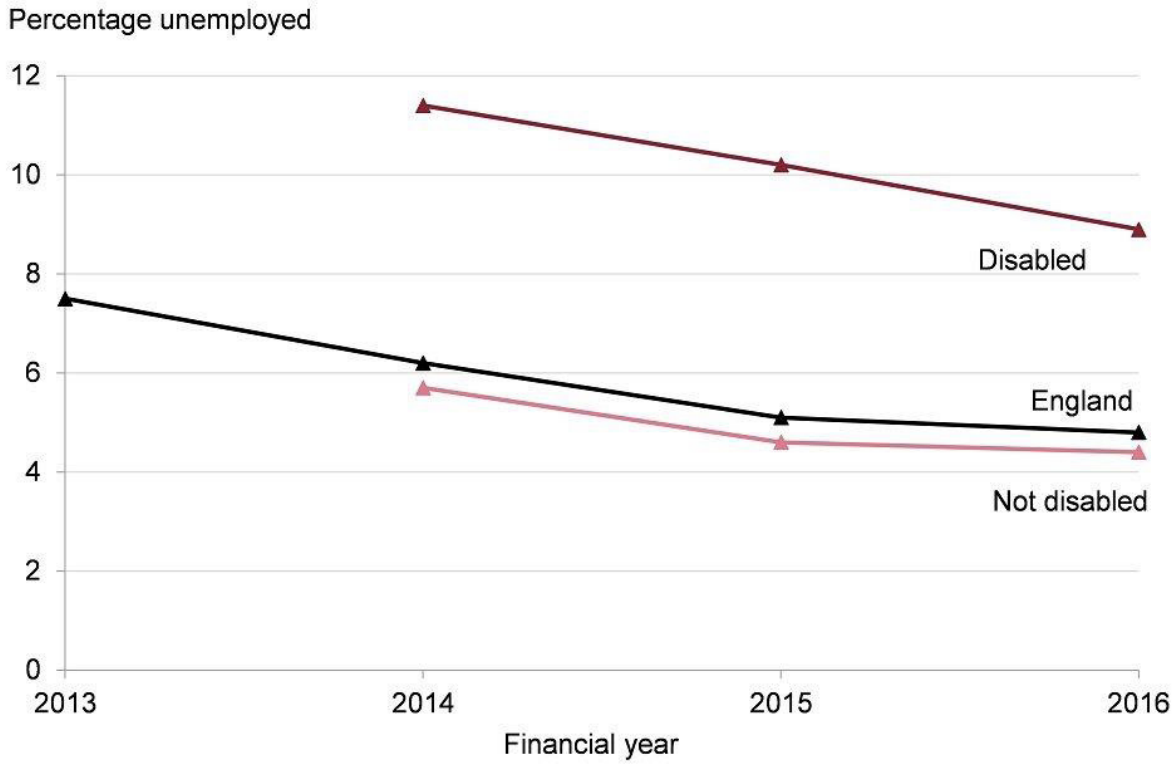
6. Work and the labour market

A strong local economy provides sufficient quantity and quality of employment opportunities for the population. On the whole, work is good for mental and physical health[24]. In addition to the health benefits associated with an adequate wage, work can provide valuable social interactions, a place to develop and practice skills, and a sense of social participation and contribution to society[25].

A person's employment status has both an associative and a causal relationship with a range of health outcomes[26],[27],[28]. While not working will be the right option for some people, staying out of work longer term may contribute to a worsening of health outcomes for others. Unemployment does not just affect working age people. Children growing up in workless households are almost twice as likely not to reach expected attainment at all stages of education compared with children growing up in working families[29].

Unemployment is the status of being available for work and looking for work, but not being in work. Unemployment in England increased substantially from 2008 peaking at over 8.0% during 2011[30], and saw a pronounced fall from 2013, down to 4.8% in 2016. However, in 2016, there was substantial variation among population groups. Unemployment among disabled people (8.9%) was double the proportion among people who were not disabled (4.4%) (Figure 8). Some ethnic minority groups also experienced significantly higher unemployment including the Pakistani or Bangladeshi (11.5%) and Black or Black British (10.3%) groups, compared with the White groups (4.3%)

Figure 8: trend in percentage of the economically active population who are unemployed, by disability status, England, 2013 to 2016



Source: NOMIS, Annual Population Survey/Labour Force Survey.

Note: England value refers to population aged 16+, whereas the disabled/not disabled values refer to population aged 16-64. The 'not disabled' category is calculated by PHE.

See unemployment data for your area

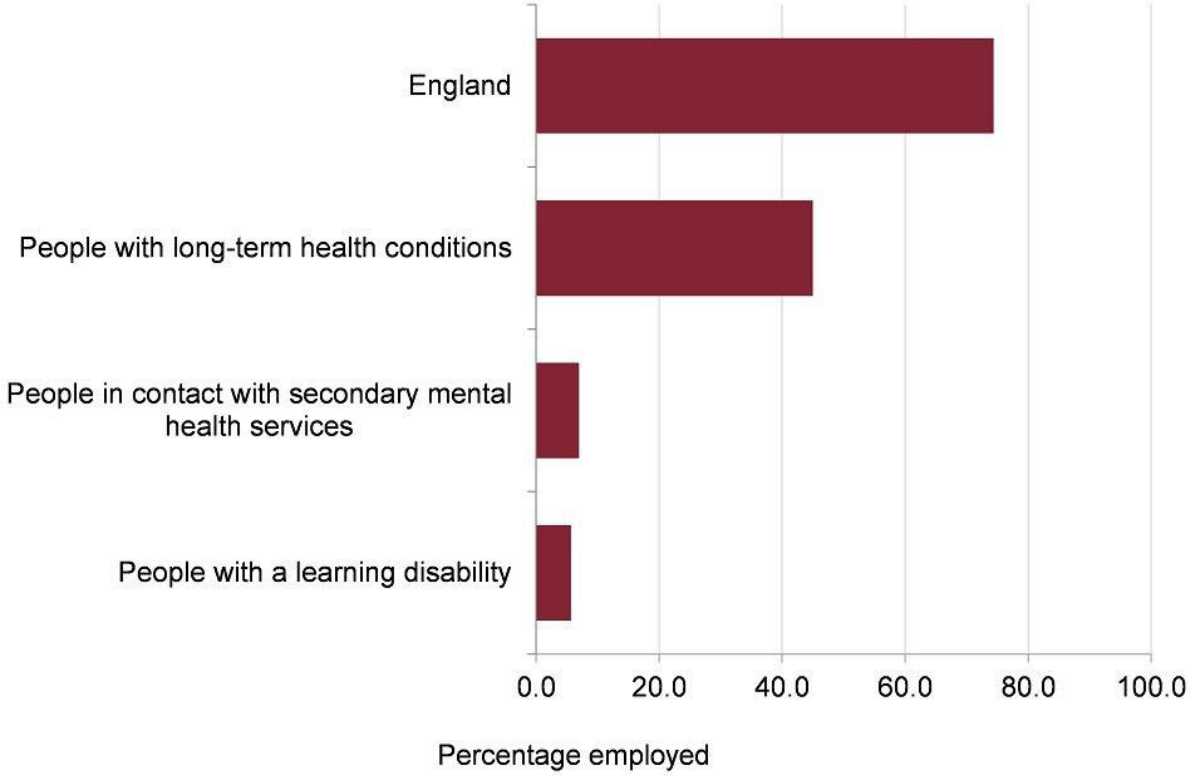
See inequality data

The unemployment rate is strictly defined, requiring people to actively seek and be ready to start work, so it does not count people who are out of work for more complex reasons but would ideally like to work. The employment rate, in contrast, takes a wider look at the status of all people aged 16 to 64 years. Consequently, irrespective of the reason people are not working it gives insight into the proportion of different groups who gain the benefits that employment provides (though not all employed people will have as much work as desired).

Across all people aged 16 to 64 years old in England, the employment rate was 74.4% in financial year 2016 to 2017. This compares to an employment rate of 45.0% for people with long term health conditions, 7.0% for people in contact with secondary mental health services, and 5.7% for people with a learning disability (Figure 9). Employment is not appropriate for all people, but

some of this inequality will compound health issues further by limiting access to the health benefits work can provide.

Figure 9: percentage of the population who are employed, by disability status, England, 2016 to 2017



Source: 1) NOMIS, Annual Population Survey/Labour Force Survey. 2) NHS Digital, Adult Social Care Outcome Framework.

Notes: the values for England and people with long term health conditions are from a different source (source 1) to the values for people with a learning disability and people in contact with secondary mental health conditions (source 2). Reference age groups vary: values from source 1 are for 16 to 64 year olds; the value for people with a learning disability is for 18 to 64 year olds; the value for people in contact with secondary mental health services is 18 to 69 year olds.

See how your area compares:

Employment rate

Gap in employment rate for people with a long term health condition

Gap in employment rate for people in contact with secondary mental health services

Gap in employment rate for people with a learning disability

The availability of jobs in the economy is the most important determinant of employment and unemployment rates. Job density (the number of jobs relative to the number of working age people) has been increasing steadily, rising from 0.80 jobs per person in 2013 to 0.85 in 2016 in England

The quality of work, and consequently the health benefits work provides, varies substantially[31]. One topical issue is the changing nature of employment arrangements. The Office for National Statistics estimates that around 1.8 million contracts did not guarantee a minimum number of hours in November 2017 and that people on these contracts (also called zero-hour contracts) were more likely to want to work more hours compared with other workers[32].

For people in work, healthy workplaces are essential for a healthy workforce. There were nearly 4,000 illnesses caused or made worse by work per 100,000 workers in England in financial year 2016 to 2017. This rate has remained broadly flat in recent years, with around 80% of these illnesses being musculoskeletal disorders, stress, depression or anxiety[33]. These are leading causes of morbidity identified in Chapter 3.

7. Crime

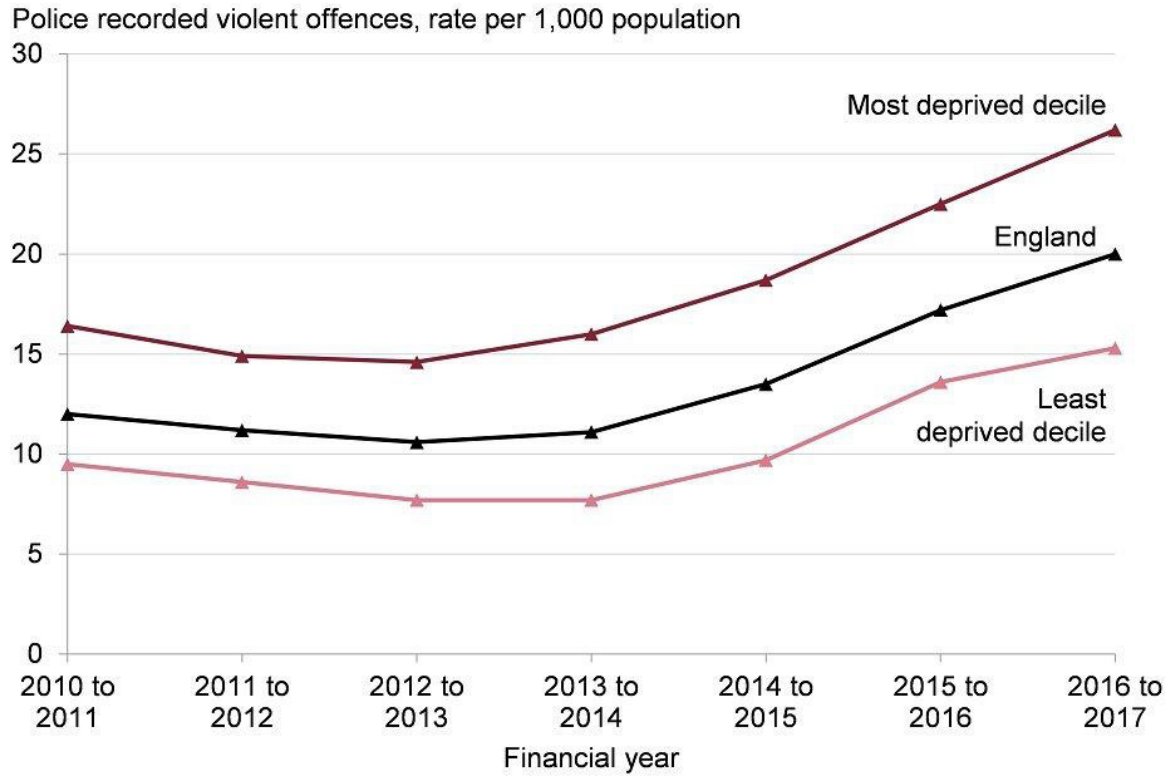
Crime affects physical and mental health in many ways[34]. Violence against people is the most direct link, while the psychological effects of experiencing crime, whether violent or not, can also have far reaching consequences. Through less direct channels, the fear of crime can not only have psychological effects but directly reduce health promoting behaviours such as physical activity and social contact. Furthermore, the economic cost of crime to both individuals and public services may reduce resources available for health improvement. Perpetrators of crime are also more likely to have worse health across a range of conditions than the general population[35].

