Fertility and mortality

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Chapter 5

Introduction

The population of the UK has experienced natural growth for almost all of the last century, with births exceeding deaths. However, all UK countries are projected to experience natural decrease in the future. This chapter begins by describing natural change in the population and how births and deaths shape the population's structure. The numbers of births and deaths that take place are themselves influenced by the size and age distribution of the population.

The rest of the chapter examines trends in fertility and mortality in the UK. These trends are important in understanding and projecting the size and age structure of the population. They are also useful in their own right, as they can inform policy and planning needs.

Fertility refers to reproductive behaviour (the number of children born to women) rather than the actual ability to reproduce, which is called fecundity. This section explores changing age patterns of fertility for men and women, together with changes in family size and childlessness over different generations of women. It also looks at births in relation to mothers' country of birth and parents' marital status.

Mortality refers to the deaths occurring in a population. The chapter focuses on the decline in mortality during the 20th century in the UK and how this varied for different age groups, and by sex. It also compares the mortality experiences of different generations of men and women in terms of their survival rates and life expectancy.

Data used in this chapter are based largely on the registration of births and deaths, and are described in Box 1. Period and cohort analyses are used to illustrate different aspects of fertility and mortality trends. These show how fertility and mortality levels in the population have changed over time, and how the experiences of different generations, or cohorts, of people have differed from one another (see Box 2 for more information).

Box 1

Data sources

In England and Wales it has been compulsory to register a birth or death since 1837, in Scotland since 1855 and Northern Ireland since 1864. Because of this, there are high quality registration data available for births and deaths, giving good coverage of the UK. Over the years there have been changes to the information collected. For example, when the Population (Statistics) Act of 1938 came into force, mother's age began to be collected in England, Wales and Scotland, and later in Northern Ireland. During the 1960s and 1970s electronic data sets began to be kept. Analyses in this chapter have been carried out to different time periods and geographies, according to the availability of data.

Births and deaths statistics are based on registrations collected by the General Register Offices of the UK countries. The data are compiled by the General Register Office for Scotland (GROS), the Northern Ireland Statistics and Research Agency (NISRA) and, for England and Wales, the Office for National Statistics (ONS). Statistics for the UK in this chapter were produced by aggregating data from each of these sources. There are however differences in the way the data are collected or compiled by each agency. These are described in the appendix.

All data presented in this chapter are shown on a calendar-year basis. All fertility analyses are based on live births and exclude stillbirths and miscarriages. Mortality analyses are based on data for all causes of death combined.

Projected numbers of births and deaths are produced by the Government Actuary's Department (GAD) as part of the national population projections. The period for the 2004-based projections for the UK countries runs from 2005 to 2074. GAD also provided historical databases of mortality in England and Wales. These were used to calculate life expectancy and chances of survival.

Box 2

Period and cohort analyses

Period and cohort analyses are used in demography to gain insights into fertility and mortality trends and compensate for the limitations of each perspective. Both period and cohort effects on births and deaths influence the size and age structure of the population; it is important to understand trends from both perspectives.

Period analysis uses data from a specific time or period to provide a snapshot of trends and existing conditions. It has been used here to estimate levels of, and trends in, fertility and mortality at particular times in the UK population.

Because fertility and mortality can vary from year to year, period measures in isolation may not accurately represent what happens to people during the whole of their lifetime. Cohort analysis can be used to look at what happens to a generation (or cohort) of people over their lifetime. By relating events to a group of people born at a specified time (for example, all women born in 1920) it reflects the actual experience of a generation over a specific period of time.

Complete cohort data take a long time to collect and so lack the immediacy of period data. Full cohort data are available only at age 45 (considered to be the end of childbearing years) for fertility or when the entire cohort has died for mortality (now taken as age 110). Thus the trends shown using cohort analysis may not reflect the current experiences of the population. However, incomplete cohort data can be used to look at the experiences of current generations to date, for example by comparing the experiences of different cohorts when they were at a particular age.

Births, deaths and population change

Natural change

The difference between the numbers of births and deaths, natural change, is a key determinant of population size and growth. If there are more births than deaths a population will experience natural increase. Conversely, if more deaths occur than births, a population will experience natural decrease. Migration has replaced natural change as the largest element of population growth in the UK. Migration is covered further in Chapter 7, and this section focuses on natural change.

Over the last century there were more births than deaths in the UK as a whole every year, except in 1976. With the exception of that year natural change has always been positive. England, Wales and Scotland each experienced some natural decrease in the population in the mid-1970s. There have been more deaths than births in Scotland in every year since 1995. Similarly there has been natural decline in Wales since 1997, although there were more births than deaths in 2004. In contrast, Northern Ireland did not experience natural decrease at any point during the 20th century.

The annual number of births in UK countries fluctuated significantly over the last century, while there was much less variation in the number of deaths (Figure 5.1). There were three main peaks in births or 'baby booms': one after each of the two World Wars and another, more sustained boom throughout the 1960s. The large generations born during the 1960s' baby boom produced an 'echo' of the original boom in the 1980s when they reached their peak childbearing years. This echo was small in Scotland, where fertility levels in the 1980s were lower than in the rest of the UK.

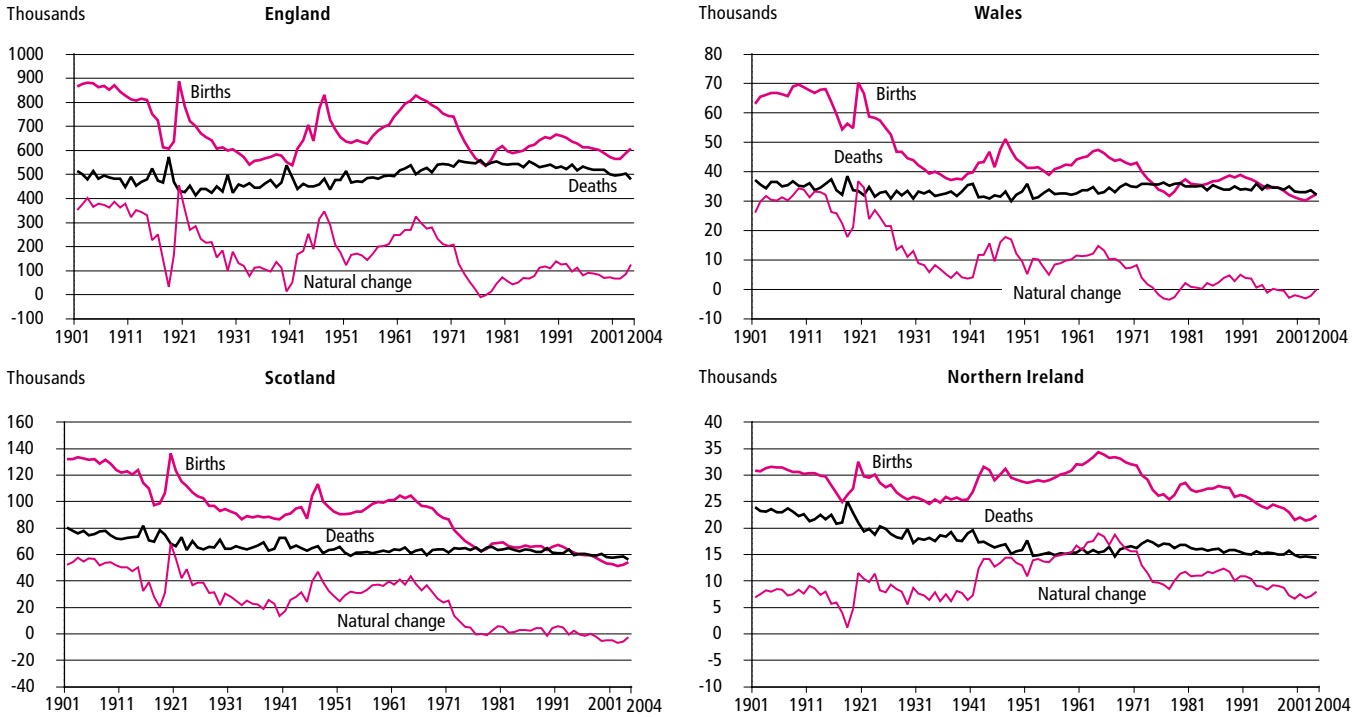
The number of deaths each year in the UK remained fairly constant during the 20th century. This is due firstly to the large increase in the size of the UK population over this period, and secondly to the decline in mortality and its increasing concentration at older ages. These two factors have resulted in the number of deaths remaining stable.

All UK countries have been projected to experience a natural decrease in their future populations (Figure 5.2). 2004-based projections suggest that the natural decrease already taking place in Scotland is likely to continue until the end of the projection period (2074). The current small natural decrease in Wales is likely to end at around 2007 but resume at around 2022. England and Northern Ireland are both projected to experience natural decrease, from around 2039 and 2034 respectively.

