

2006-based national population projections for the UK and constituent countries

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The 2006-based national population projections, carried out by the Office for National Statistics in consultation with the devolved administrations, show the population of the UK rising from 60.6 million in 2006, passing 65 million in 2016 and 70 million in 2028, to reach 71.1 million by 2031. In the longer-term, the projections suggest that the population will continue rising beyond 2031 for the full length of the projection period. The population will become older with the median age expected to rise from 39.0 years in 2006 to 41.8 years by 2031. Since the last projection round legislation has been passed to increase the state pension age from 65 to 66 for both sexes between 2024 and 2026. Despite this change, the number of people of working age for every person of state pensionable age will reduce from 3.32 in 2006 to 2.91 by 2031. The legislation includes further increases in the state pension age to 68 for both sexes by 2046.

Introduction

The Government Actuary's Department (GAD) had produced the official national population projections for the UK and its constituent countries since 1954. However, on 31 January 2006, responsibility for the production of national projections transferred to the Office for National Statistics (ONS). The 2006-based national population projections are the first projection set produced within the ONS. The approach used has remained unaltered since the transfer of the work.

The principal projection and the key variant projections were published simultaneously on 23 October 2007, with additional variants published on 27 November 2007. Key results from the principal projection are available on the National Statistics website.¹ Full details, including variant projections, are currently only available on the GAD website.² It is planned that the full projection results will be added to the National Statistics website during 2008.

The projections were produced by ONS on behalf of the Registrars General of England & Wales, Scotland and Northern Ireland. The underlying assumptions were agreed in liaison with the devolved administrations, following consultation with key users of projections in each country and advice from an expert academic advisory panel.³

The projections use an internationally accepted standard cohort component methodology involving ageing on the population, adding projected births, subtracting deaths and adding assumed numbers of net migrants.

Normally, a new 'full' set of projections is made every second year, based on a full-scale review of the underlying assumptions about fertility,

mortality and migration. The previous full set of projections, published on the GAD website in October 2005, was 2004-based.⁴ The next full set of projections, scheduled for issue in October 2009, will be based on the estimated population at mid-2008.

The availability of subnational projections is discussed in Box One.

Box one Subnational projections

Subnational population projections are the responsibility of the statistical offices of the individual countries. ONS expects to publish mid-2006 based projections for England, consistent with the national projections, in June 2008. Both the General Register Office for Scotland and the Northern Ireland Statistics and Research Agency have recently published 2006-based subnational projections, consistent with the national projections described in this article, on 22 January 2008⁵ and 28 February 2008 respectively.⁶ The Welsh Assembly Government Statistical Directorate issued regional 2003-based population projections in June 2005, and in conjunction with local authorities and other interested parties in Wales, has reviewed the provision of future subnational projections. They intend to publish local authority projections using a different methodology by summer 2008.

Projection period

The main focus of these projections is on the 25 years to 2031. However, the results of longer-term projections are included in the graphs in this article and discussed where appropriate. In the detailed results available on the National Statistics and GAD websites, the projections are carried forward for 75 years (i.e. to 2081) for all countries. In previous projections, results were published up to 70 years ahead. However, the long-term figures should be treated with great caution. Population projections become increasingly uncertain the further they are carried forward, and particularly so for smaller geographic areas.

Table 1 Population change 2004–2006: actual change compared with 2004-based projected change, UK

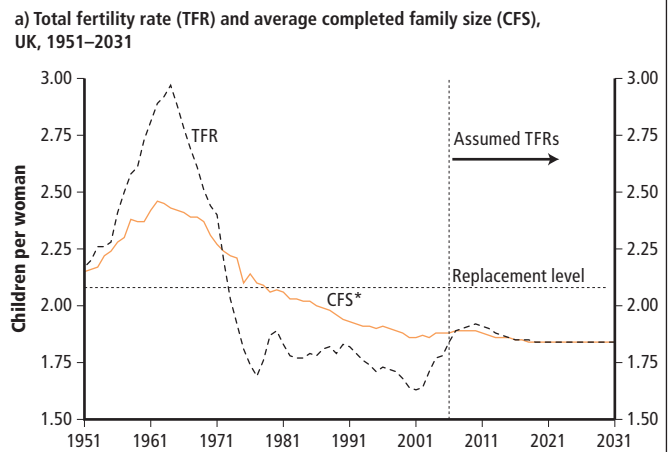
	Mid-year estimates (000s)	2004-based projections (000s)	Difference	
			000s	%
Population at mid-2004	59,846*	59,835	11	0.0%
Components of change (2004–2006)				
Births	1,452	1,428	24	1.7%
Deaths	1,166	1,180	-14	-1.2%
Natural change	286	248	39	--
Net migration & other changes	455	450	5	--
Total change	742	698	44	--
Population at mid-2006	60,587	60,533	55	0.1%
England	50,763	50,714	49	0.1%
Wales	2,966	2,977	-11	-0.4%
Scotland	5,117	5,108	8	0.2%
Northern Ireland	1,742	1,733	9	0.5%