Both offenders and victims are more likely to live in the most deprived areas. The rate of first time entrants into the criminal justice system in the most deprived upper tier local authorities was 226.3 per 100,000 population in 2017, compared with 132.7 per 100,000 in the least deprived areas. Across England the rate reduced in 2017 to 166.4 per 100,000 population, down from 262.6 per 100,000 in 2014. The rate of first time entrants into the youth justice system follows the same pattern, with inequalities by deprivation level and a reducing trend across England.

Police recorded offences for violence against the person in England have increased from 10.6 per 1,000 in financial year 2012 to 2013, up to 20.0 per

1,000 in 2016 to 2017 (Figure 10). For people living in the most deprived upper tier local authorities the rate was 26.2 per 1,000, compared with 15.3 per 1,000 in the least deprived areas. The gap between the most and least deprived areas has widened as rates increased. A similar pattern is evident for police recorded violent sexual offences, both in the trend for England and for differences between the most and least deprived areas, though at the much lower rate of 1.9 per 1,000 in England in 2016 to 2017.

Figure 10: trend in police recorded violence against the person offences, rate per 1,000 population, England and selected deprivation deciles*, financial year 2010 to 2011 up to 2016 to 2017



Source: Figures calculated by PHE using crime data supplied by the Home Office and population data supplied by Office for National Statistics (ONS).

*County and unitary authority deprivation deciles in England (Index of Multiple Deprivation 2015).

Note: improved recording and/or increased reporting may be responsible for some change in reported crimes.

See how your area compares See inequality data

8. Social capital

Community life, social connections and having a voice in local decisions are all factors that have a vital contribution to make to health and wellbeing. These community level determinants build control and resilience and can help buffer against disease and influence health related behaviour[36].

The Community Life Survey revealed that 39% of the population in England formally or informally volunteered at least once a month in survey year 2016 to 2017[37]. Furthermore, the survey found that only 27% of people felt they could influence decisions that affect their local area, and 51% of people would like to be more involved in decisions made by their local council.

Most people in England (62% in survey year 2016 to 2017) felt strongly that they belonged to their immediate neighbourhood[37]. Those with a lower sense of belonging to their neighbourhood or who have little trust in others in their local area reported feeling lonely more often[38]. In England, around 1 in 5 adults in 2016 to 2017 reported feeling lonely all or some of the time[37]. Loneliness was reported more frequently by women than men, and by young adults (16 to 24 years) compared with those in older age groups. In addition, the most recent Adult Psychiatric Morbidity Survey 2014 found that most mental health problems were more common in people living alone[39].

9. Further information

PHE's Wider Determinants of Health Profiles present further information.

PHE has a statutory duty to have due regard to reducing health inequalities within England: Health and Social Care Act 2012 and, like other public sector organisations, to promote equality: Equality Act 2010.

PHE's Health Equity Board has selected 18 indicators to help monitor how these duties are met, and this forms the PHE Health Equity Dashboard. The indicators are drawn from the Public Health Outcomes Framework and indicators on the social determinants of health are included.

10. References

1. The King's Fund (2016) Time to Think Differently. Broader determinants of health: future trends. Accessed 1 August 2016. ↩
2. Dennis R (2004) Social Determinants of Health: Canadian Perspectives. Toronto: Canadian Scholar's Press Inc. ↩

3. Bell R (2017) Psychosocial pathways and health outcomes: Informing action on health inequalities. Public Health England.

4. Marmot MG, Allen J, Goldblatt P and others. (2010) Fair society, healthy lives: Strategic review of health inequalities in England post-2010. Accessed 27 April 2018.

5. Dahlgren G and Whitehead M (1993) Tackling inequalities in health: what can we learn from what has been tried? Working paper prepared for the King's Fund International Seminar on Tackling Inequalities in Health, September 1993, Ditchley Park, Oxfordshire. London, King's Fund. In Dahlgren, G. and Whitehead, M. (2007). Editors. European Strategies for Tackling Social Inequities in Health: Levelling Up Part 2. Copenhagen: WHO Regional Office for Europe; pp. 20 to 32.

6. COMEAP (2010) The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom. Accessed 27 April 2018.

7. Air Quality Expert Group (2012) Fine Particulate Matter (PM2.5) in the United Kingdom. Accessed 27 April 2018.

8. DEFRA (2006) Air quality and social deprivation in the UK: an environmental inequalities analysis. Final report to Department of Environment, Food and Rural Affairs.

9. Whitelaw S and others. (2008) Physical activity and mental health: The role of physical activity in promoting mental wellbeing and preventing mental health problems: an evidence briefing. NHS Scotland: Edinburgh.

10. Forest Research (2010) Benefits of green infrastructure: Health and well-being. Forest Research, Farnham.

11. Ministry of Housing, Communities and Local Government (2018) English Housing Survey Headline Report, 2016 to 2017 Accessed 27 April 2018.

12. Local Government Association (2017) The impact of homelessness on health. A guide for local authorities Accessed 27 April 2018.

13. Fitzpatrick S et al. (2018) The homelessness monitor: England 2018.

14. Cutler DM and Lleras-Muney A (2006) Education and health: evaluating theories and evidence. National Bureau of Economic Research: Cambridge, MA. Working paper 12352.

15. Department for Education (2017) Statutory framework for the early years' foundation stage. Setting the standards for learning, development and care for children from birth to five Accessed 14 June 2017.

16. Allen M (2014) Reducing the number of young people not in employment, education or training (NEET). Public Health England and the Institute of Health Equity.

17. Joseph Rowntree Foundation (2014) How Does Money Influence Health?. Accessed 14 June 2017.

18. Davillas A and others. (2017) The income-health gradient: Evidence from self-reported health and biomarkers using longitudinal data on income (No. 2017-03). ISER Working Paper Series.

19. Anand S, Peter F and Sen A (2004) Public health, ethics, and equity. Oxford University Press on Demand.

20. Padley M et al. (2017) Households below a Minimum Income Standard: 2008/09 to 2015/16. Joseph Rowntree Foundation. Accessed 27 April 2018.

21. Department of Work and Pensions (2018) HBAI: an analysis of the UK income distribution 1994/95 to 2016/17 Accessed 27 April 2018.

22. Joyce R (2018) Poverty and low pay in the UK: the state of play and the challenges ahead. Institute of Fiscal Studies. Accessed 27 April 2018.

23. Hills J (2012) Getting the measure of fuel poverty. Final report of the fuel poverty review: CASE Report 72. Department of Energy and Climate Change. Accessed 14 June 2017.

24. Waddell G and Burton K (2006) Is work good for your health and well-being? An independent review. Accessed 27 April 2018.

25. Sen A (1997). Inequality, unemployment and contemporary Europe. International Labour Review, 136(2), 155 to 171.

26. Warr P (1987) Work, unemployment, and mental health. New York: Oxford University Press.

27. Brown J and others. (2012) Employment Status and Health: Understanding the Health of the Economically Inactive Population in Scotland. BMC Public Health, 12(327).

28. Steele F and others. (2013) Adjusting for selection bias in longitudinal analyses using simultaneous equations modelling: the relationship between employment transitions and mental health. Epidemiology, 24(5), 703 to 711.

29. Department for Work and Pensions (2017) Improving Lives, Helping Workless Families Accessed 14 June 2017.

30. Office for National Statistics (2018) Unemployment rate (aged 16 and over, seasonally adjusted) Accessed 27 April 2018.

31. Benach J and others. (2014) Precarious Employment: Understanding an Emerging Social Determinant of Health. Annual Review of Public Health. 35, 229 to 253.

32. Office for National Statistics (2018) Contracts that do not guarantee a minimum number of hours: April 2018 Accessed 27 April 2018.

33. Health and Safety Executive (2018) LFS - Labour Force Survey - Self-reported work-related ill health and workplace injuries: Index of LFS tables Accessed 27 April 2018.

34. Lorenc T and otehrs. (2014) Crime, fear of crime and mental health: Synthesis of theory and systematic reviews of interventions and qualitative evidence. Public Health Research, 2(2).

35. Public Health England (2017) Health and Justice Annual Review 2016/17 Accessed 19 June 2018.

36. UCL Institute of Health Equity (2013) Review of social determinants and the health divide in the WHO European Region: executive summary. Copenhagen: World Health Organization Europe.

37. Department for Digital, Culture, Media & Sport (2016) Community Life Survey 2016-2017 Accessed 12 June 2018.

38. Office for National Statistics (2018) Loneliness – What characteristics and circumstances are associated with feeling lonely? Accessed 19 June 2018.

39. McManus S, Bebbington P, Jenkins R, Brugha T. (eds.) (2016) Mental health and wellbeing in England: Adult Psychiatric Morbidity Survey 2014. Leeds: NHS DigitalAccessed 19 June 2018.

Chapter 7: current and emerging health protection issues

Published 11 September 2018

1. Main messages

Health protection is a relatively recent description of a set of functions to protect individuals and populations through an integrated approach to infectious diseases, radiation, and chemical and environmental hazards.

Air pollution contributes to an estimated 28,000 to 36,000 deaths in the UK every year. There are opportunities to reduce air pollution and address climate change together, as the causes are similar, with ‘co-benefits’ for both reducing non-communicable diseases and improving wellbeing.

Antimicrobial resistance (AMR) describes the change of an organism which makes a previously effective treatment ineffective. One of the main influences on AMR is the use of antibiotics. Between 2012 and 2016, overall antibiotic prescribing reduced by 5% in England.

There is wide variation across England in new diagnosis of sexually transmitted infections. In 2017 there were higher rates in more deprived areas, and for some infections, among young heterosexuals, people in the Black ethnic group and men who have sex with men (MSM). Although the incidence of most infections has been falling in recent years, syphilis diagnoses have risen 148% between 2008 and 2017, including a 20% rise between 2016 and 2017.

Hepatitis C is a bloodborne virus that often has few symptoms. As a consequence, many individuals with chronic infection remain undiagnosed and fail to access treatment. However, between financial years 2015 to 2016 and 2016 to 2017, the number of people accessing treatment increased from 6,066 to 9,440, representing a 56% increase, and there was fall in deaths from

complications of the infection. In line with internationally agreed targets, the UK aims to eliminate hepatitis C as a public health problem by 2030.

The number of new cases of tuberculosis (TB) in England has fallen since 2011. The incidence remains higher in the non-UK born population than the UK born population. Between 2010 and 2015, 18.2% of all cases among people born in the UK had a social risk factor (drug misuse, alcohol misuse, homelessness or imprisonment). Addressing social risk factors is therefore important in reducing the number of new cases of TB.

There have been major improvements in morbidity and mortality from vaccine-preventable diseases over recent decades. Recent outbreaks of measles in England, an infectious disease that can lead to serious complications and even death, highlight the importance of maintaining high vaccination coverage.

2. Introduction

Infectious diseases and environmental threats are once again at the forefront of public health, after decades of decline. This year marks the centenary of the 1918 H1N1 (‘Spanish flu’) pandemic which killed between 20 to 40 million people, and pandemic influenza remains the most significant civil risk facing the UK (discussed in the Health Profile for England 2017).