In the UK, the numbers of births and deaths are projected from the existing population size and age structure, and from assumptions made about fertility and mortality trends. The assumptions are based on existing trends, knowledge of determinants of fertility and mortality, and judgements about possible future trends. The 2004-based projections assume that average completed family size will level off for cohorts (generations) born at the start of the 1990s, at 1.75 children per woman in both England and Wales, 1.80 in Northern Ireland and 1.60 in Scotland. According to the mortality assumptions, there will be generally higher rates of improvement in life expectancy for all ages in the early years of the projection, tailing to a constant rate after 2029.[1]

Figure 5.1

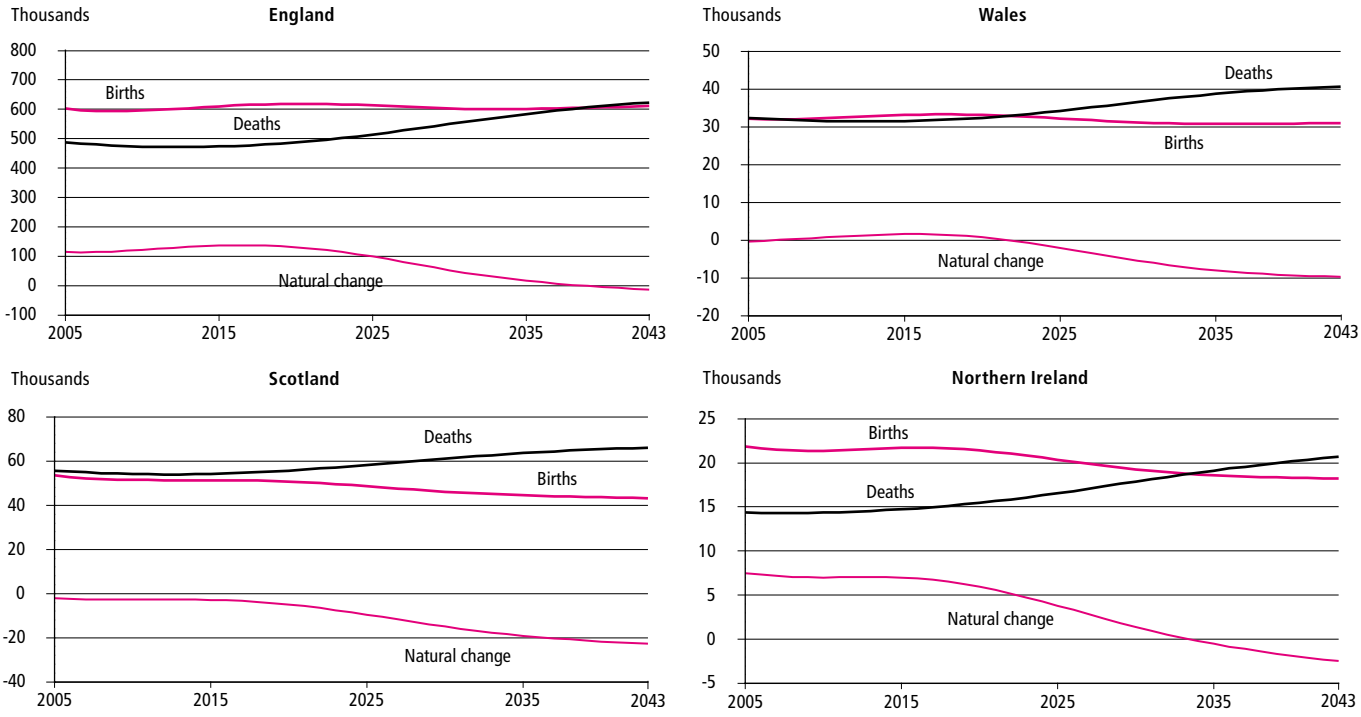
Births, deaths and natural change: UK countries, 1901 to 2004



Source: Office for National Statistics; General Register Office for Scotland; Northern Ireland Statistics and Research Agency

Figure 5.2

Projected births, deaths and natural change: UK countries, 2005 to 2043[1]



1 Data shown are mid-year to mid-year.

Source: United Kingdom 2004 – based national population projections – Government Actuary's Department

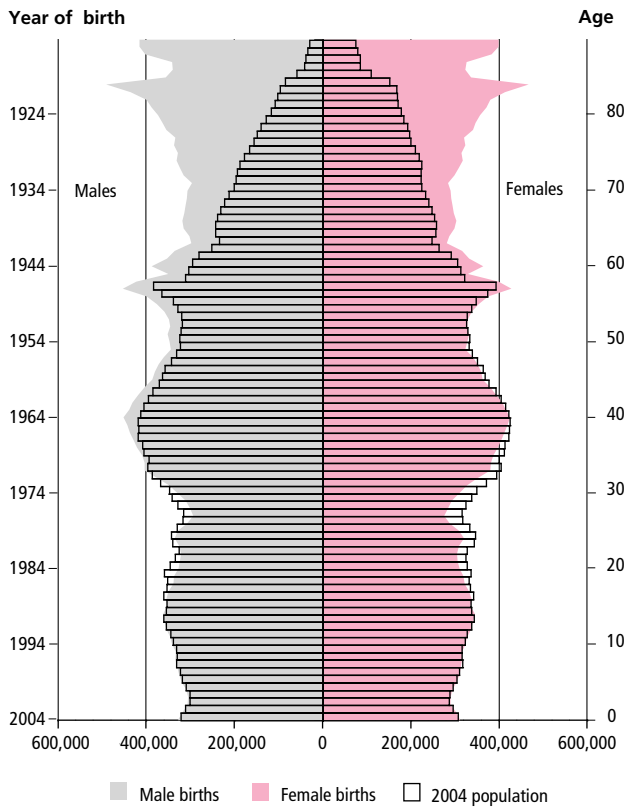
The changing population structure

Births, deaths and migration each shape the age structure of a population. The key determinant of the existing population's age distribution is the annual number of births over the last 90 years (Figure 5.3). The correlation between births and the age structure of the population is strong up to around age 70. From this age onwards deaths have an increasing effect on the age structure and the close relationship is lost. This happens because members of a birth cohort do not all die at the same age. Their deaths are spread out, mainly over older ages. For example, in 2004 there were 58,600 men aged 85 alive in England and Wales, but these men were just a small part of the 1919 birth cohort of 356,200 male births.

Figure 5.3

Births 1915 to 2004 and 2004 population by age and sex

England and Wales



Source: Office for National Statistics

The age structure of a population also affects the numbers of births and deaths that occur. For example, in an ageing population the number of deaths may increase in spite of falling mortality rates. This is because there are growing numbers of older people and they are the age group with the highest risk of dying. A population with high numbers of women aged 15 to 44 would be expected to have more live births than one of the same size but with fewer women in this age group, even if the women of childbearing age in the two populations had the same fertility rates.

The future growth of the population will be influenced by its present age distribution. This effect is known as population momentum.[2] There are projected to be more births than deaths at the start of the projection period (2005) in England and Northern Ireland, even though fertility rates are projected to remain below the level required to replace the population (Box 3). High fertility in the past means that current cohorts of women are sufficiently large that the births they have exceed the number of deaths, even though fertility rates are below replacement level. But, as the population ages, the large cohorts of men and women at older ages will slow this effect and eventually stop it.

Box 3

Replacement fertility

Replacement fertility is the level of fertility required to ensure a population continues to replace itself in size. To replace themselves women, on average, need to have one female child who survives long enough for a female grandchild to be born, and so on for succeeding generations.[3] An average of two children will 'replace' all mothers and fathers, but only if the same number of boys as girls are born and all female children survive to the end of their reproductive age. However, because of mortality and the fact that in most populations around 105 boys are born for every 100 girls, fertility needs to be a little higher than a rate of 2.0 children per woman to achieve replacement.

In the UK, as in all developed countries, a fertility rate of 2.1 is usually taken as roughly approximate to the level of replacement fertility, although the precise level will vary between countries. It is important to remember that the level of 2.1 children is an average across all women. To ensure replacement fertility, a substantial proportion of women must have three or more children in order to compensate for those who remain childless or have only one child.[4]

Fertility

This section examines trends in fertility and how it varies, for example, between the UK countries, and in relation to the ages of mothers and fathers. It also looks at changes in family size and levels of childlessness over generations. It describes differences in fertility trends according to the mothers' country of birth, and investigates whether there are fertility patterns associated with the act of migration itself. Finally, it looks at

births with regard to the marital or cohabitation status of parents.

Trends in fertility

The total fertility rate (TFR) is the average number of children a group of women would have if they experienced the age-specific fertility rates of a particular year throughout their childbearing life (Box 4). It is the most commonly used period measure of fertility as it gives a single rate of fertility for a population for a specific period, usually a year. (See Box 2 for more information on period and cohort analyses.) The TFR is an age-standardised measure. It allows fertility trends to be separated out from the effects of changes in the population's age structure over time. It also allows fertility patterns to be compared across population subgroups with different age distributions.