*Following the publication of the 2004-based projections, the mid-2004 estimates on which they were based were revised downward by 1,000 in December 2005 and upward by 12,000 in August 2007

Base population

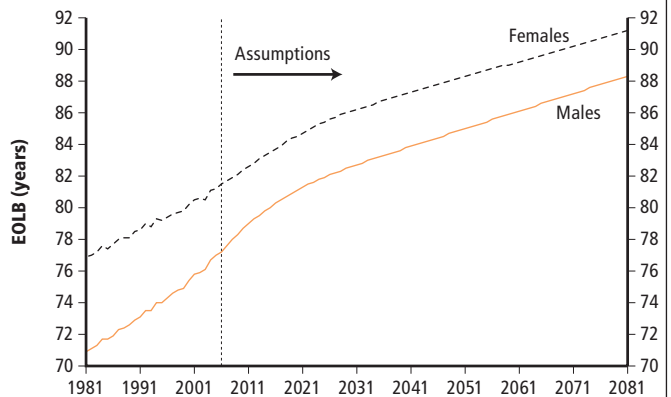
The projections are based on the Registrars General's estimate (published on 22 August 2007) of the resident population of the UK at mid-2006 of some 60.6 million.⁷ This estimate therefore takes account of the revisions to the mid-2002 to mid-2005 populations of England and Wales also published on 22 August 2007.

Figure 1 Assumptions for the 2006-based national population projections



*CFS relates to cohort born 28 years earlier – 28 years being roughly the mean age at childbearing. Projected CFS is given for cohorts who have not yet completed childbearing

(b) Period expectation of life at birth, UK, 1981–2081



(c) Total net migration, UK, 1991–92 to 2021–22

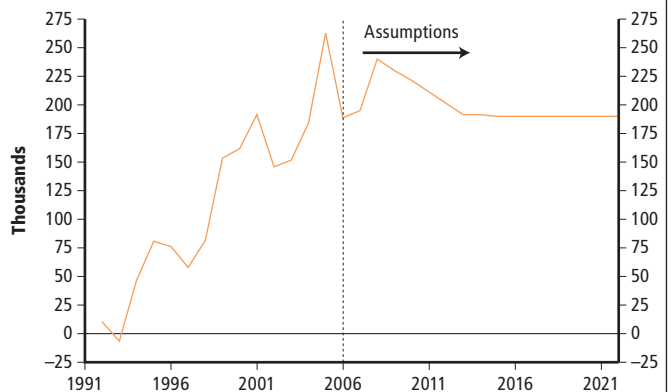


Table 2

Summary of assumptions for individual countries

	Total fertility rate			Net annual migration (000s)		
	2006–7	2010–11	from 2020–21	2006–07	2010–11	from 2014–15
England	1.90	1.93	1.85	153.5	189.4	171.5
Wales	1.86	1.92	1.85	11.0	10.0	9.5
Scotland	1.70	1.73	1.65	20.5	10.5	8.5
Northern Ireland	1.97	1.99	1.95	10.0	1.5	0.5
UK	1.89	1.92	1.84	195.0	211.4	190.0

	Period expectation of life at birth (years)							
	Males				Females			
	2006–07	2010–11	2020–21	2030–31	2006–07	2010–11	2020–21	2030–31
England	77.6	79.1	81.5	82.9	81.9	82.7	84.8	86.3
Wales	77.3	78.6	80.9	82.4	81.6	82.2	84.4	85.9
Scotland	75.0	76.5	78.9	80.4	79.9	81.0	83.2	84.8
Northern Ireland	76.2	78.3	80.7	82.2	81.2	82.4	84.5	86.0
UK	77.3	78.8	81.2	82.7	81.7	82.5	84.6	86.2

As Table 1 shows, the estimated population of the UK at mid-2006 was 55,000 (0.1 per cent) higher than envisaged in the 2004-based projections. This is largely explained by a combination of three factors: an underprojection of births during 2004–06 (24,000), an overprojection of deaths (14,000) and the subsequent upward revision to the mid-2004 population (11,000) on which the previous projections had been based. There were differences at individual country level, with Wales having an estimated population at mid-2006 that was 11,000 (0.4 per cent) lower than expected from the 2004-based projections. The three remaining countries were all underestimated overall, with the greatest relative error being for Northern Ireland where the actual mid-2006 population was 0.5 per cent higher than projected.