The black smog which once shrouded British cities has now cleared but it is estimated that invisible air pollution still produces an effect equivalent to 28,000 to 38,000 deaths in the UK annually[1]. Ninety years on from Alexander Fleming’s first discovery of penicillin in 1928, we have a growing problem of antimicrobial resistance in the UK and across the globe.

Health protection as discussed here is a relatively new description of a set of functions to protect individuals and populations through an integrated approach to infectious diseases, radiation, chemical and environmental hazards. This system emerged in the UK from a series of system failures, including the Stafford Hospital Legionnaires’ disease outbreak in the 1980s, and the foot and mouth disease outbreak in 2001. Health protection in England was formalised in 2003 through the amalgamation of radiation, microbiology and chemical functions.

Over the intervening years, the health protection challenges which have emerged are increasingly global, interdisciplinary and challenging. Public

Health England has health protection teams operating across 9 centres in England which respond to around 11,500 disease outbreaks and incidents every year. Whilst routine work primarily relates to infectious diseases, high profile incidents over the last year such as the Grenfell Tower fire and the chemical poisoning in Salisbury highlight the value of a flexible and responsive health protection system.

Threats to health are not equally shared; the impoverished, incarcerated, institutionalised and homeless are often at far higher risk of illness and premature mortality than the general population [2]. Marginalised populations experience extremes of poor health due to a combination of poverty, social exclusion and increased burden of risk factors [3].

Documenting the extent of health inequalities of populations without a fixed address is challenging as they can often be missed from routine datasets [2]. Inequalities in health and the wider determinants of health are discussed in further detail in Chapter 5 and Chapter 6.

This chapter will build upon the Health Profile for England 2017 drawing attention to emerging issues in health protection and cross-linkages with other important public health challenges we face.

3. Climate change and air pollution

The causes of air pollution and climate change are closely related and efforts to address these challenges often overlap. Both arise mainly from burning fossil fuel and transport emissions. Shifting from motorised to active forms of transport, such as walking and cycling, can reduce the levels of particulate matter (PM) and nitrogen dioxide (NO2) while also contributing to reducing the burden of obesity and non-communicable diseases – known as ‘co-benefits’. This approach can also reduce healthcare costs with substantial benefits for public health [4].

The UK is a signatory to a series of United Nations landmark agreements, including the Sendai Framework on Disaster Risk Reduction, Paris Climate Change Agreement and the Sustainable Development Goals. There are opportunities to reduce air pollution and address climate change in ways which fulfil international agreements and create sustained benefits for health [5].

3.1 Climate change

In 2008 the Climate Change Act came into force in the UK. It was the world’s first long-term, legally binding framework, to deal with the dangers of climate change and committed the UK to reduce carbon dioxide (CO2) emissions

by at least 80% by 2050. The Climate Change Act also requires the UK government, and devolved administrations, to produce a National Adaptation Programme (NAP) to help the country respond to the risks of climate change, including specific objectives for the health and social care sector.

In 2015 the UK signed the Paris Climate Change Agreement, an internationally agreed framework to limit global temperature rise to well below 2°C on pre-industrial levels, in recognition of the grave threat which climate change poses to humanity.

Extreme weather events and disasters are increasing in the UK and across the world [6]. In the UK, 5 million properties are at risk of flooding from rivers or the sea, with substantial implications for mental health [7] (discussed in the Health Profile for England 2017) and public finances - the 2015 to 2016 floods cost £1.6 billion alone [8].

Increased frequency and intensity of hot weather is one of the most likely effects of climate change. The 2017 UK Climate Change Risk Assessment identified this as a priority area in recognition of the risk this poses to health, wellbeing and productivity. Already around 20% of homes and 90% of hospital wards are thought to be at risk of overheating in the current climate. Without further adaptation, heat related deaths are expected to increase from 2,000 to 7,000 per year by 2050 [9].

3.2 Air pollution

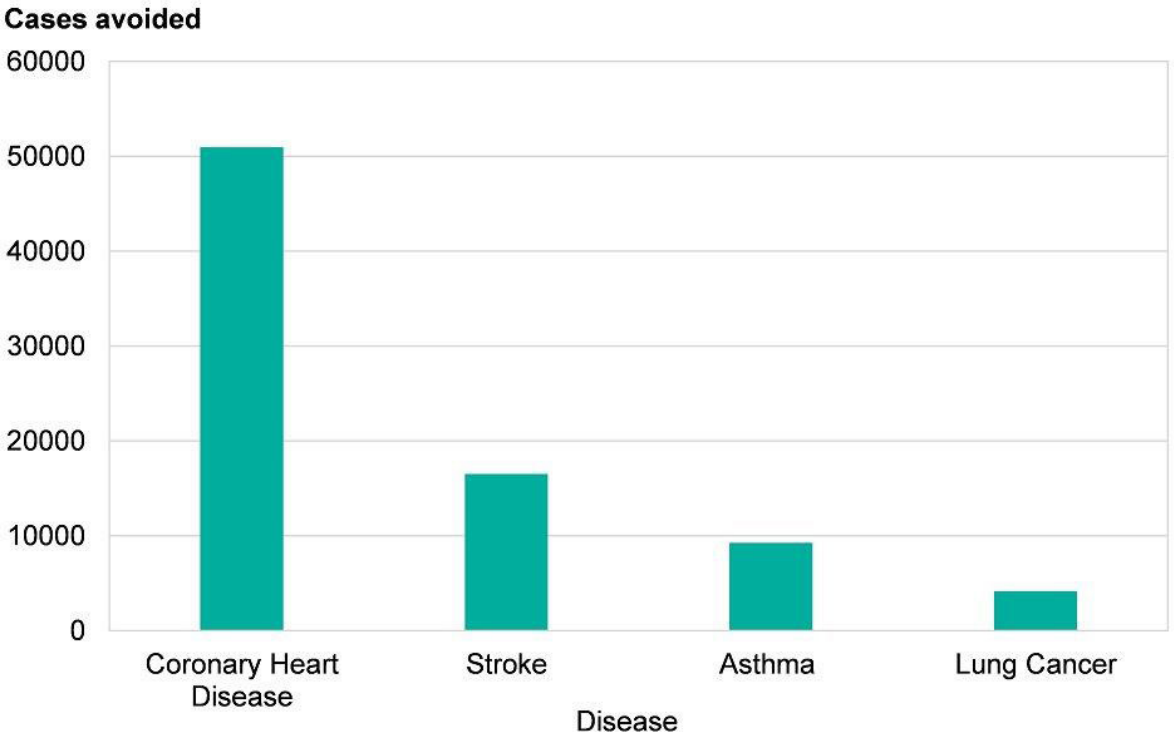
During the 1950s, smog (a toxic combination of soot and sulphur dioxide) was commonplace in UK cities and a major source of ill health. Since the Clean Air Act of 1956, the character of air pollution in the UK has changed and much of it is invisible to the naked eye. The major pollutants in urban environments, particulate matter (PM 2.5 and PM 10, which are particles with diameters smaller than 2.5μm and 10μm respectively) and nitrogen dioxide (NO_2), derive predominantly from transport.

Assessing the health burden of air pollution is challenging as the impact is related to the concentration of a pollutant and the exposure of an individual. Both short term and long term exposure can adversely affect health.

It is estimated that long-term exposure to the air pollution mixture in the UK has an annual effect equivalent to 28,000 to 36,000 deaths [1]. Recent modelled data shows that reducing the concentration of PM 2.5 by 1μg/m3 in a single year can reduce the burden of a range of conditions, including coronary heart disease, stroke, asthma, and lung cancer (Figure 1). A 1 μg/m3 reduction in PM 2.5 in England in a single year can prevent around 50,000 cases of

coronary heart disease, 16,500 strokes, 9,000 cases of asthma and 4,000 lung cancers over the following 18 years [10].

Figure 1: cumulative new cases of disease avoided by 2035 for 1 µg/m3 reduction in PM 2.5, England



Source: Estimation of costs to the NHS and social care due to the health impacts of air pollution, Pg. 32-32. Produced by Public Health England, 2018

See the full data source

There are inequalities in the health impacts of air pollution. Highest exposures are in busy, urban environments, often with high levels of deprivation. For further detail on the geographical variation of air pollution refer to Chapter 6.

4. Antimicrobial resistance

When Alexander Fleming was awarded the Nobel Prize for the discovery of penicillin in 1945 he described the threat of resistance. Antimicrobials are vital to almost all aspects of modern medicine, including surgery and cancer treatment. Despite warnings, the global community has only recently awoken to the implications of this threat. Antimicrobial resistance (AMR) describes the change of an organism which makes a previously effective treatment ineffective.

One of the main drivers of AMR is the use of antibiotics. On a global level, it is estimated that antimicrobial resistance is responsible for 700,000 deaths each year which could increase to 10 million deaths per year by 2050 without coordinated action. This includes better sanitation, improved public awareness and a rapidly developed new drug pipeline [11].

4.1 Gram negative bloodstream infections

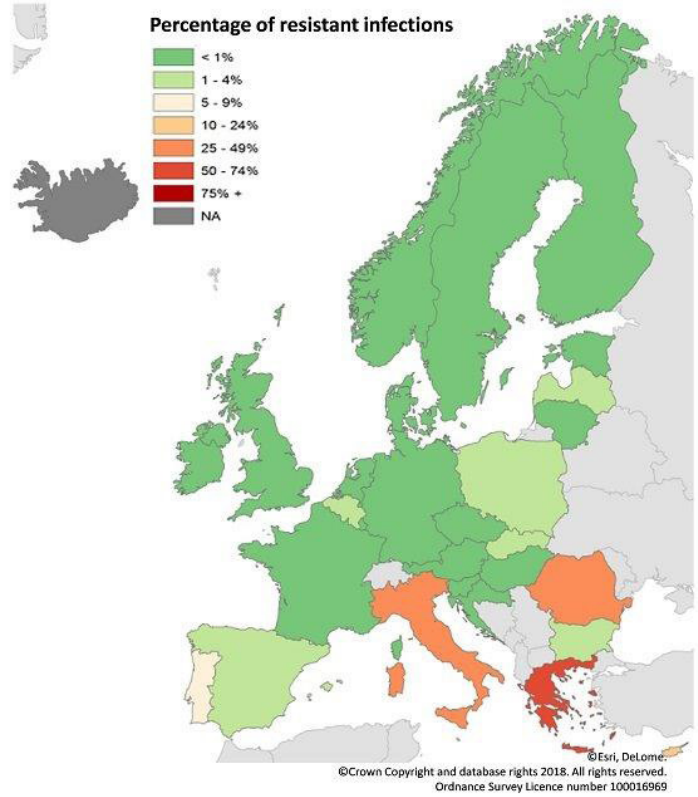
Gram negative bloodstream infections are caused by a class of bacteria which rapidly develop resistance to existing treatments (the main organisms in this group are E.Coli, Klebsiella and Pseudomonas). These are the leading causes of healthcare associated bloodstream infections. The government has set a target of halving healthcare associated gram-negative bloodstream infections by 2021 and has set an ambition of reducing inappropriate antimicrobial prescribing by 50%, over the same time frame, in order to achieve this [12].

Between 2012 and 2016, overall antibiotic prescribing in England reduced by 5% in humans, with declines across all drug classes [12]. Cases of E. coli, the most common gram negative bloodstream infection, have continued to rise in line trends described in the Health Profile for England 2017.

A particular concern globally is the spread of carbapenemase-producing gram-negative infections (CPE) which are resistant to carbapenem antibiotics – often the last line treatment in severe bacterial infections. Antimicrobial resistance to carbapenems is currently at low levels in England; however, there is considerable variation across Europe (Figure 2). In 2016 there was less than 1% resistance in most of northern Europe, including the UK, in contrast to 5.2% in Portugal, 31.4% in Romania, 33.9% in Italy and 66.9% in Greece [13].

Of concern is the potential for levels to rise quickly. For example, Italy had 1% to 2% resistance from 2006 to 2009 but by 2014 this had increased to 33% at which point control efforts became expensive and challenging [14]. This reinforces the need for proactive control measures which are vital to prevent the rapid development of resistance.