Box 4

Glossary of fertility terms

Age-specific fertility rate (ASFR) – the number of births in a year to women aged *x*, per thousand women aged *x* in the mid-year population.

$$\text{Age-specific fertility rate} = \frac{\text{Births to women aged } x}{\text{Mid-year population of women aged } x} \times 1{,}000$$

Childbearing years – defined as being ages 15 to 44.

Completed family size (CFS) – the average number of live births a woman (in a cohort) has had by the end of her childbearing years. Completed family size can be calculated for all women or only for those who have had children.

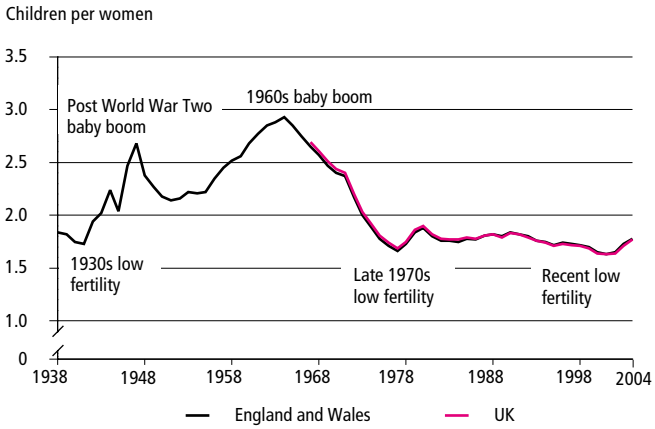
Total fertility rate (TFR) – the average number of children a woman would have if she experienced the age-specific fertility rates for a particular year throughout her childbearing life. For example, a TFR of 1.78 in 2004 means that, on average, a woman would have 1.78 children during her lifetime based solely on 2004's age-specific fertility rates. It is calculated as the sum of the age-specific fertility rates in one year.

Since 1938 (when official data were first available) the TFR in England and Wales has varied considerably. There was a short baby boom after the Second World War, which was followed by a period of lower fertility in the 1950s (Figure 5.4). A more sustained baby boom occurred during the 1960s and resulted in the TFR reaching its peak of 2.93 children per woman in 1964. The late 1960s and 1970s saw a rapid decline in fertility.

Figure 5.4

Total fertility rate, 1938 to 2004

England and Wales



Source: Office for National Statistics, General Register Office for Scotland, Northern Ireland Statistics and Research Agency

In 1973 the TFR fell below the level needed to replace the population (2.1 children per woman).[5] It continued to decrease until 1977, when it fell to 1.66. There was a slight recovery from this trough, but fertility remained at low levels throughout the 1980s and 1990s. It fell to its lowest point in 2001, reaching a TFR of 1.63 children per woman.

Since 2001 there has been a rise in fertility each year, and in 2004 the TFR was 1.78 children per woman. It is too early to predict whether this represents the start of a sustained rise in fertility. The previous short upturn in fertility, after the 1977 trough, was followed by two decades of gradual decline.

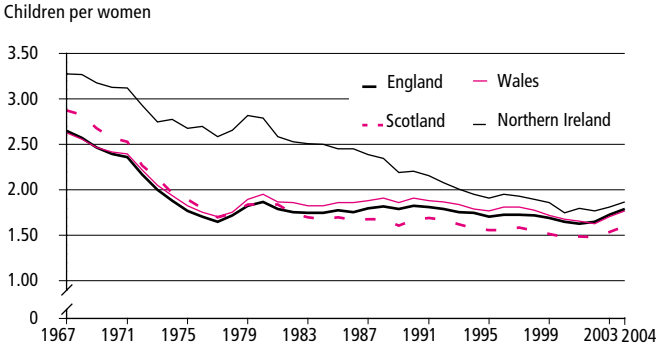
Fertility trends in the UK countries

Fertility has been below the level required to replace the population since 1973 in England and since 1974 in Wales and Scotland (Figure 5.5). Northern Ireland has had a higher TFR than the other UK countries for at least 30 years. In 1967 the TFR in Northern Ireland was 3.28 children per woman compared with 2.69 for the UK as a whole. However, since the late 1980s this difference has substantially declined. In 1993 the Northern Ireland TFR also fell to below replacement level and, by 2004, it had declined to 1.87 children per woman, compared with 1.77 children for the UK.

The longest time series available for fertility rates is for England and Wales. Figure 5.4 demonstrates that this is likely to be a good indicator of trends for the UK as a whole, even though the constituent countries have had their own distinct trends over time. This is because England and Wales make up a large proportion of the UK population. In 2004 approximately 85 per cent of births in the UK were in England, 7.5 per cent in Scotland, 4.5 per cent in Wales and 3.1 per cent in Northern Ireland.

Figure 5.5

Total fertility rate: by UK country 1967 to 2004



Source: Office for National Statistics, General Register Office for Scotland, Northern Ireland Statistics and Research Agency

Factors associated with low fertility

TFRs have declined and, at the start of the 21st century, were at low levels across nearly all countries in the developed world (see Chapter 10 for fertility in the countries of the European Union). For almost all the previous 25 years, TFRs in most western European countries have been stable at low levels (below replacement level).

There is plentiful academic debate about the reasons for these low TFRs. Many factors affect childbearing behaviour, and hence fertility levels. These include increased education and economic independence among females. High and rising aspirations have created a need for a second income and also encouraged women's participation in the labour force. This has led to both sexes investing more in their careers. There have been important changes in society's attitudes and people are increasingly less constrained by social norms. There has been a rise in the importance attached to the individual and freedom of choice, and a greater emphasis is placed on quality of life and leisure. People have also retreated from permanent commitments and are more cautious about investing their identity in family because of the increased probability of separation and divorce.[6]

There will also be country-specific factors that impact on fertility levels, including the cost and availability of housing, and flexibility of the labour market.[6] The effect of all of these factors is difficult to quantify, and there is no agreement on which of them are more important in determining fertility trends.[7] Their impact will vary between countries and between different groups within countries, and will also change over time.

There have been two notable changes in childbearing in the UK associated with such factors. Firstly, there has been a reduction in the size of family that women desire or intend to have. In England and Wales, women's childbearing intentions are slightly lower now than in the previous 20 years, with a greater proportion of women in 2000–01 intending to have a smaller family or to remain childless than in 1979–81.[8] This is associated with changing attitudes to ideal family sizes[9] and greater acceptability of voluntary childlessness. Secondly, women are postponing childbearing to later ages. Age of marriage and age of cohabitation leading to marriage have increased and, since the majority of childbearing takes place in a married or cohabiting environment, delayed entry into this will delay childbearing.[10] Higher levels of education are also associated with a later average age of entry into motherhood.[11] These changes in family size, childlessness and the age at which women become mothers are discussed further in the next two parts of this chapter.

Age patterns of fertility

Women in the UK are increasingly bearing their children at older ages. Since records began in 1938 women in their 20s in England and Wales have generally had the highest fertility rates (Figure 5.6). But, since the start of the 1980s, the fertility of women in their 20s has fallen, while that of women in their 30s has risen. In 1992 the fertility of women in their early 30s overtook that of women in their early 20s. In 2004, for the first time, women in their early 30s had the highest fertility rate of all age groups, with marginally higher fertility than 25 to 29 year olds.

Fertility among women in their 40s has increased since the early 1980s but has remained below 21 births per 1,000 women since 1938. The current trend for women to delay the start of childbearing has contributed to this rise. In 2004 there were 10.4 births per 1,000 women aged 40 to 44. The fertility rate among women in their 40s peaked in the mid-1940s at around 20 births per 1,000 women. These women had larger families than later generations and their childbearing was spread over more years. Three-quarters of their births were to women who already had at least two children. In 2004 just over half of births to women in their 40s were first or second children.

The fertility rate of the 15 to 19-year-old group increased between 1938 and 2004, from 14.7 to 26.9 births per 1,000 women. It peaked in 1971, at 50.6 births per 1,000 women.

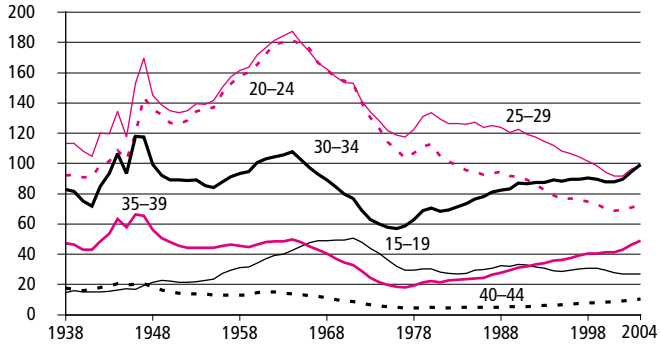
From 2002 onwards fertility rates have increased for women in all age groups, except those under 20. It is too early to say whether this is the start of a new trend. The rise in fertility among women in their 20s is a reversal of a long-term decline, but the reasons behind this change are not yet understood.

Figure 5.6

Age-specific fertility rates: females, 1938 to 2004

England and Wales

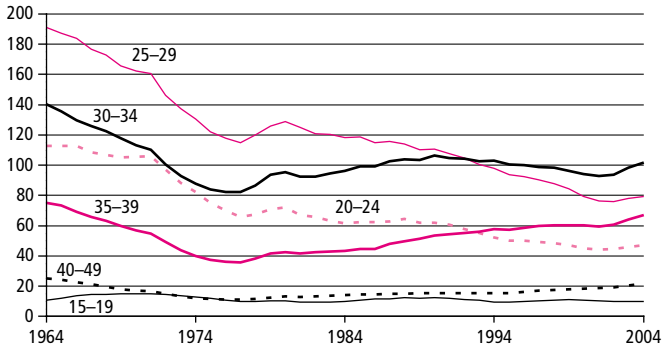
Births per 1,000 women



Age-specific fertility rates: males, 1964 to 2004

England and Wales

Births per 1,000 men



Age of fathers for sole-registered births were estimated - see appendix for more details.

Source: Office for National Statistics

Men, like women, are having children later. As for women, the fertility rates of men in their 20s has declined from the 1980s onwards, and those of men in their 30s has generally increased (Figure 5.6). In 2004 the highest fertility rate for men was for those aged 30 to 34 (at 101.9 children per 1,000 men).

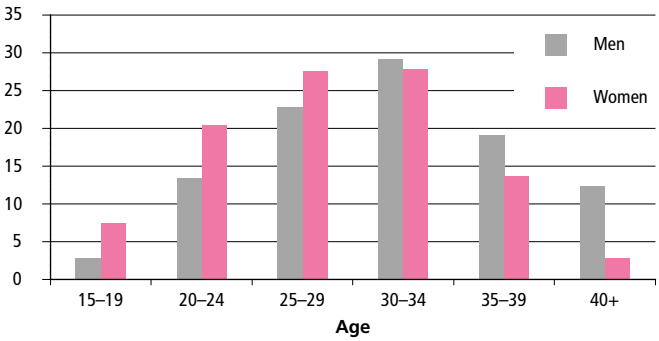
The age distribution of fertility for men leans more towards older age groups compared with that of women. In 2004, 61 per cent of the male TFR could be attributed to men aged 30 and over fathering children. The comparable figure for women was 44 per cent (Figure 5.7). In particular, the fertility of men aged 40 and over contributed 12 per cent of the TFR compared with only 3 per cent for women. The fertility rate of 15 to 19-year-old men has always been lower than for women of the same age and has remained below 15 children per 1,000 men, except in 1971 (Figure 5.6).

Figure 5.7

Percentage contribution to total fertility rate by age group, 2004

England and Wales

Percentage



Source: Office for National Statistics

Because women are having their children at older ages, over the last 30 years there has been a steady increase in their average (age-standardised mean) age at childbirth (Figure 5.8). The average age declined throughout the second half of the 1960s and early 1970s, reflecting the early childbearing that contributed to the 1960s' baby boom, and reached a low in 1974 of 26.4 years. Subsequently, every year there was an increase in women's mean age at childbirth, and in 2004 it reached 28.9 years.

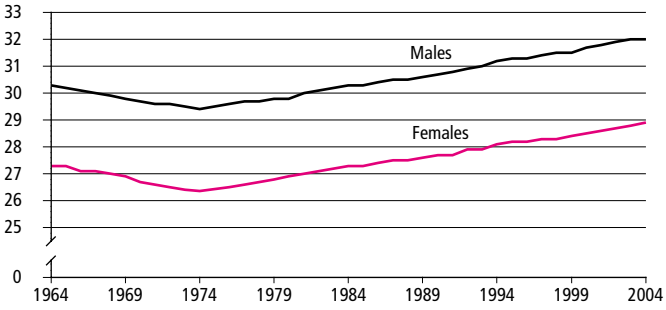
Men have followed the same trend for mean age at childbearing as women over the last 40 years, but their mean age at childbirth has always been around three years higher. This reflects the fact that the majority of births occur to married or cohabiting couples. Within marriage, the man is, on average, two years older than the woman, and cohabiting partners typically have a greater age difference than marital partners.[12]

Figure 5.8

Standardised mean age at birth: by sex, 1964 to 2004

England and Wales

Age (years)



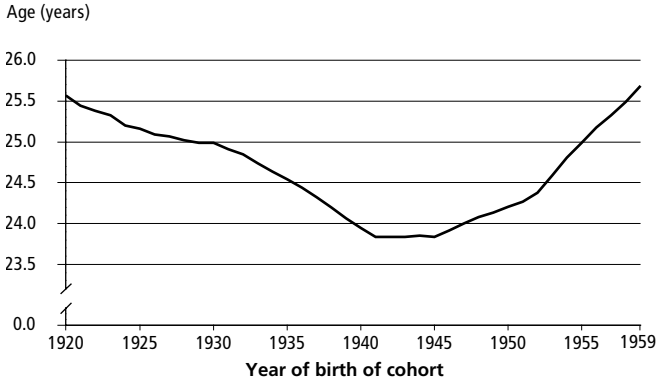
Source: Office for National Statistics

The average age at which women *commence* childbearing has also increased. From the 1946 cohort onwards, each successive generation of women postponed the start of their childbearing to older ages (Figure 5.9). The age-standardised mean age at first birth was 25.6 years for women born in 1920, the first cohort for which data are available, and fell for subsequent cohorts, reaching a low of 23.8 years for women born in the years 1941 to 1943. Women born in the first half of the 1940s would have started childbearing during the 1960s' baby boom. Thus the boom, in part, resulted from women starting childbearing earlier than previous cohorts. The mean age at first birth for the cohort who have most recently completed childbearing (those born in 1959) was 25.7 years, a return to the level of the 1920 cohort.

Figure 5.9

Standardised mean age of mother at first birth, 1920 to 1959 cohorts

England and Wales



Source: Office for National Statistics

Changes in family size and childlessness

Completed family size (CFS) is the average number of children born to a woman by the end of her childbearing years, and is a cohort measure of fertility. The average CFS in the UK declined from 2.45 children for women born in 1935 to 1.99 children for those born in 1959, the cohort to have most recently reached the end of their childbearing years. (See Box 5 for more information on CFS and how it compares to the TFR.)

In Northern Ireland the decline in CFS started later than in the other UK countries, occurring from the 1947-born generation onwards (Figure 5.10). Cohorts in Northern Ireland have also had larger families on average than women in other UK countries. In contrast, there has been little difference in CFS between England, Wales, and Scotland from the 1935-born generation to the most recent generation to complete childbearing.

The CFS of women who have most recently completed childbearing was below replacement level in the UK as a whole

Box 5

Completed family size and total fertility rate

Completed family size (CFS) is the average number of children born to a woman by the end of her childbearing years. The total fertility rate (TFR) is sometimes mistakenly used as a measure of family size. However, changes in the timing of childbearing between generations can distort the TFR. It will then not reflect the average number of children a cohort of women will have had by the end of childbearing (family size).

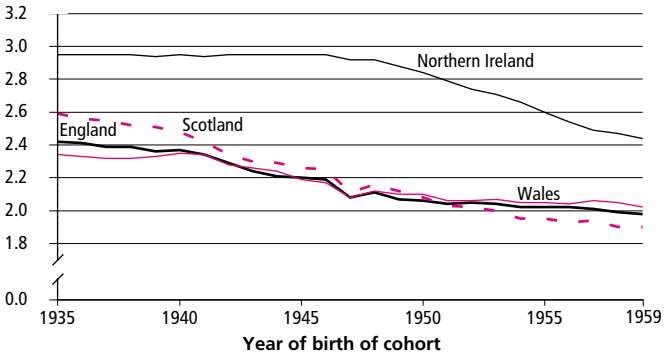
Currently, the TFR is likely to underestimate the average family size because women are delaying childbearing. It can also overestimate the average family size if women have children earlier in their childbearing years compared with previous generations, as happened during the 1960s' baby boom. However, the TFR is not actually intended to reflect completed family size but the current intensity of childbearing and the rate at which the population is replacing itself.

The disadvantage of CFS is that it may not reflect the family size of women still in their childbearing years because it is based on women who have completed childbearing. Therefore CFS does not provide a timely measure of family size.

Figure 5.10

Completed family size: by UK country 1935 to 1959 cohorts

UK countries



Source: Office for National Statistics

and in every constituent country, except Northern Ireland. Replacement level is the level of fertility required to replace the population. It is approximately equal to a CFS of 2.1 children per woman. Below-replacement fertility leads to population ageing and, in the absence of net in-migration, eventually to a decrease in population size.[5] (Replacement fertility is explained in Box 3.)