Figure 2: percentage of Klebsiella pneumoniae infections resistant to carbapenem antibiotics, Europe, 2016



Source: Surveillance atlas of infectious disease. Produced by European Centres for Disease Control, 2016

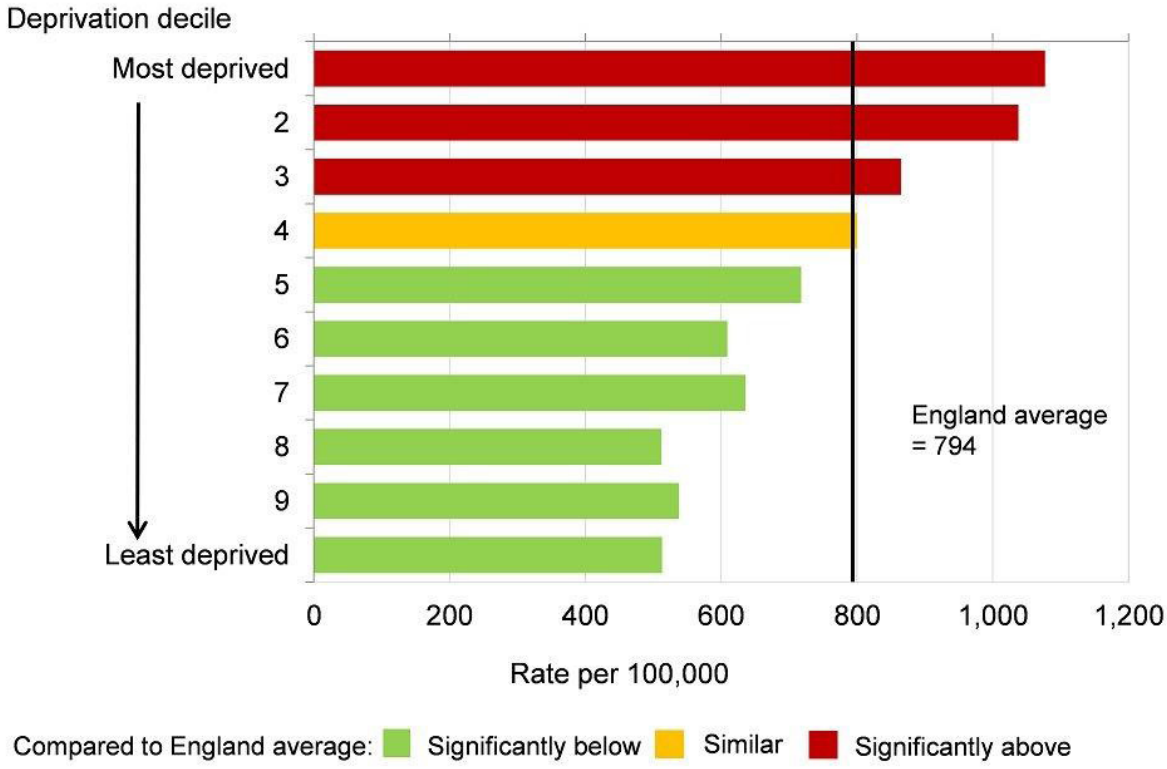
See the full data source

5. Sexually transmitted infections

The epidemiology of sexually transmitted infections (STIs) has changed markedly over the last two decades, reflecting changes in demographics, individual behaviours, surveillance techniques, diagnostics and treatments. There is wide variation across the country in new diagnosis of STIs.

In 2017 there were higher rates in more deprived areas (Figure 3), and for some infections, among young heterosexuals (15 to 24 years), people from the Black ethnic minority group and men who have sex with men (MSM) [15]. Antimicrobial resistance is a growing challenge in reducing STIs. England average = 794

Figure 3: new sexually transmitted infections diagnoses



Source: Sexual and Reproductive Health Profiles

*excluding Chlamydia in people aged under 25 years.

**deprivation deciles based on groups of district and unitary authorities in England (Index of Multiple Deprivation 2015).

See how your area compares

See the inequalities data

5.1 Gonorrhoea, chlamydia and syphilis

Following a rapid increase over the period 2008 to 2015, diagnoses of gonorrhoea among MSM have fallen. In early 2018 a multidrug resistant strain of Neisseria gonorrhoea was isolated in a patient in the UK – a first of its kind globally. Two further cases were reported soon after in Australia, highlighting growing concern of multidrug resistant gonorrhoea in a globalised world [16].

Over this period chlamydia diagnoses have been stable. However, syphilis diagnoses increased by 148% between 2008 and 2017, including a 20% rise from 2016 to 2017 - there were 7,137 new diagnoses in 2017, which was the highest level since 1949 [15]. This highlights the need for a comprehensive sexual health approach which promotes collaboration with partners across the health and care system.

The PHE health promotion strategy for sexual and reproductive health focuses

on reducing STIs, unwanted pregnancies and teenage pregnancies, and HIV transmission through an integrated approach. Improving the sexual health of young people continues to focus on increasing condom use and positive relationship building through promoting high quality sex education delivered in schools [15].

5.2 Human papilloma virus

Human papillomavirus (HPV) is a group of infections primarily transmitted through sexual contact which are associated with genital warts and anogenital cancers, predominantly in women. HPV is associated with almost all cervical cancers. The vaccine is around 99% effective against the 2 types (HPV 16 and 18) which cause over 70% of cases.

In 2008 the national HPV vaccination programme was introduced for girls aged 12 to 18. This has had uptake of around 85%, with lower uptake among minority ethnic groups. Cases of first episode genital warts among females 15 to 17 were 90% lower in 2017 compared to 2009 reflecting the effectiveness of the HPV vaccination programme [15]. The vaccination has a crucial role, together with the cervical screening programme, in reducing the burden of cervical cancer and improving sexual and reproductive health, while providing herd protection for heterosexual men.

HPV infections are associated with approximately 80% to 85% of anal cancers, 35% of oropharyngeal cancers and 50% of penile cancers in men, as well as genital warts. MSM bear an increased burden of HPV associated disease and are far less likely to benefit from this HPV vaccination programme than heterosexual men. Following a successful PHE led pilot in 2016 to 2018, the HPV vaccine has been offered to MSM under 45 years attending genito-urinary medicine (GUM) and HIV clinics since April 2018 [17].

6. Blood borne viruses

6.1 Hepatitis C

Hepatitis C is a bloodborne virus that is often asymptomatic, and symptoms may not appear until the liver is severely damaged. Consequently, many individuals with chronic infection remain undiagnosed and fail to access treatment [18].

Across the world 71 million people have chronic hepatitis C infection, resulting in 400,000 deaths annually. It is estimated 160,000 people in England have chronic hepatitis C infection, of which half are undiagnosed [18]. Over 90% of

these infections are associated with injecting drug use and approximately half of people who inject drugs (PWID) are infected with hepatitis C. Hepatitis C prevention, through increasing access to clean needles in community drug services, is therefore vital for disease control. In England, Wales and Northern Ireland, in 2016, 17% of PWID reported sharing needles over the last 4 weeks, which has decreased from 23% in 2006 [19].

Direct-acting antiviral (DAA) medications, a new class of drugs for the treatment of hepatitis C, came to market in 2014. The combination of over 90% cure rates, shorter course duration and fewer side effects have transformed prospects for disease control. The UK has signed up to the World Health Organization (WHO) strategy on viral hepatitis which commits to eliminating hepatitis C as a major public health threat by 2030 [18].

Whilst high costs initially impeded the scale and pace of treatment with DAAs [20], the numbers of people accessing treatment rose from 6,066 in financial year 2015 to 2016 to 9,440 in 2016 to 2017 (a 55.6% increase), with a corresponding decrease in deaths from complications of the infection [18].

Regular, confidential hepatitis C testing of people who inject drugs, with linkage to treatment and care services, is a major component to hepatitis C control. The numbers of people who have ever been tested have been increasing, however, the proportion of those tested regularly has remained largely static over the last decade [18].

6.2 HIV

New HIV diagnoses in England fell in 2016. This was most notable among gay and bisexual men living in London (Figure 4), in which new diagnoses reduced 29% from 1,554 in 2015 to 1,096 in 2016. Addressing HIV in this group is challenging and internationally the UK has been a leader in this area. The decline is in part due to a significant increase in HIV testing at sexual health clinics over the last decade (37,224 in 2007 to 143,560 in 2016), which includes the targeting of high risk individuals. It is likely that pre-exposure prophylaxis (PrEP), condom use and improvements in anti-retroviral therapies have also contributed to the decline in cases [21].

The PrEP Impact Trial which is currently underway is assessing the efficacy of PrEP in reducing the risk of developing HIV. This is one of 12 projects PHE are funding through the HIV Prevention Innovation Fund.

Figure 4: number of new HIV diagnoses in gay and bisexual men by region, England, 2007 to 2016

Source: HIV in the United Kingdom: decline in new HIV diagnoses in gay and bisexual men in England. Produced by Public Health England, 2017

See the full data source

See data on HIV diagnoses for your area

Late diagnosis, measured as CD4 <350 cells/mm3 (a measure of immune response), is lower among gay and bisexual men (32%) as compared to heterosexual women (47%) and heterosexual men (60%) reflecting ongoing areas for improvement in all groups [21]. Early diagnosis improves outcomes for the individual affected and reduces the likelihood of onwards transmission.

Currently, around one in 100 people who inject drugs have HIV, a figure which has been stable. Emerging practices such as ‘slamming’ – the injection of drugs before or during sexual activity – are increasingly frequent among MSM attending drug services and could increase HIV and hepatitis C prevalence in this group. Understanding the social and behavioural factors which influence the spread of disease is important for effective monitoring and disease control [19].

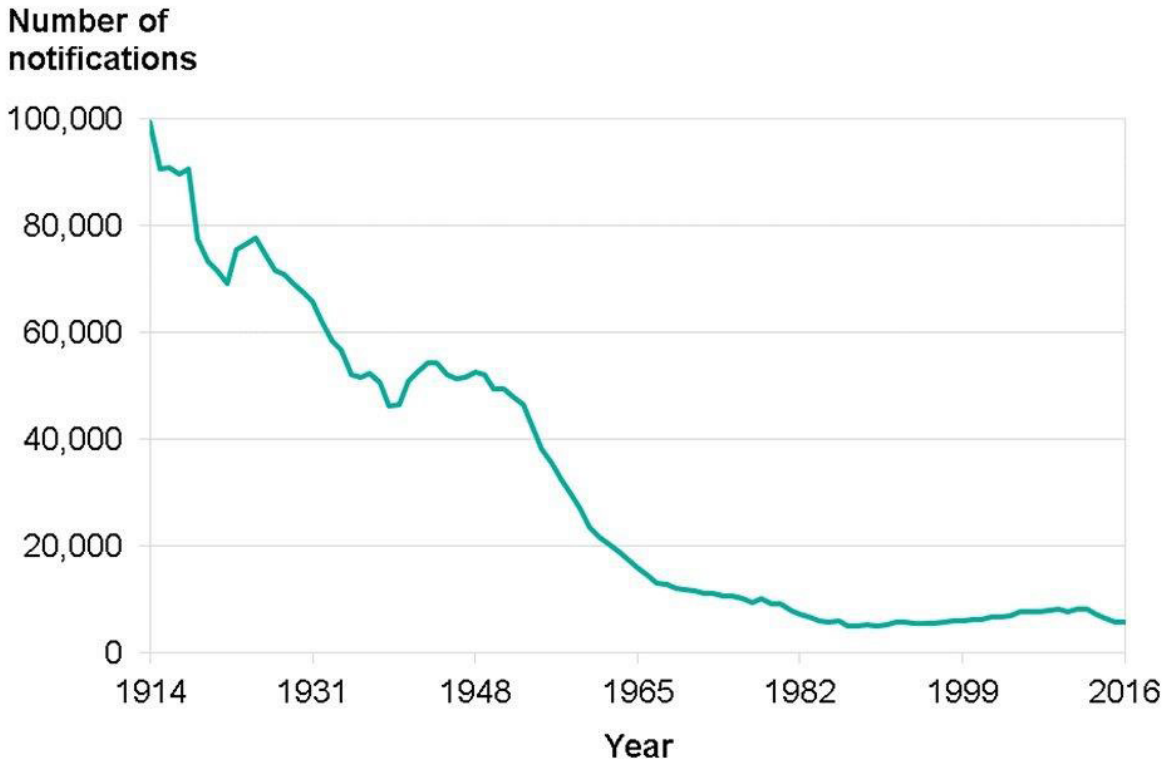
7. Respiratory infections

7.1 Tuberculosis (TB)

TB (tuberculosis) is an infectious disease that usually affects the lungs, although it can affect almost any part of the body. TB rates in England have decreased dramatically over the last century (Figure 5).

Between 1914 and 1987 notifications for TB fell from 99,497 to 5,086, reflecting improved social conditions and subsequent emerging diagnostics and treatments, before climbing to 8,371 in 2011. There have been sustained decreases in tuberculosis cases since 2011, as outlined in the Health Profile for England 2017; however, England continues to have one of the highest TB rates in Western Europe [22].

Figure 5: trend in the number of TB notifications, England and Wales, 1914 to 2016



Source: TB case notifications by site of disease, England and Wales, 1914-2016. Produced by Public Health England, 2017

See the full data source

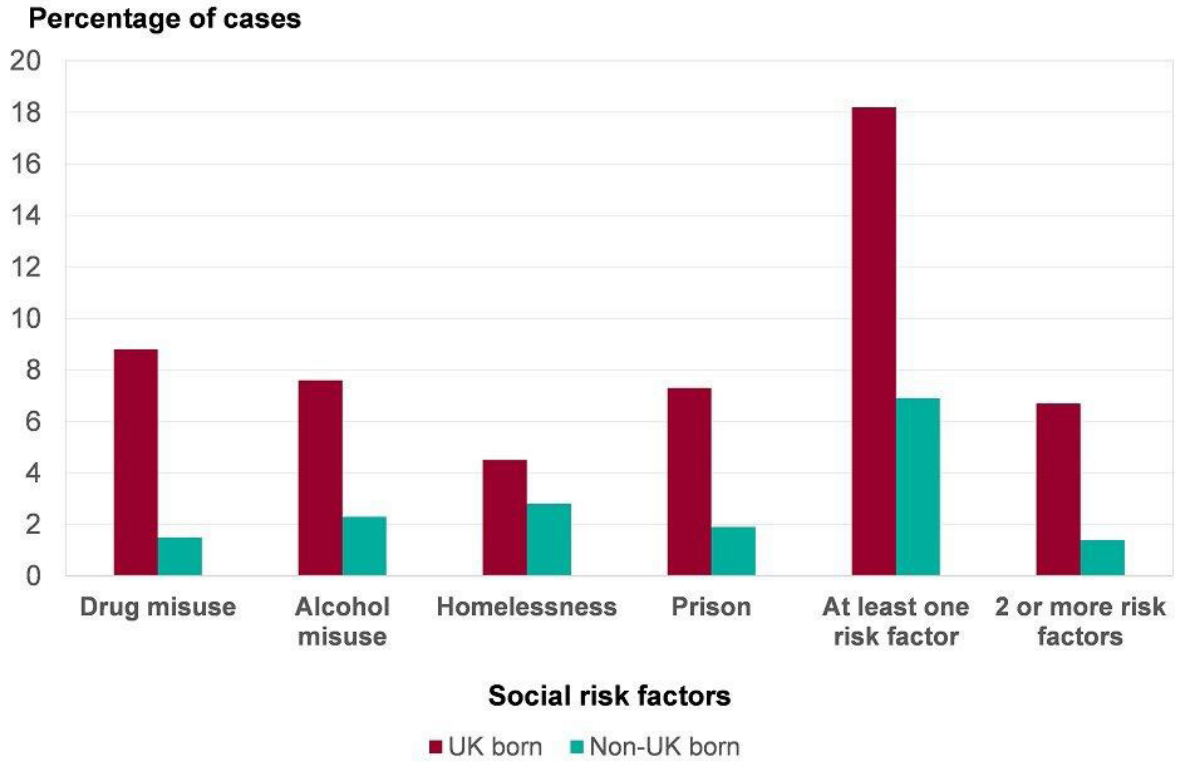
See how your area compares

Robert Koch, who isolated the tuberculosis bacilli, described the condition as a social disease, requiring an understanding of the social and economic factors which put individuals at risk [23]. In England in 2016, the incidence rate of TB in

the non-UK born population was 15 times higher than the rate in the UK born population [24].

Of the total number of tuberculosis cases among people born in the UK in 2010 to 2015, 18.2% had a social risk factor (history of drug misuse, alcohol misuse, homelessness or imprisonment) which is 2.6 times higher than the percentage among non-UK born people. The absolute number and proportion of cases with a social risk factor was increasing up to 2015 [25]. This underlines the affinity of tuberculosis with poverty, as well as geography.

Figure 6: percentage of TB cases by social risk factors, England, 2010 to 2015



Source: Tackling TB in Under-Served Populations: A Resource for TB Control Boards and their partners. Produced by Public Health England, 2017

See the full data source

The England TB strategy aims to reduce incidence by 50% by 2025 and ultimately eliminate TB as a public health problem (defined as <1 case per million population), through different methods, including: latent TB screening, improving early diagnosis, targeted BCG vaccination and reducing drug resistance [26].

7.2 Influenza

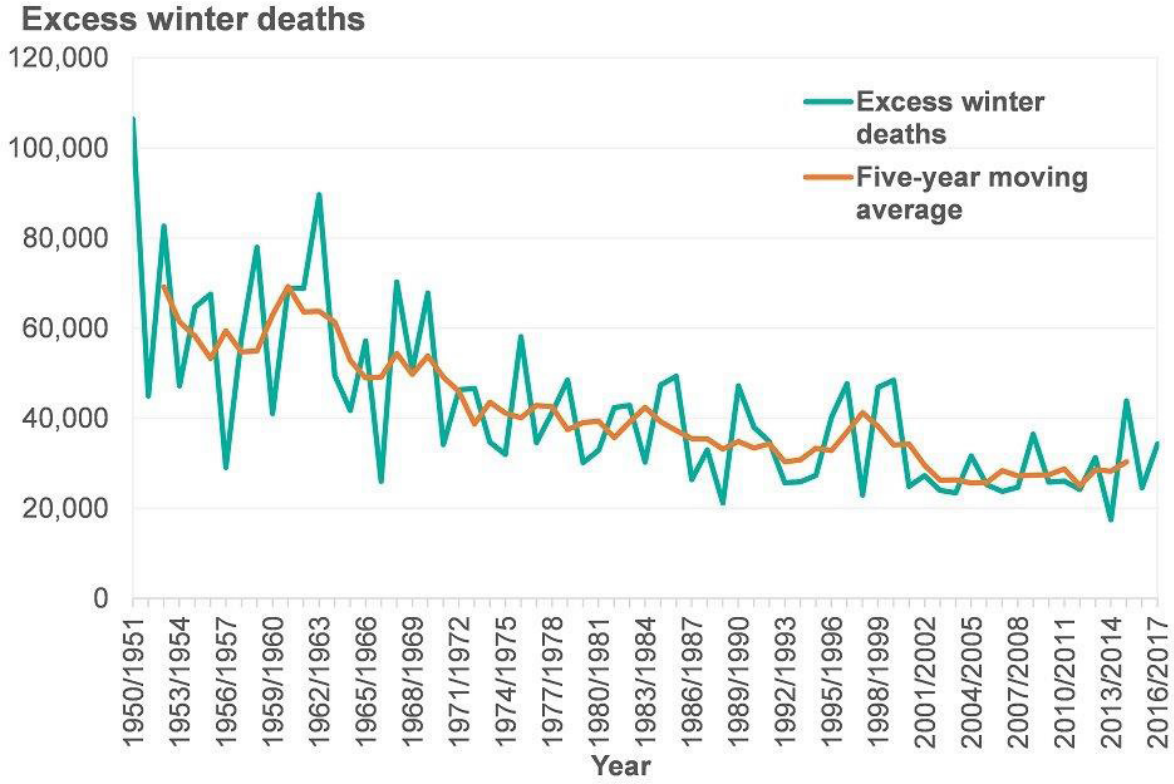
Seasonal influenza is a respiratory viral infection which in otherwise healthy individuals is typically a self-limiting disease. The public health effect varies

considerably with the predominant circulating strains, the age groups most affected and the match of the vaccine. Up to a third of people with flu display no symptoms, yet some people, particularly those with underlying risk factors, can experience a much more serious infection. Influenza is a contributing factor to excess winter deaths [27].

As described in the Health Profile for England 2017, excess winter deaths are thought to be due to a complex interplay between weather, circulating viruses (including influenza) and an elderly population.

Although excess winter deaths have fallen in recent decades, there was a sharp rise in 2015 (Figure 7). Total excess winter deaths for 2017 to 2018 are not yet available, but it is estimated that approximately 16,000 deaths were associated with influenza in the 2017 to 2018 winter season [27]. This is similar to 2016 to 2017, though lower than 2014 to 2015 when influenza A(H3N2) – a strain which particularly affects the elderly – also dominated.

Figure 7: trend in the number of excess winter deaths, England and Wales, winter 1950 to 1951 up to winter 2016 to 2017 [A12]



Source: Excess winter mortality in England and Wales: 2016 to 2017 (provisional) and 2015 to 2016 (final). Produced by Office for National Statistics, 2017

See the full data source

See how your area compares

Influenza outbreaks in institutional settings pose a particular problem due to the speed at which infections can spread between individuals. The majority of outbreaks occur in care homes where vulnerable individuals are at higher risk of contracting influenza and developing complications [27].

Vaccination is a critical part of the influenza prevention strategy and uptake in children, at risk adults, the elderly and health care workers continue to increase year on year. Nearly one and a half million more people were vaccinated during 2017 to 2018 than the season before [28].

Pandemic influenza refers to a novel influenza virus of which there is little or no pre-existing immunity, which allows it to spread rapidly. Previously healthy people, including young people, are more likely to experience severe symptoms, due to poor immunity, such as was the case in the 2009 H1N1 pandemic, and the 3 major pandemics in the last 100 years. For further discussion, see Health Profile for England 2017.

8. Emerging infectious diseases

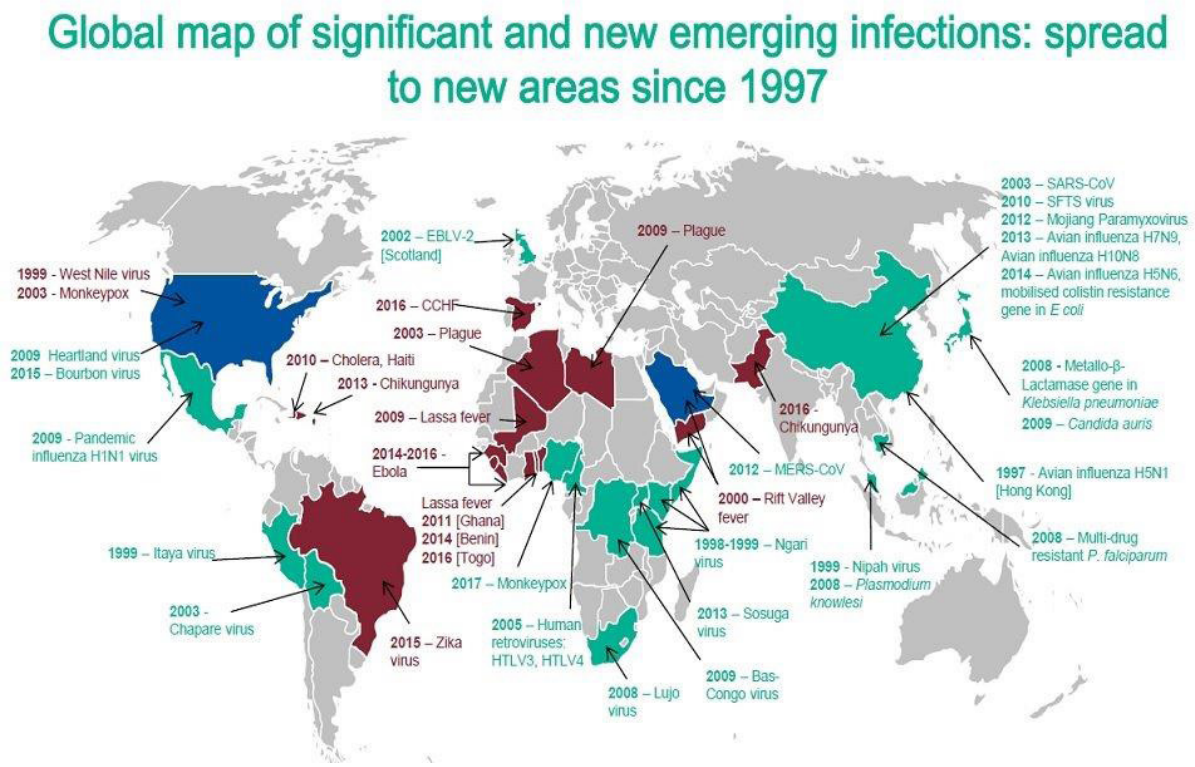
The 2014 to 2016 Ebola virus disease outbreak in West Africa killed more than 11,300 people [29]. It began in Guinea, spread across borders into Sierra Leone and, Liberia (these 3 countries sustained the largest numbers of cases), with limited regional spread. For the first time in an Ebola outbreak, a small number of cases occurred in humanitarian aid workers who returned to their country of origin and onwards across the globe, including the United Kingdom.