This measure of family size includes women who remained childless but it is also useful to assess family size for only those women who have had a child. Completed family size for women who have had children has remained stable for women born since the Second World War, at around 2.4 children per woman, it having declined from 2.70 for those born in 1930 (Table 5.11). Thus the common perception of an average family size of 2.4 children is true for women born from 1945 onwards who have had children.

Table 5.11

Completed family size: 1920 to 1959, selected cohorts

England and Wales

Year of birth	Completed family size of all women	Completed family size of women who had children
1920	2.00	2.53
1925	2.12	2.55
1930	2.35	2.70
1935	2.42	2.73
1940	2.36	2.66
1945	2.19	2.42
1950	2.07	2.39
1955	2.02	2.39
1959	1.98	2.42

Source: Office for National Statistics

The increase in the number of childless women is a notable recent trend in fertility. The proportion who were childless at the end of their childbearing years has increased from one in ten for women in England and Wales born in the 1940s to almost one in five for those born in 1959 (Table 5.12). This is the same level as for the 1920s-born cohort. The decline in the size of the families of women born from the mid-1930s onwards began because women were having fewer children, but has continued because the proportion of women remaining childless has increased.

Women born between 1930 and the early 1940s were less likely than those in previous and later cohorts to have remained childless, and more likely to have had larger families of four or more children. This is part of a set of childbearing behaviours shown by these cohorts. For example, they started childbearing at younger ages compared with previous cohorts. They were the cohorts that produced the 1960s' baby boom.

Data from the General Household Survey show that the proportion of women in their 20s intending to have fewer than two children increased slightly between 1978 to 1981 and the period 1998 to 2001. The result of this was a slight reduction in intended average family size.[8] Women are also delaying starting their childbearing to later ages. This can affect their ability to achieve their desired family size and may result in further declines in the average size of families.

Table 5.12

Distribution of women by number of children born, 1920 to 1959, selected cohorts

England and Wales Percentages

Year of birth	Number of children				
	0	1	2	3	4 or more
1920	21	21	27	16	15
1925	17	22	28	17	16
1930	13	18	30	19	20
1935	12	15	32	21	20
1940	11	13	36	22	18
1945	9	14	43	21	12
1950	14	13	44	20	11
1955	15	13	41	20	10
1959	18	13	38	20	11

Source: Office for National Statistics

Because delayed entry into motherhood is associated with a lower likelihood of going on to have another child, women who postpone childbearing may not be able to achieve the family size they intend. Other women may end up 'involuntarily' childless because their fecundity has declined before they can start a family. Analysis of British Household Panel Study data found that among childless women in their 30s who intended to start a family, only around a half had managed to do so in the subsequent six years.[13]

Fertility and country of birth

Recently the percentage of births to women born outside the UK has increased. In the 1980s and 1990s, around 12 to 13 per cent of births in England and Wales were to mothers born outside the UK. From 1998 onwards this percentage rose, and in 2004 almost 20 per cent of births were to non-UK born mothers.

This increase is likely to be due to changes in both population structure and fertility levels. The number of women living in England and Wales who were born outside the UK has grown, and this has largely been among women of childbearing age. In addition, these women have higher fertility than UK-born women and, as found among migrants in other countries, their fertility may be particularly high in the years immediately after arrival.

Since 1994 there has been net migration into the UK. Although some migrants stay for a few years only,[14] others come with their families, or form families after arrival, and settle. The proportion of women of childbearing age living in England and Wales who were born outside the UK rose from 6.9 per cent in 1971 to 11.5 per cent in 2001.

Women who are resident in England and Wales but were born outside the UK have higher average fertility than UK-born women (Table 5.13). The TFR for non-UK born women was 2.2 children per woman in 2001 compared with 1.6 for UK-born women. Women born outside the UK are a heterogeneous group and their fertility will vary over a range, with some groups having fertility above and some below their combined TFR. In 2001, women born in Pakistan had the highest TFR (4.7), followed by women born in Bangladesh (3.9).

Migrant women tend to commence childbearing at an earlier age than UK-born mothers.[15] They can also have a distinctive pattern of fertility, which can lead to their fertility being overestimated. Studies in several countries indicate that migrants often have lower fertility before they migrate than the women in their destination country. After migration, they often show a steep rise and peak in their fertility, followed by a decline. Their fertility may later become similar to that of native-born women.[16, 17, 18] This pattern may indicate a disruption effect whereby migrants compensate for births, and possibly the formation of partnerships, they postponed due to migration. It may also reflect a lower likelihood of women with already established or larger families to migrate compared with those with fewer or no children. Younger childbearing and the timing of births in relation to migration, combined with changes to immigration levels, can exaggerate the differences in TFRs between UK-born women and those from other countries.

Therefore the difference in family size at the end of childbearing for UK-born and non-UK born women may not be as large as indicated by period measures such as TFR. However, a French study found that, even after adjusting for the migrant fertility pattern described above, women born outside France still had a higher TFR than French-born women.[16] This suggests that there may be some residual difference between the fertility of UK-born and non-UK born women that cannot be explained by the timing of births around migration.

As well as differences in fertility between UK-born and non-UK born women, there are likely to be variations in TFR between ethnic groups. However, investigations are limited to analyses by parents' country of birth because ethnicity is not collected at registration. Further information on ethnicity and country birth in fertility analysis is available in the appendix.

Table 5.13

Total fertility rate: by country of birth of mother, 1991 and 2001

England and Wales

Country of birth of mother	1991	2001
Total	**1.8**	**1.6**
United Kingdom[1]	**1.8**	**1.6**
Total Outside UK	**2.3**	**2.2**
including:		
New Commonwealth	2.8	2.8
India	2.5	2.3
Pakistan	4.8	4.7
Bangladesh	5.3	3.9
East Africa	1.9	1.6
Rest of Africa[2]	2.7	2.0
Rest of New Commonwealth[3]	1.9	2.2
Rest of the World	1.9	1.8

1 Including Isle of Man and Channel Islands.
2 Includes countries listed under Southern Africa and Rest of Africa in Table A of Birth Statistics, series FM1 No. 32.
3 Includes countries listed under Far East, Mediterranean, Caribbean and Rest of New Commonwealth in Table A of Birth Statistics, series FM1 No. 32.

Source: Office for National Statistics, FM1 Table 9.5

Childbearing and marital status

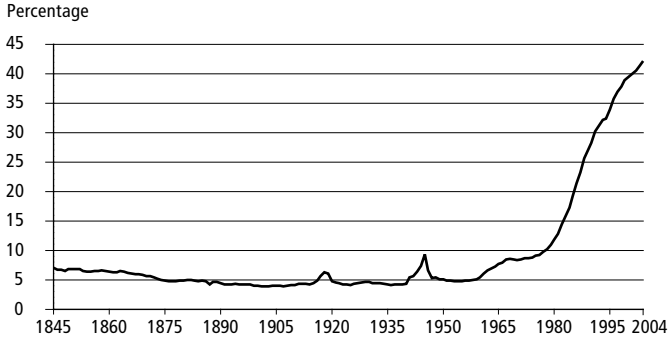
In 2004 the majority (58 per cent) of all births in the UK took place inside marriage, 35 per cent were registered outside marriage by both parents and 7 per cent were registered outside marriage by the mother alone.

The proportion of births taking place outside marriage in England and Wales was relatively low, at between 4 and 7 per cent until the 1960s (Figure 5.14). This is with the exception of a spike around the Second World War. From the 1960s onwards the proportion of births taking place outside marriage has risen and there have been rapid increases from the late 1970s. This has been due to shifting social norms, including the greater acceptability of cohabitation, for both men and women, and having children outside marriage. Even though most births still take place within marriage, childbearing has continued to become less strongly associated with marriage over the last three decades.

Figure 5.14

Births occurring outside marriage: 1845 to 2004

England and Wales



Source: Office for National Statistics

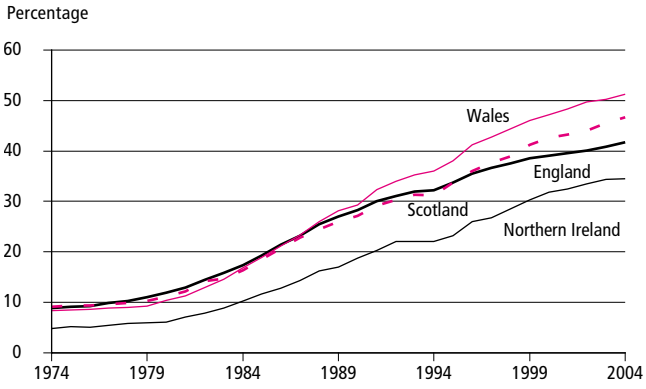
In 2004 Wales had the highest proportion (51 per cent) of births outside marriage, having seen a steep rise throughout the 1980s (Figure 5.15). In 2004, 47 and 42 per cent of births in Scotland and England respectively happened outside marriage. The difference between Scotland and England largely reflects the steeper increase in the percentage of births outside marriage in Scotland since 1994. Northern Ireland has had the lowest proportion of births outside marriage of the four UK countries throughout the last three decades (35 per cent in 2004).

Most of the rise in births outside marriage has been due to births to cohabiting couples rather than lone mothers. Over three-quarters (76 per cent) of births outside marriage that were jointly registered in the UK in 2004 were to parents living at the same address. This is taken as a proxy indicator of cohabitation because neither cohabitation nor lone parenthood are recorded in the birth registration process. Births to lone mothers may be registered solely by the mother but they may also be registered by both parents. Sole-registered and jointly registered births where the parents are living at separate addresses are taken as an indicator of lone parenthood at birth.

Figure 5.15

Births occurring outside marriage: 1974 to 2004

UK countries



Source: Office for National Statistics

As discussed, the age at which people marry or start a cohabitation that leads to marriage has risen. In 1966 the average (mean) age at which women in England and Wales first married was 22.5 years. In 2003 it had risen to 28.9 years. This shift to later ages at marriage has implications for the age at which women begin to form families and the size of family they are able to achieve.

Mortality

This section examines the fall in mortality that occurred over the 20th century and how it varied between the UK countries and different age groups. It also looks at how differences between male and female mortality rates have changed over time, and compares the survival rates and life expectancy of different generations. The analysis is based on mortality from all causes. There is a more detailed analysis, showing the different causes of death, in *Focus on Health*.[19]

Because the age distribution of a population affects its overall mortality, age-specific and age-standardised mortality rates are used here (Box 6). This allows comparisons of mortality over time and between countries without the results being affected by the populations' differing age structures.

Changes in mortality rates over time

Mortality has been declining in the UK since the 18th century but the greatest decline occurred in the 20th century, especially for infants.[20] Mortality rates fell for all age groups during the 20th century. This means that people alive at the start of the 21st century are much more likely to survive to older ages than those alive around the turn of the previous century.

In the first half of the 20th century, the fall in mortality occurred predominantly among babies and children. In the second half, mortality also fell for adults, with deaths occurring at increasingly later ages for successive generations.

This fall in mortality is associated with the decline of infectious diseases, such as tuberculosis, as the leading causes of death and reflects improvements in both medicine and living conditions. Prior to this the main reasons for declining mortality were improved living conditions, including advances in nutrition, sanitation, housing and working conditions.[21]

There were notable annual fluctuations in the decline in mortality during the 20th century in England and Wales, but these have been diminishing since the 1950s (Figure 5.16). The

Box 6

Glossary of mortality terms

Age-specific mortality rate – the number of deaths in a year of males or females aged *x*, per thousand males or females aged *x* in the mid-year population. It is calculated as:

$$\text{Age-specific mortality rate} = \frac{\text{deaths in age/sex group}}{\text{mid-year population of age/sex group}} \times 100{,}000$$

Age-standardised mortality rate – the expected mortality rate when the observed age-specific mortality rates are applied to a given standard population.

A comparison of crude mortality rates may present a misleading picture when comparing populations because of differences in their respective sex and age structures. Age-standardised rates make allowances for differences in the age structure of a population over time and between sexes. The age-standardised mortality rate is the number of deaths (per 100,000 people) that would have occurred if the observed age-specific mortality rates had applied in a given standard population.

In this chapter the European Standard Population was used for standardisation. This is a hypothetical population standard, which is the same for both males and females, allowing standardised rates to be compared for each sex and between sexes.

Infant mortality rate – the number of deaths of infants aged between 0 and 1 in a year per 1,000 live-births in the same year. It is calculated as:

$$\text{Infant mortality rate} = \frac{\text{deaths of infants aged under 1}}{\text{number of live-births}} \times 1{,}000$$

Life expectancy – the average number of additional years a person would live under a given set of mortality conditions. This can be calculated on a period or cohort basis (see Box 7).

peak in mortality in 1918, which interrupted the general declining trend, was due to an influenza outbreak that occurred after the end of the First World War.

There were spikes in the mortality rate around the time of both World Wars, but these must be interpreted with caution. Deaths in the armed forces occurring in England and Wales were included in the figures for the years of the First World War but not the Second. And the deaths in the armed forces that happened overseas were not included in the figures for either war.[20] Therefore wartime rates refer, on the whole, to the civilian population. The spikes partly reflect that the population was depleted of healthy individuals.[22]

Over the last 30 years mortality has declined for all UK countries but there have been differences between them. Since 1981 the highest mortality rate has been in Scotland (Figure 5.17). In the 1970s, Northern Ireland had a similar level of mortality to Scotland. But mortality in Northern Ireland declined more steeply than in Scotland during the early 1980s. In 2003 Northern Ireland's age-standardised mortality rate was similar to that of England and Wales.

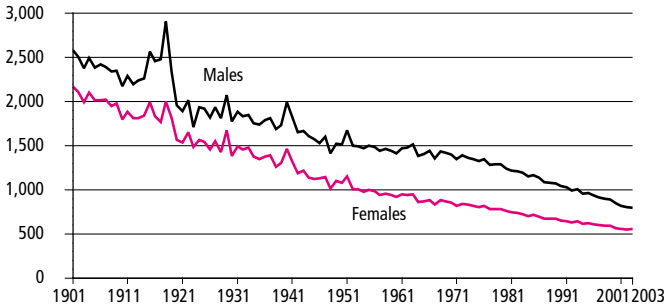
One factor that has been linked to Scotland's poor mortality status is deprivation.[23] However, deprivation explains less of the gap in mortality between Scotland and England and Wales now than it did in the early 1980s. The excess of deaths in Scotland that is not accounted for by deprivation has been referred to as the 'Scottish effect'.[23]

Figure 5.16

Age-standardised annual mortality rate: by sex, 1901 to 2003

England and Wales

Age-standardised rate per 100,000

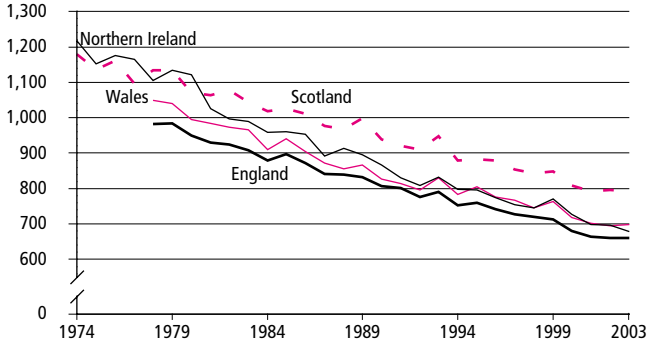


Source: Office for National Statistics

Figure 5.17

Age-standardised annual mortality rate, 1974 to 2003

UK countries



Source: Office for National Statistics

Age patterns of mortality

The overall decline in mortality during the 20th century in England and Wales (Figure 5.16) was accompanied by large changes in the age distribution of deaths. The decline in infectious diseases meant that mortality at young ages decreased hugely and became increasingly concentrated at older ages. This was associated with a rise of chronic diseases (for example, coronary heart disease) as the main cause of death. These diseases take a lifetime of exposure to different risk factors to manifest themselves so mainly occur at older ages.

Whatever the prevailing mortality rate, the first year of life is one of high risks. This is particularly true at the time of birth and immediately following it. Infants aged less than a year old have a higher risk of dying than other children. Therefore, infant mortality is often examined separately from overall and child mortality.

The infant mortality rate (IMR, see Box 6) has declined dramatically over the course of the last century in England and Wales (Figure 5.18). The decline began abruptly around the early 1900s, with rates having been stable before this.[20] In 1901 the IMR for boys was 165.6 infant deaths per 1,000 live births. By 1950 the male IMR had declined to 33.6 deaths per 1,000 live births. In 2003 it was 5.7 deaths per 1,000 live births. The female IMR has followed the same trend, but has always been slightly lower. As the IMR has declined, the difference between male and female infant mortality rates have narrowed.

The peaks in infant mortality in the early part of the 20th century coincided with hot summers when diarrhoeal disease played a part in many deaths.[20] There was a period of accelerated decline in IMR immediately after the Second World War. This could have been due to the national food policy, which concentrated on the health of expectant mothers, infants and children.[20] It may also have been associated with the use of antibiotics or other improvements in social conditions.[22] Since the 1970s, there have been further marked improvements.

The reduction in the infant mortality rate has been a major factor in the overall increase in life expectancy of the last century. The rate gives an indication of child-rearing behaviour, sanitation, health and communities at risk, as well as overall levels of social and economic development.[24] As such, it is often used as a measure of the level of 'development' of a country. Chapter 10 discusses infant mortality rates and life expectancy in the countries of the European Union.