There were multiple inter-linking factors which contributed to the outbreak, including deforestation in the region which increased human contact with bats carrying the infection [30], urbanisation and greater population mobility which drove regional and transnational spread of disease. The lack of surveillance mechanisms and effective vaccines or treatments compounded these problems and highlighted the shortcomings of the global health security framework, including pharmaceutical funding models for emerging infectious diseases [31].

Ebola outbreaks continue to occur with the most recent in Democratic Republic of Congo (DRC) in 2017 and 2018. In response to deficiencies identified during the West Africa outbreak, WHO has increased partnership working during health emergencies and improved the speed of response [32].

Infectious diseases such as Middle East respiratory syndrome (MERS), Zika virus and severe acute respiratory syndrome (SARS) have emerged from across the globe and spread rapidly - new diseases will be no different. Historically, diseases have emerged from all continents and spread across the globe (Figure 8).

Figure 8: global map of emerging infections since 1997



Source: Emerging infections: how and why they arise. Produced by Public Health England, 2018

See the full data source

A combination of factors contribute to the emergence of new infections. Around 60 to 80% of emerging infections come from an animal source and monitoring of zoonotic diseases is an important component of protecting public health [33].

Strong infectious disease surveillance, including mechanisms to support low-resource countries to fulfil their obligations under the international health regulations, and engagement of the UK Public Health Rapid Support Team during an outbreak are critical to protecting the United Kingdom and improving global health security. Many diseases have emerged from East Asia where there is close contact between poultry and humans, and sub-Saharan Africa where there is limited public health surveillance (Figure 8).

9. Vaccine preventable diseases

After observing that milkmaids were protected from outbreaks of smallpox, Edward Jenner proposed the inoculation of healthy humans with material from livestock suffering from pox-like diseases. Vaccination, from the French ‘vache’ (cow), transformed the landscape of infectious disease control and has saved countless lives - smallpox is estimated to have killed 300 million people in the 20th century alone [34].

The disease followed the path of European empires in the 15th to 19th century, bringing smallpox to communities in the Americas and Africa, which had no previous immunity to the disease, with devastating effect [34]. The subsequent eradication of smallpox in 1980 embodies the power of global collective action and remains one of the most celebrated public health achievements.

Control of other devastating diseases such as polio, measles, rubella and haemophilus influenza, have led to dramatic improvements in childhood survival. More recent developments such as the introduction of the childhood rotavirus vaccine (2013) and the HPV vaccine (Section 5.2) continue to demonstrate the value of new vaccinations.

9.1 Hepatitis A

Hepatitis A virus infection causes a range of illnesses from mild symptoms through to hepatitis and liver failure and is normally spread by the faecal-oral route, or occasionally blood. Improved social conditions have led to steep reductions in the numbers of cases. From mid-2016 there was an increase in cases of hepatitis A, involving three distinct strains originating in Europe. The increase was initially among MSM living in London but then spread across the UK [35].

Due to a global vaccine shortage vaccine sparing recommendations were implemented to preserve UK stock, with sexual health services able to access a central stockpile to protect MSM. The outbreak came under control in early 2018. The outbreak reflects the social dimensions of infectious disease outbreaks, the importance of collaboration with national partner institutions and the vital role of high quality epidemiological intelligence to guide the response [36].

9.2 Measles

A consequence of effective vaccination programmes is that many deadly, disfiguring diseases are fading in the collective consciousness. Meanwhile, some diseases that have been previously well controlled, such as measles, have re-emerged among unvaccinated communities. Measles is a viral illness that can lead to serious complications and even death. Prior to the introduction of the vaccination in 1968, measles notifications every year in the UK numbered 160,000 to 800,000 with around 100 deaths [37].

Measles is an extremely infectious disease; therefore, increasing vaccine coverage over the 1980s and 1990s was vital to controlling the disease. Following the now discredited work of Andrew Wakefield in 1998 which falsely

linked the measles, mumps, rubella (MMR) vaccine with autism, vaccination uptake fell significantly below the required threshold for herd immunity [38].

In 2017, England met the WHO target of 95% coverage and achieved elimination status; however, outbreaks continue to occur in pockets of the population with low vaccine uptake. Half of the cases in the UK since have occurred in people over 15 years old reflecting the legacy of Wakefield, the value of strong public health surveillance, and the coordinated action required to control infectious disease [38].

10. Further information

The challenges we face are increasingly global and require collaborative action within communities and between countries. The growing threat which problems such as emerging infectious diseases, air pollution and antimicrobial resistance pose are driven by a diverse range of factors from environmental change, urbanisation and the widening gaps between the least and most deprived communities. This requires an integrated approach with input from far beyond the health sector.

More information on the health protection issues covered in this chapter can be found on the PHE website and data on several areas including AMR, STIs and TB can be explored through the PHE Fingertips Portal.

11. References

1. Committee on the Medical Effect of Air Pollutants (2018) COMEAP: Associations of long-term average concentrations of nitrogen dioxide with mortality. Accessed 6 September 2018. ↩ ↩2

2. Aldridge R, Story A, Hwang SW and others. (2018) Morbidity and mortality in homeless individuals, prisoners, sex workers, and individuals with substance use disorders in high-income countries: a systematic review and meta-analysis. Lancet 391, 10117; 241 to 250. ↩ ↩2

3. Marmot M (2010) Fair society, healthy lives the Marmot Review: strategic review of health inequalities in England post-2010. Accessed 18 July 2018. https://www.gov.uk/dfid-research-outputs/fair-society-healthy-lives-the-marmot-review-strategic-review-of-health-inequalities-in-england-post-2010 ↩

4. Jarrett J, Woodcock J, Griffiths UK, and others. (2012) Effect of increasing

active travel in urban England and Wales on costs to the National Health Service. Lancet 379: 9832.

5. Watts N, Amann M, Ayeb-Karlsson S, and others. (2108) The Lancet Countdown on health and climate change: from 25 years of inaction to a global transformation for public health. Lancet 391:10120 (581 to 630).

6. United Nations International Strategy for Disaster Reduction (2015) Sendai framework for disaster risk reduction 2015–2030. Accessed 20 July 2018.

7. Jermacane D, Waite TD, Beck CR and others. (2018) The English National Cohort Study of Flooding and Health: the change in the prevalence of psychological morbidity at year two. BMC Public Health 18:330.

8. Environment Agency (2018). Estimating the economic costs of the 2015 to 2016 winter floods. Accessed 20 July 2018.

9. Hajat S, Vardoulakis S, Heaviside C, Eggen B (2014) Climate change effects on human health: projections of temperature-related mortality for the UK during the 2020s, 2050s and 2080s. J Epidemiol Community Health 68:641 to 648.

10. PHE (2018). Estimation of costs to the NHS and social care due to the health impacts of air pollution. pp 32 to 33. Accessed 20 July 2018.

11. O'Neil J [chair] (2016) Tackling Drug-Resistant Infections Globally. Accessed 20 July 2018.

12. PHE (2017) English surveillance programme for antimicrobial utilisation and resistance (ESPAUR). Accessed 20 July 2018. [2]

13. European Centres for Disease Prevention and Control (2018) Surveillance Atlas of Infectious Diseases. Accessed 18 July 2018.

14. European Centre for Disease Prevention and Control (2016) Carbapenem-resistant Enterobacteriacae: Rapid Risk Assessment. Stockholm: ECDC.

15. PHE (2017) Sexually Transmitted Infections and Chlamydia Screening in England 2017. Accessed 18 July 2018. [2] [3] [4]

16. PHE (2018) UK case of Neisseria gonorrhoeae with high-level resistance to azithromycin and resistance to ceftriaxone acquired abroad. Accessed 20 July 2018.

17. PHE (2018) HPV vaccination programme for men who have sex with men (MSM): Clinical and operational guidance. Accessed 18 July 2018.

18. PHE (2018) Hepatitis C in England and the UK. Accessed 18 July 2018.

19. PHE (2017 update) Health Protection Scotland, Public Health Wales, Public Health Agency Northern Ireland. Shooting up: infections among people who inject drugs in the UK, 2016. Accessed 20 July 2018.

20. Gornall J, Hoey A, Ozieranski P (2016) A pill too hard to swallow: how the NHS is limiting access to high priced drugs. BMJ 354:i4117.

21. PHE (2017) HIV in the United Kingdom: decline in new HIV diagnoses in gay and bisexual men in London, 2017 report. Accessed 20 July 2018.

22. WHO, ECDC (2018). Tuberculosis surveillance and monitoring in Europe, 2018. Accessed 20 July 2018.

23. Daniel TM (2006) The history of tuberculosis. Respiratory Medicine 100(11):1862 to 1870.

24. PHE (2017) Tuberculosis in England, 2017 Report. Accessed 20 July 2018.

25. PHE, TB alert, NHS (2017) Tackling tuberculosis in under-served populations: A resource for TB control boards and their partners. Accessed 19 July 2018.

26. PHE, NHS England (2015) Collaborative Tuberculosis Strategy for England 2015 to 2020. Accessed 19 July 2018.

27. PHE (2018) Surveillance of influenza and other respiratory viruses in the UK: Winter 2017 to 2018.

28. PHE, DHSC, NHSE (2018). The national flu immunisation programme 2018/19 (letter). Accessed 2 July 2018.

29. World Health Organization (2016) Ebola Outbreak 2014-2015. Accessed 7 June 2018.

30. Olivero J, et al. (2017) Recent loss of closed forests is associated with Ebola virus disease outbreaks. Scientific Reports 7:14291.

31. Science and Technology Committee (2016). Science in emergencies: UK lessons from Ebola (Second Report of Session 2015-16). London, House of Commons.

32. WHO Ebola Response Team (2016) After Ebola in West Africa - Unpredictable Risks, Preventable Epidemics. NEJM 11;375(6):587 to 596.

33. PHE (2018) Emerging infections: how and why they arise. Accessed 20 July 2018. ↩

34. Fenner F, Henderson DA, Isao A, and others. Smallpox and its eradication. Geneva: World Health Organization, 1988. p. 232. ↩ ↩2

35. PHE (2017) Hepatitis A Outbreak in England Under Investigation. Accessed 20 July 2018. ↩

36. European Centre for Disease Prevention and Control (2018) Epidemiological update: hepatitis A outbreak in the EU/EEA mostly affecting men who have sex with men. Accessed 18 July 2018. ↩

37. Vanessa S. Measles has been eliminated in the UK – so why do we still see cases and outbreaks?. Accessed 20 April 2018. ↩

38. Ramsay, ME. Measles: the legacy of low vaccine coverage. Arch Dis Child (2013) Vol 98 No 10. ↩ ↩2

Methods, data and definitions

Published 11 September 2018

Absolute and relative measures of inequality

Both absolute and relative measures of inequality are presented in this report.