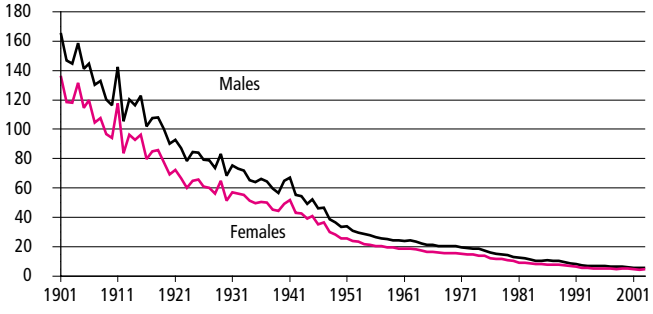
Mortality has fallen in both sexes and across all age groups over the 20th century. In particular, there was a large and steady decrease in the 1 to 14-year-old mortality rate (Figure 5.19). The age-standardised rate for this age group declined from 883 deaths per 100,000 males in 1901 to 16 deaths per 100,000 in 2003. Over the same period, the age-standardised rate for females declined from 863 deaths per 100,000 females to 15 deaths per 100,000.

Figure 5.18

Infant mortality rate: by sex, 1901 to 2003

England and Wales

Deaths of under ones, per 1,000 live births



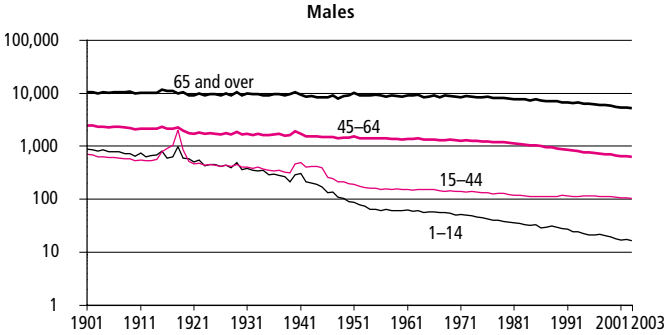
Source: Office for National Statistics

Figure 5.19

Age-standardised age-specific mortality rates: by sex and age group, 1901 to 2003

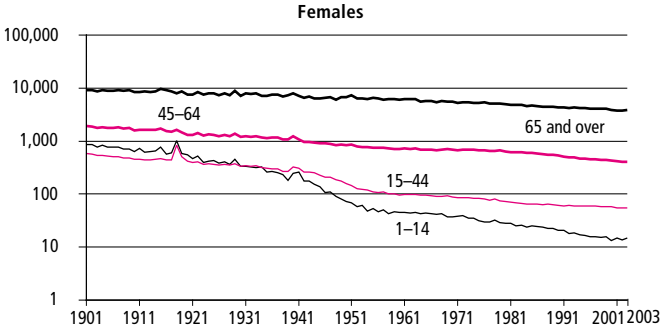
England and Wales

Age standardised rate per 100,000 (log scales)



England and Wales

Age standardised rate per 100,000 (log scales)



The age-specific mortality rates have been presented on a log scale because the data cover a large range of values and the log scale reduces this to a more manageable range.

Source: Office for National Statistics

The mortality rate for 15 to 44-year-olds was similar to the mortality rate for children in 1901 and, until the 1940s, both were declining at a similar rate. The decrease in 15 to 44-year-old mortality slowed during the 1940s, compared with child mortality and, over the last 20 years, has levelled off. In 2003 the mortality rate for 15 to 44-year-olds was 103 deaths per 100,000 for males and 55 deaths per 100,000 for females.

Falls in the mortality of adults aged 45 to 64 happened throughout the 20th century for women, but began only in the second half of the century for men. The decline in the mortality rates of men and women aged 65 and over followed the same pattern.

Since the early 1970s, the mortality rate at very old ages (aged 85 and over) has also been declining, for both men and women. Between 1970 and 2003 it fell from 25,110 deaths per 100,000 to 19,042 for men and from 20,038 deaths per 100,000 to 16,576 for women. However, because mortality rates at younger ages have declined to low levels, deaths have become more concentrated at very old ages. Consequently, the contribution of deaths at very old ages to the overall mortality rate has increased. Between 1983 and 2003 deaths at age 85 and over increased from 19 to 24 per cent of all deaths for males and from 24 to 30 per cent for females. (Because death counts have been standardised, these findings reflect changes in mortality at older ages, excluding the effects of the ageing of the population).

Sex differences in mortality

Females had a lower overall mortality rate than males throughout the 20th century (Figure 5.16). The sex differential started widening after the Second World War but narrowed from the mid-1970s onwards. This may be due to changes in smoking trends among men and women. Smoking influenced many of the major causes of death in the UK after the Second World War, for example, heart disease, lung cancer and respiratory diseases.[20] Since 1900 a larger proportion of men than women have smoked cigarettes, which has elevated men's risk of death and contributed to the sex differential in mortality.[26] Women, however, increased their cigarette smoking after the Second World War, which may account for the decreased sex differential from the mid-1970s onwards.

Smoking patterns do not account for the whole gender gap, since non-smoking males still have lower life expectancies than non-smoking females.[26] Other lifestyle differences between men and women, such as alcohol consumption and dietary patterns,[27] are also likely to contribute to the sex differential. Biological differences, for example the role of sex hormones in the risk of heart disease and degenerative diseases, may also play a part.[27, 28, 29]

The difference between male and female mortality rates is explored further in Figure 5.20, which looks at the sex ratio of mortality rates for different age groups. For example, a ratio of 1.5 indicates that male mortality rates are 1.5 times, or 50 per cent higher than, female rates.

Females had lower mortality than males in every age group throughout the 20th century, with the exception of 1 to 14-year-olds in 1918. The sex ratio for the mortality rate of infants has stayed around the same over the last century but, for those aged 1 to 14, it has increased since 1901. For both age groups, the fluctuation in the sex ratio increased over the 20th century as the number of deaths in each group fell to low levels.

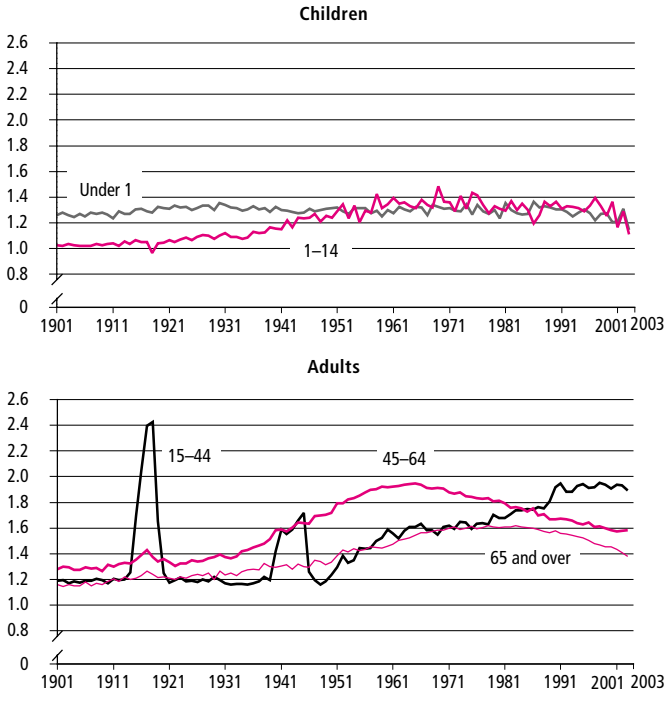
After the Second World War, the sex difference in mortality of 15 to 44-year-olds increased. In 2003 male mortality was 1.9 times, or 90 per cent higher than, female mortality for this age group. Some of this is due to differences in male and female mortality resulting from accidents.[27] The decline in maternal mortality (deaths of mothers up to a year after childbirth) since the mid-1930s onwards in England and Wales might also have played a role in widening the sex gap at reproductive ages.[27] However, the level of mortality among 15 to 44-year-olds is low and so the sex difference does not represent a large number of excess male deaths over female deaths.

Figure 5.20

Sex ratio of mortality rates by age groups, 1901 to 2003

England and Wales

Ratio of male to female death rates



Source: Office for National Statistics

The sex difference for the 45 to 64-year-old group rose between the early 1930s and mid-1960s, before falling. This is likely to be due to the effect of the changes in smoking trends on different cohorts of men and women. The ratio of mortality rates for men and women aged 65 and over followed a similar pattern of an increase followed by fall, in part due to the same cohort effect.

Cohort survival

Changes in mortality rates throughout the 20th century have meant that people's chances of survival to any age have improved. This also means that their life expectancy has increased. The analysis of survival and life expectancy here has been done on a cohort basis, that is, for different generations of men and women. The calculations were based on mortality data up to age 110. Thus for the cohorts born from 1893 onwards, the data include an increasing element of projection for survival beyond their current ages.

Changes in survival between different ages have led to the changes in the age distribution of mortality described in the previous section. As infant mortality has declined, so the chance of survival to age 1 has increased over generations. The chance of surviving to one's first birthday was unchanged between 1851 and 1901 (at 83 per cent for males and 86 per cent for females) (Table 5.21). For those born in 1951 the chance of surviving to age 1 had increased to 97 per cent for both males and females. The increased chance of survival for women between ages 65 and 85 has been particularly marked, rising 48 percentage points between the 1851 and 1951 cohorts.

Table 5.21

Percentage chance of survival between selected ages: selected birth cohorts

England and Wales

	Male			Female		
	1851	1901	1951	1851	1901	1951
0–1	*83*	*83*	*97*	*86*	*86*	*97*
1–15	*81*	*89*	*99*	*79*	*89*	*99*
15–65	*45*	*64*	*86*	*53*	*77*	*91*
65–85	*11*	*17*	*55*	*18*	*37*	*66*
65–100	*0*	*0*	*6*	*0*	*1*	*9*

Areas of the table that are shaded are based on projected mortality.

Source: Government Actuary's Department Mortality Database (Author's own calculations)

Figure 5.22 shows the percentage chance of survival to each exact age for a cohort. For example, the age to which males born in 1851 had a 50 per cent chance of survival was 45. This increased for the 1901 cohort to approaching age 64 and is projected to be around age 83 for men born in 1951. For females the age to which there was a 50 per cent chance of survival increased from 50, to 72 and to over 87 for the 1851-, 1901- and 1951-born generations respectively.

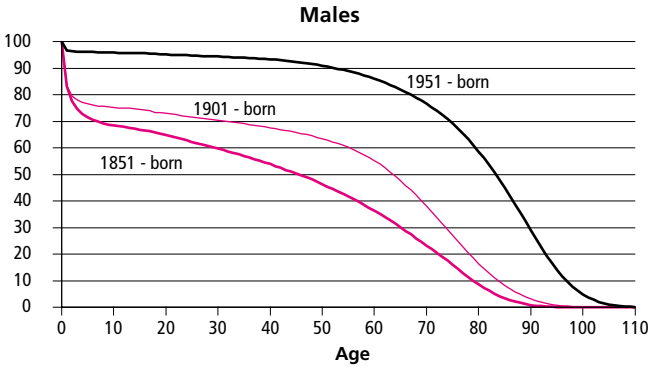
Figure 5.22 also illustrates how mortality has become concentrated at older ages over the last two centuries. This reflects the tendency over time, as a country develops, for the chance of survival to younger and middle ages to approach 100 per cent and to decline only in the oldest ages. The decline in infant mortality is apparent from the absence of the sharp drop between age 0 and age 1 for the 1951 cohort compared with the 1851- and 1901-born generations. A comparison of the survival curves for each of the 1951, 1901 and 1951 cohorts shows the move from a curved shape to a more rectangular one, as survival to early middle age is now almost certain.[21]

Figure 5.22

Percentage chance of survival to exact age: selected cohorts, by sex

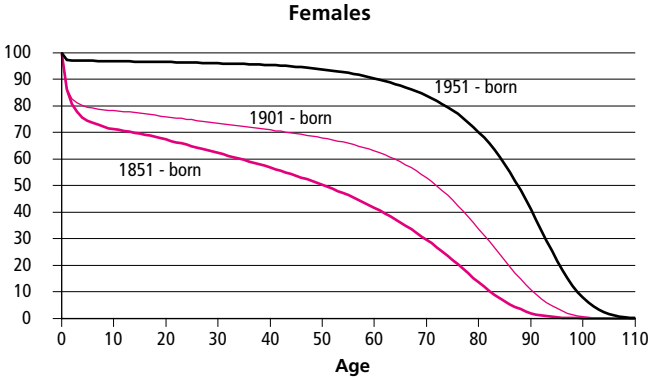
England and Wales

Number alive out of each 100 born



England and Wales

Number alive out of each 100 born



Source: Government Actuary's Department Mortality Database (Author's own calculations)

Cohort life expectancy

Life expectancy at birth in England and Wales increased substantially from generations born in the mid-19th century to the 1951-born cohort (Figure 5.23). For people born in 1851 expectation of life at birth was years 40.2 for males and 43.6 years for females. This is projected to increase to 77.3 years for males and 82.1 years for females born in 1951.

Cohort life expectancy is the average number of additional years a member of a cohort would live based on the mortality rates the cohort has experienced or is projected to experience. (See Box 7 for more information on cohort and period life expectancy.) Life expectancy at *birth* is not a guide to the remaining expectancy of life at any given age, so it is informative to look at the expectation of life at other ages.

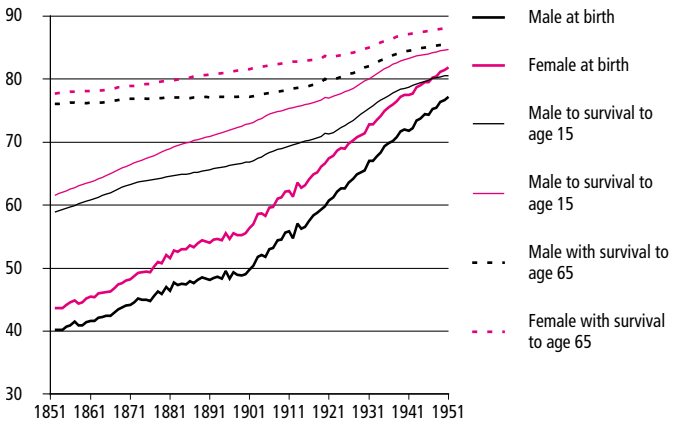
For generations born during the 19th century when infant and childhood mortality was high, the differences between life expectancy at birth and life expectancy at ages 15 or 65 were very wide (Figure 5.23). As infant and childhood mortality declined, the gap between life expectancy at birth and life expectancy at older ages narrowed. For the 1851-born generation life expectancy at age 65 (including years lived) was 76.0 years for males. For males born in 1951 it is projected to be 85.7 years. The gap between life expectancy at birth and life expectancy at age 65 (including years lived) is therefore projected to narrow from around 36 years for males born in 1851 to eight years for those born in 1951. Female life expectancy is projected to follow a similar pattern to this.

Figure 5.23

Life expectancy by sex: at selected ages and selected birth cohorts

England and Wales

Years (including years lived)



Source: Government Actuary's Department Mortality Database (Author's own calculations)

Box 7

Period and cohort life expectancy

The expectation of life at birth is a commonly used summary measure of mortality rates. Life expectancy can be presented on a period or cohort basis. Period life expectancy is the average number of additional years a person would live if they experienced the age-specific mortality rates of a particular year throughout their life.

Cohort life expectancy is the average number of additional years a member of a cohort would live based on the mortality rates the cohort has experienced or is projected to experience. Because improvements in mortality happen over the life of a cohort, period life expectancy at birth cannot be taken as an estimated average age at death for the generation born in that year.

Life expectancy at birth represents the average of the individual life expectancies of all people born in the same year. It is therefore an average of all their ages at death. Consequently, life expectancy at birth is not a guide to the remaining expectancy of life at any given age. For example, if male life expectancy at birth for a population is 80 years, the life expectancy of men aged exactly 80 would not be zero. Similarly, remaining life expectancy for those aged 75 would exceed five years. This reflects the fact that survival from a particular age depends only on the mortality rates beyond that age, whereas survival from birth is based on mortality rates for all ages.[31]

For the generations born up to and at the start of the 20th century the main increases in life expectancy at birth were due to the decline of infant mortality, and to some extent child mortality, rather than increased survival at older ages. This can be inferred from the shallow rates of increase in life expectancy for men and women who survived to age 65. For later cohorts, it is worth noting that, although life expectancy at age 65 has not increased greatly, the number of men and women surviving to age 65 has (Figure 5.22).

Further analysis of life expectancy at birth by social class and by local authority is presented in *Focus on Social Inequalities*.[30] This also features standardised death rates and infant mortality by social class.

Summary

Throughout the last century there have been large changes in fertility and mortality in the UK. Fertility trends have been more variable than mortality trends. There have been several periods

of high fertility (baby booms) but also of low fertility. The last 30 years have seen low fertility rates and notable changes in childbearing behaviour. These include a decrease in average completed family size; an increase in childlessness; postponement of childbearing to older ages; and an increase in the percentage of births occurring outside marriage. Migration has also played an increasingly important role in fertility. The percentage of births occurring to women born outside the UK has grown, reflecting the rise in the number of women of childbearing age born overseas and their higher fertility rates.

There has been an increase in longevity, with falls in mortality at every age. As a result, mortality has become concentrated at (ever) older ages. Infant mortality has declined steeply and is now at a very low level. Childhood mortality has also fallen, and continues to do so, while the decline in young adult mortality has levelled off. Since the 1950s there have been improvements in survival to pensionable age and to very old ages.

The shift to mortality at older ages combined with the decline in fertility has caused the UK population to age. This has led to rises in the median age of the population and in the proportion of the population aged 65 or over, as noted in Chapter 4. Currently, population momentum means that there are still more births than deaths each year, and so natural increase occurs. But it is likely that current and future fertility and mortality trends will result in the UK experiencing natural decrease in the 21st century.

Notes and references

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