Absolute inequality shows the magnitude of difference between subgroups of the population (most simply calculated by subtracting the value for one group from another), whereas relative inequality shows the proportional difference between subgroups (most simply calculated by dividing the value for one group by another).

For example, if 30% of people smoke in Group A and 20% smoke in Group B then the absolute inequality between them is 10 percentage points and the relative inequality is 1.5, therefore the prevalence of smoking in Group A is 1.5 times higher than Group B.

Both absolute and relative measures are important indicators of inequality. However, they can lead to differing conclusions about the direction of change in inequality over time, depending on the trend in the indicator overall. Each measure has advantages and disadvantages but used together they can provide a more complete picture of inequality.

Adult Psychiatric Morbidity Survey (APMS)

The Adult Psychiatric Morbidity Survey (APMS) series provides data on the prevalence of both treated and untreated psychiatric disorders in the English

adult population (aged 16 and over). The survey has been carried out on four occasions, in 1993, 2000, 2007 and 2014. The most recent survey was conducted by NatCen Social Research, in collaboration with the University of Leicester, for NHS Digital.

All the APMS surveys have used largely consistent methods and in 2014 the sample size was around 7,500 adults.

APMS assesses psychiatric morbidity using actual diagnostic criteria for a range of disorders: common mental disorders, post-traumatic stress disorder, psychotic disorder, autism spectrum disorder, personality disorder, attention-deficit/hyperactivity disorder, bipolar disorder, alcohol dependence, drug use and dependence, suicidal thoughts, suicide attempts and self-harm, and comorbidity in mental and physical illness.

Age-standardised mortality rates

Age-standardised rates adjust for differences in the age structure of populations and allow comparisons to be made between geographical areas and through time[1]. The direct method applied across this report uses the age-standardised rate for a particular condition which would have occurred if the observed age-specific rates for the condition had applied in a given standard population. The European Standard population 2013 is used.

Age-standardised years of life lost (YLL)

Age-standardised years of life lost (YLL) is a measure of premature death within a group of people. YLL are calculated by comparing the age at death with the aspirational life expectancy at that age. YLL are the years that a person who died at a certain age ideally would have lived according to the standard life table. For all countries and time periods, the same ideal standard life expectancy is applied. This allows results to be compared between locations and over time.

Breastfeeding at 6 to 8 weeks

This is the percentage of infants that are totally or partially breastfed at age 6 to 8 weeks. Totally breastfed is defined as infants who are exclusively receiving breast milk at 6 to 8 weeks of age - that is, they are not receiving formula milk, any other liquids or food. Partially breastfed is defined as infants who are currently receiving breast milk at 6 to 8 weeks of age and who are also receiving formula milk or any other liquids or food. Not at all breastfed is defined as infants who are not currently receiving any breast milk at 6 to 8 weeks of age.

To calculate the prevalence of breastfeeding, the numerator is the count of the number of infants recorded as being totally breastfed at 6 to 8 weeks and the number of infants recorded as being partially breastfed. The denominator is the total number of infants due a 6 to 8 weeks check.

The indicator is based on observation and is therefore susceptible to measurement bias. Infants whose breastfeeding status at 6 to 8 weeks after birth is unknown are included in the denominator. This will result in an underestimate of the percentage of infants who are breastfeeding.

Dental decay in children

This is defined as children who are not free from obvious dental decay (having one or more teeth that were decayed to dentinal level, extracted or filled because of caries).

Data for individual local authorities are not included if the authority did not take part in the survey or if the number of children examined was too small (less than 30) for a robust estimate.

Deprivation deciles

Deprivation deciles have been constructed using the Index of Multiple Deprivation (IMD) scores at lower super output area (LSOA) level where

possible, and if not at district and unitary (UA) authority level or county and UA authority level. The choice of decile methodology is clearly stated in the text. Unless otherwise specified in the text, Index of Multiple Deprivation 2015 (IMD2015) scores have been used.

LSOAs are small geographic areas produced by the ONS to enable reporting of small area statistics in England and Wales. There are 32,844 LSOAs in England, each having a population of approximately 1,500.

To create LSOA deprivation deciles for use in chart presentation and also in the calculation of the slope and relative index of inequality measures, LSOAs within England were ranked from most to least deprived and then organised into ten categories with approximately equal numbers of LSOAs in each.

Since the total number of LSOAs in England is not exactly divisible by ten, the 'extra' LSOAs were allocated to deprivation deciles using a systematic method outlined in PHE's Technical Guide: Assigning Deprivation Categories.

To create district and UA or county and UA deprivation deciles these local authorities were ranked from most to least deprived within England and then organised into ten categories with approximately equal numbers of local authorities in each. Further information can be found in PHE's Technical Guide: Assigning Deprivation Categories.

Excess weight in children

The data presented for these indicators only includes children participating in the National Child Measurement Programme (NCMP) in state maintained schools. Any measurements taken at independent and special schools are excluded from the analysis.

Deprivation deciles are derived from the postcode of child residency; only children with valid geographical coding (postcode of residence) have been included in this analysis.

England totals include all children in state-maintained schools, with a valid height and weight measurement, including those with an unknown residency.

Children are classified as overweight (including obese) if their BMI is on or above the 85th centile of the British 1990 growth reference (UK90) according to age and sex.

Fentanyl

A powerful synthetic opioid analgesic used to treat or manage severe pain. Fentanyl can also be manufactured illegally and be misused as a recreational drug.

Forecasting

All forecasts presented in the report as PHE forecasts were produced by the expert system built into the forecasting software ForecastPro. For time series that are sufficiently long (over 20 years), the system uses either the Box-Jenkins method to fit autoregressive integrated moving average (ARIMA) models[2] or Exponential Smoothing[3] to fit a log-linear trend. For shorter time series it uses Exponential Smoothing. The specifications of the models are given in Table 1.

The 95% confidence intervals for the forecasts reflect the level of uncertainty around the forecasts. Uncertainty arises from two factors in the historic time series: 1) the amount of fluctuation from year to year, which will tend to result in broad confidence intervals, and 2) the consistency of any trend – any apparent changes in trend, particularly in recent years, which will tend to give rapidly widening funnel-shaped confidence intervals, as it is not clear whether the trend will be up, down or level in the future.

Table 1: forecasting model specifications

Indicator	Historic series	Model specification	
Male life expectancy at birth	1981 to 2017	ARIMA (1,1,2)	AR: 0.9916, MA (1): 1.1924, MA (2): –0.4744
Female life expectancy at birth	1981 to 2017	Holt's exponential smoothing	Smoothing weights: Level: 0.3514, Trend: 0.7448
Male all cause mortality	2001 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.5106, Trend: 0.6350
Female all cause mortality	2001 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.6052, Trend: 0.09732
Male CHD mortality*	2001 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.8991, Trend: 0.1175
Female CHD mortality*	2001 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.8079, Trend: 0.1270
Male stroke mortality*	2001 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.8196, Trend: 0.1138
Female stroke mortality*	2001 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.1259, Trend: 0.7705
Male dementia and Alzheimer's mortality*	2001 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.8673, Trend: 0.2105
Female dementia and Alzheimer's mortality*	2001 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.2550, Trend: 0.9998
Smoking	2010 to 2017	Holt's exponential smoothing	Smoothing weights: Level: 0.6059, Trend: 1
High blood pressure	2010 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.3253, Trend: 0.2643
Obesity	2007 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.1485, Trend: 1
Alcohol consumption	2010 to 2016	Simple exponential smoothing	Smoothing weight: Level: 6.189×10^–8
Smoking at time of delivery	2006 to 2017	Holt's exponential smoothing	Smoothing weights: Level: 0.8037, Trend: 0.1369
Teenage pregnancies	1998 to 2015	Holt's exponential smoothing	Smoothing weights: Level: 0.8399, Trend: 0.9046
Excess weight in 10/11 year-olds	2006 to 2016	Holt's exponential smoothing	Smoothing weights: Level: 0.6894, Trend: 0.09752

Note: AR refers to the AR part of autoregressive integrated moving average (ARIMA) models and MA refers to the MA part. For more information see here.

*cause-specific mortality forecasts are not included in the report, but are included in the accompanying data pack.

Good level of development in children

Children defined as having reached a good level of development at the end of the Early Years Foundation Stage (EYFS) as a percentage of all eligible children. Children are defined as having reached a good level of development if they achieve at least the expected level in the early learning goals in the prime areas of learning (personal, social and emotional development; physical development; and communication and language) and the early learning goals in the specific areas of mathematics and literacy.

This measure only includes pupils with a valid result for every achievement scale.

Global Burden of Disease study (GBD)

The Global Burden of Disease study (GBD) collects data from over 80,000 data sources from countries across the world. These are used as inputs for the GBDmodelling methodology to produce comparative estimates of death and disability.

The GBD groups diseases into a 4 level cause hierarchy. Level one groups diseases at a high level: communicable diseases, non-communicable diseases, and injuries. Each subsequent level in the hierarchy presents a finer grouping of conditions that nest within the level above. For example, the second level consists of major disease or injury groups, such as musculoskeletal conditions or mental and substance use disorders. The third level, which is used for most of the analysis presented in Chapter 3, further subdivides causes into disease or injury type such as osteoarthritis, low back and neck pain, and depressive disorders.

More information on the disease hierarchy can be found in Appendix Table 3 of the GBDwebsite.

GP Patient Survey (GPPS)

The GP Patient Survey is an independent, England wide survey run by Ipsos MORI on behalf of NHS England. The survey is annual and is sent to over a million people, providing practice-level data about patients' experiences.

The latest version saw just over 800,000 people respond. It provides data at practice level using a consistent methodology, which means it is comparable across organisations and over time. It is a long running survey, with a large sample size.

Healthy life expectancy

Healthy life expectancy at birth is an estimate of the average number of years that would be lived in a state of ‘good general health’ by babies born in a given time period, given mortality levels at each age and the level of good health at each age for that time period.

Similarly, healthy life expectancy at age 65 is an estimate of the average number of remaining years lived in ‘good general health’ from age 65, given mortality levels and the level of good health at each age beyond 65 for that time period.

The healthy life expectancy measure adds a ‘quality of life’ dimension to estimates of life expectancy by dividing it into time spent in different states of health. Health status estimates for England are based on the following survey question: ‘How is your health in general; would you say it was… very good, good, fair, bad, or very bad?’ If a respondent answered ‘very good’ or ‘good’ they were classified as having ‘good’ health. Those who answered ‘fair’, ‘bad’, or ‘very bad’ were classified as having ‘not good’ health and equate to those in ’poor’ health in the reported figures for England.

There are known limitations to data on self-assessed health status. We know that people give subjective answers to the question used to determine health status. Responses are influenced by an individual’s expectations and there are measurable differences across sociodemographic factors such as age, sex, and deprivation.

There is also likely to be a bias arising from the way respondents are selected to take part in the survey. The data are based on surveys that are not able to select people for interview who are living in institutional accommodation (for example, care homes). This may lead to an underestimate of the level of poor health.

Poor health in the EU data is defined by responses to a question in the EU Statistics on Income and Living Conditions survey (EU-SILC) which asks people: 'How is your health in general? Is it … very good, good, fair, bad, or very bad?' If a respondent answered 'very good', 'good' or 'fair' they were classified as having 'good' health. Those who answered 'bad', or 'very bad' were classified as having 'not good' health.

The EU data, therefore, uses a different definition of 'not good' health to that used by ONS for England estimates. In the EU data, people who say their health is 'fair' are regarded as having 'good' health but in the ONS data people who say their health is 'fair' are defined as having 'not good' health. This difference explains the very different figures quoted in Chapter 1 for the proportion of life lived in poor health in England (Table 1) and the UK (Table 2).

The EU indicator of healthy life expectancy is calculated using the same method for all countries, but Eurostat caution that the way the survey question was worded by different EU members might hamper cross-country comparisons. In addition, it has long been known that there are cultural differences in the self-reporting of health status which are difficult to resolve and are likely to affect the comparability of data for healthy life expectancy and years in poor health between countries.

Index of Multiple Deprivation (IMD)

The Index of Multiple Deprivation (IMD) is a measure of relative deprivation for small areas. It is one element of the English Indices of Deprivation released by the Ministry of Housing, Communities and Local Government.

Life expectancy

Life expectancy at birth is a summary measure of the population. It represents the average number of years that would be lived by babies born in a given time period according to the mortality rates for that time period. Similarly, life expectancy at age 65 is the average number of remaining years of life that a person aged 65 years would have according to the mortality levels at each age for that time period.

Life expectancy decomposition method and interpretation

The contribution of different age bands or causes of death to changes in life expectancy over time (due to changes in age or cause specific death rates) can be calculated using a method of ‘life expectancy decomposition’. In this report, the Arriaga III method has been used, as described by Ponnapalli[4]. The method is based on a life table divided into 5-year age groups. The contributions of each age group are then distributed into causes of death using a method described by Preston and others[5]. Contributions are distributed proportionately according to the difference in mortality between time periods by cause of death within each age group.

Contributions to changes in life expectancy over time show the amount that life expectancy has increased in the later time period due to changes in the mortality rate since the earlier time period in a given age group or cause of death, assuming all other rates remained constant. Contributions that increased life expectancy (that is, where mortality rate has reduced over time) have a positive value, while contributions that offset the life expectancy increase (that is, where mortality rate has increased over time) have a negative value.

The same decomposition method can also be used to assess the contribution of different age bands or causes of death to differences (or the gap) between areas with different levels of deprivation.

Contributions to the gap show the amount that life expectancy would increase in the most deprived area if its mortality rate for a given age group or cause of death was changed to that of the least deprived area, assuming all other rates remained constant. Contributions that widen the inequality gap (that is, where mortality rate is higher in the most deprived area) are represented with a positive value, while contributions that offset the gap (that is, where mortality rate is higher in the least deprived area) are represented with a negative value.

Life expectancy projections

ONS produces regular projections of life expectancy which are derived by estimating long term trends in mortality improvement and projecting them forward for future decades. A summary of the latest results are available from ONS.

Besides their Principal Projections of life expectancy, ONS also produce high and lowlife expectancy variants, which respectively assume more and less improvement in future mortality rates.

Low birthweight at term

This indicator is defined as live births with a recorded birth weight under 2,500g and a gestational age of at least 37 complete weeks as a percentage of all live births with recorded birth weight and a gestational age of at least 37 complete weeks.

The ONS has linked birth registrations with NHS birth notification records to allow reporting by gestational age and birth weight. With 99.4% of records linked successfully, completeness of this dataset is very good. However, not all births are recorded with a valid birth weight and gestational age. There may be regional variations in the completeness of these fields.

Lower Super Output Areas (LSOAs)

These are small geographic areas produced by the ONS to enable reporting of small area statistics in England and Wales. There are 32,844 LSOAs in England, each having a population of approximately 1,500.

Mean deviation

This is a measure of inequality. Where the dimension of inequality being considered contains a number of population groups which cannot be logically ordered, such as indicators by ethnic group, a summary measure called the mean deviation has been presented.

The measure shows the average of the absolute differences between each of the groups and a reference group. Values are treated as positive whether they are higher or lower than the reference group. The largest group is selected as the reference group for each indicator.

Minimum Income Standard (MIS)

‘The Minimum Income Standard (MIS) is the income that people need in order to reach a minimum socially acceptable standard of living in the United Kingdom today, based on what members of the public think. It is calculated by specifying baskets of goods and services required by different types of household in order to meet these needs and to participate in society. The research entails a sequence of detailed deliberations by groups of members of the public, informed by expert knowledge where needed. The groups work to the following definition: ‘A minimum standard of living in the UK today includes, but is more than just, food, clothes and shelter. It is about having what you need in order to have the opportunities and choices necessary to participate in society.’[6]

Neurological conditions

In this report, the term relates to deaths registered in England in adults aged 20 and over with a mention (either as the underlying cause of death or as a contributory cause of death) of at least one of the 473 ICD-10 codes used to define adult neurological conditions. The major condition groups and ICD-10 codes are detailed in Table 2.

Table 2: major condition groups and ICD-10 codes for neurological conditions

Condition	ICD-10 Code
Epilepsy	G400, G401, G402, G403, G404, G405, G406, G407, G408, G409, G410, G411, G412, G418, G419, R568
Motor neurone disease and spinal muscular atrophy	G120, G121, G122, G128, G129
Multiple sclerosis and inflammatory disorders	G35X, G360, G361, G368, G369, G370, G371, G372, G373, G374, G375, G378, G379
Neuromuscular diseases	G700, G701, G702, G708, G709, G710, G711, G712, G713, G718, G719, G720, G721, G722, G723, G724, G728, G729, G730, G731, G732, G733, G734, G735, G736, G737, M600, M601, M602, M608, M609, M620, M621, M622, M623, M624, M625, M626, M628, M629
Parkinsonism and other extrapyramidal disorders/tic disorder	R251, F950, F951, F952, F958, F959, G903, G10X, G20X, Q210, G211, G212, G213, G214, G218, G219, G22X, G230, G231, G232, G238, G239, G240, G241, G242, G243, G244, G245, G248, G249, G250, G251, G252, G253, G254, G255, G256, G258, G259
Traumatic brain and spine injury	S04, S060, S061, SO62, S063, S064, SO65, S066, S067, S068, S069, S141, S142, S143, S144, S240, S241, S242, S341, S342, S343, S344, T060, T061, T093, T094
Tumours of the nervous system	C700, C701, C709, C710, C711, C712, C713, C714, C715, C716, C717, C718, C719, C728, C729, D320, D321, D322, D330, D331, D332, D333, D334, D337, D339

Population projections

Population projections are produced by the ONS. They provide an indication of the future size and age structure of the UK and its constituent countries based on a set of assumptions of future fertility, mortality and migration. For each country, ONS produce Principal Projections, plus a number of variant projections based on alternative scenarios. Details of the methods used in their calculation are available from ONS.

From the Principal Projections, ONS makes available the estimated numbers of deaths for both calendar years and mid-year periods.

One of the variant projections assumes there will be no improvement to mortality rates in the future and that age- or sex-specific mortality rates will remain constant at the values assumed for the first year (mid-2016 to mid-2017) of the Principal Projection.

From this variant of the projections, ONS makes available the estimated numbers of deaths in each mid-year period in England, assuming no improvement in mortality rates.

Proportion of life spent in poor health

The total number of years lived in poor health divided by the total number of years lived (life expectancy), expressed as a percentage.

Quality of life score (EQ-5D)

Quality of life has been calculated using the EQ-5D score. EQ-5D is a standardised instrument for measuring health status. Health status is converted to an index score by the GP Patient Survey team from responses to Q34 on the GP Patient's Survey, which asks respondents to describe their health status using the 5 dimensions of the EQ-5D survey instrument: mobility, self care, usual activities, pain/discomfort, and anxiety or depression.

EQ-5D can be used to assess whether health related quality of life is changing over time while controlling for potential measurable confounders (such as age, sex, long term conditions, caring responsibility). A higher score indicates a better quality of life with the best possible score being one.

Relative index of inequality (RII)

This is a measure of inequality. The relative index of inequality (RII) is a measure of the social gradient in an indicator and shows how much the indicator varies with deprivation (by deprivation decile). It takes account of inequalities across the whole range of deprivation within England and summarises this into a single number.

The relative index of inequality (RII) represents the proportional difference in the indicator across the social gradient from most to least deprived.

Where the relationship between the indicator and deprivation is not linear, an adapted version of the relative index of inequality has been used. For these indicators, the indicator values for the 10 deprivation deciles have been log transformed prior to calculation of the relative index of inequality.

Serious mental illness (SMI)

This is measured by recording the number of people in contact with secondary mental health services for specific conditions. SMI include schizophrenia-spectrum disorders, severe bipolar disorder, and severe major depression.

Slope index of inequality (SII)

This is a measure of inequality. The slope index of inequality (SII) is a measure of the social gradient in an indicator and shows how much the indicator varies with deprivation (by deprivation decile). It takes account of inequalities across the whole range of deprivation within England and summarises this into a single number. The measure assumes a linear relationship between the indicator and deprivation.

The slope index of inequality (SII) represents the absolute difference in the indicator across the social gradient from most to least deprived.

A more detailed description of the methodology used to calculate the SII can be found in the PHOF overarching indicators technical user guide.

Smoking at time of booking

This is measured by the number of mothers recorded to be smokers at the time of booking as a percentage of mothers where the smoking status is recorded.

Smoking status at the time of delivery

This is measured by the number of mothers known to be smokers at the time of delivery, as a percentage of all maternities where the smoking status is known. A maternity is defined as a pregnant woman who gives birth to one or more live or stillborn babies of at least 24 weeks gestation, where the baby is delivered by either a midwife or doctor at home or in an NHS hospital.

The indicator is based on observation and is therefore susceptible to measurement bias.

Smoking prevalence

This is defined as the percentage of adults aged 18 and over. The England average figure presented in Chapter 5 for smoking prevalence differs from the England figure presented in Chapter 3 and in the Public Health Outcomes Framework. The data are based on a household survey in which the interviewer can ask questions about household members not present at the time of interview (proxy responses). However, the sexual orientation question is not asked by proxy, and therefore the England average presented in Figure 11, Chapter 5 excludes proxy responses to the smoking question.

Teenage conceptions

This is defined as conceptions in women aged under 18 per 1,000 females aged 15 to 17. Conceptions are defined as the number of pregnancies that occur in women aged under 18 and result in either one or more live or stillbirths or a legal abortion under the Abortion Act 1967.

The date of conception is estimated using recorded gestation for abortions and stillbirths, and assuming 38 weeks gestation for live births. A woman's age at conception is calculated as the number of complete years between her date of birth and the date she conceived. The postcode of the woman's address at time of birth or abortion is used to determine geographical area of residence at time of conception. Only about 5% of under 18 conceptions are to girls aged 14 or under and to include younger age groups in the base population would produce misleading results. The 15 to 17 age group is effectively treated as the population at risk.

Years lived in poor health

The average number of years lived in poor health is the average life expectancy minus the average healthy life expectancy (number of years lived in good health). An increase in the average number of years lived in poor health is often referred to as 'expansion of morbidity', whereas a reduction is referred to as 'compression of morbidity'[7].

Years lived with disability (YLD)

Years lived with disability (YLD) is a measure that summarises levels of poor health and disability in a given population. It combines the prevalence of each disease with a rating of how disabling the disease state is.

For a particular year, age and sex, the YLDs associated with a given disease or condition are calculated in 3 steps:

- the consequences associated with the disease are identified (known as the 'sequelae' for the disease)
- the prevalence of each of the associated sequelae is multiplied by a 'disability weight'.

Disability weights are a measure of the disability a person perceives when in a particular health state. Each health state is matched to a sequel, so the disability weight represents the magnitude of health loss associated with that sequela. The weights are measured on a scale from 0 to 1, where 0 equals a state of full health and 1 equals death.

- these figures for each sequela associated with the disease or condition are then summed to give an overall estimate of the morbidity associated with the disease

This means, for example, that conditions with a low perceived disability but high prevalence are comparable with conditions with a low prevalence and high disability, in terms of overall loss of quality of life. The YLD measure is used throughout Chapter 3 to describe the non-fatal burden and is referred to as morbidity. Better health is associated with fewer years lived in disability.

References

1. ONS (2012) Age-standardised rates. Accessed 14 May 2018. ↩
2. Wikipedia (2018) Autoregressive integrated moving average. Accessed 14 August 2018. ↩
3. Wikipedia (2018) Exponential smoothing. Accessed 14 August 2018. ↩
4. Ponnapalli K (2005) A comparison of different methods for decomposition of

changes in expectation of life at birth and differentials in life expectancy at birth. Demographic Research 12:141 to 172. ↩

5. Preston S, Heuveline P, Guillot M (2000) Demography: Measuring and Modelling Population Processes. Blackwell Publishing. ↩
6. Padley M, Valadez Martinez L and Hirsch D (2017) Households below a Minimum Income Standard: 2008/09 to 2015/16. Joseph Rowntree Foundation. Accessed 27 April 2018. ↩
7. Fries JF (1980) Ageing, natural death, and the compression of morbidity. N Engl J Medicine 303(3):130 to 135. ↩