Underlying assumptions

The assumptions used in the 2006-based national population projections are shown, for the UK as a whole, in Figure 1, while those for the individual countries are summarised in Table 2.

Fertility

Fertility assumptions are formulated in terms of the average number of children that women born in particular years will have. This *cohort* measure of fertility is more stable than the analogous calendar year or *period* measure (the total fertility rate), as it is affected only by changes in the total number of children women have and not by the timing of births within their lives. Period rates, in contrast, may rise or fall if births are brought forward or delayed for any reason. The assumed average completed family sizes and resultant total fertility rates (TFRs) are both shown in Figure 1a, while the TFRs for individual countries are summarised in Table 2.

The assumptions about completed family size are based on family building patterns to date and other relevant evidence (see separate article in this issue of Population Trends).⁸ For the UK as a whole, completed family size has been falling steadily from an average of around 2.45 children for women born in 1935 to 1.96 children for those born in 1961, the most recent cohort to have effectively reached the end of their childbearing years. The family sizes to be achieved by younger cohorts are highly conjectural. For this projection it has been assumed that average completed family size, for the UK as a whole, will continue to decline gradually until around the 1990 cohort and eventually level off at 1.84 children per woman.

For England, and for Wales, long-term average completed family size is assumed to be 1.85 children per woman. A higher level of 1.95 is assumed for Northern Ireland where fertility remains higher than elsewhere in the UK. In Scotland, where current fertility levels are relatively low and differentials with the rest of the UK are now long established, a lower level of 1.65 has been assumed. These long-term assumptions have been increased, by varying degrees for each country⁸, from the 2004-based projections. The long-term UK fertility assumption in official national projections has been lowered on a number of occasions since the 1960s baby boom,⁹ but this is the first time it has been increased during that period. The long-term UK fertility assumption of 1.84 children per woman is the highest since it was reduced from 1.90 to 1.80 in the 1994-based projections. However, despite the increase for these projections, the long-term assumption remains well below 'replacement level' (see Box four).

The last four years have seen increases in total fertility rates¹⁰ in all countries of the UK to levels significantly above the long-term assumptions made for the 2004-based projections. The 2006-based projections assume that the total fertility rate continues to increase until 2010 then falls slightly to the newly elevated long-term levels.

Mortality

The 2004-based projections assumed that mortality rates at each age would converge to a common rate of improvement of 1 per cent a year at 2029 and continue to improve at that constant rate thereafter. The average annual rate of improvement over the whole of the 20th century was around 1 per cent for both males and females, although the improvement rates vary by age. There continues to be considerable debate as to whether the impact of future lifestyle, medical and technological changes will have a greater or lesser impact in the future than they had over the 20th century. Taking these various factors into consideration it was decided, for the new projections, to again assume an improvement rate of 1 per cent a year for most ages from 2031 onwards.

However, those born in the period 1923–1940 have experienced greater rates of improvement in the last 25 years than those born before or after. There is no evidence of this differential declining, so the 2006-based projections assume that these cohorts will continue to experience rates of improvement above 1 per cent after 2031. It is now assumed, therefore, that annual rates of mortality improvement after 2031 will rise from 1 per cent for those born before 1923 to a peak of 2.5 per cent for those born in 1931 and then decline back to 1 per cent for those born in 1941 and later.

Short and medium term period life expectancies are generally higher than in the previous projections, partly because of lower starting levels of mortality caused by higher than expected falls in mortality in 2004 and 2005. By 2031 period UK expectation of life at birth is around 1.3 years higher for males and 1.2 years higher for females in the 2006-based projections than in the previous projection round. Beyond 2031, the differential increases slightly further because of the more optimistic assumption for the 1923 to 1940 cohorts (as described above).

As the projected age-specific annual rates of improvement prior to 2031 are generally higher than 1.0 per cent, this produces averaged annualised rates of mortality improvement in age standardised mortality rates for ages 0 to 99 of around 1.4 per cent for both males and females over the whole 75 year projection period. As the following table shows, the new projections generally assume slightly higher average rates of improvement for the future than experienced over corresponding periods in the past.

Actual and assumed overall average annual rates of mortality improvement

	Males		Females	
	Past (actual)	Future (assumed)	Past (actual)	Future (assumed)
Last/next 24 years	2.1%	2.1%	1.5%	2.2%
Last/next 44 years	1.5%	1.6%	1.3%	1.6%
Last/next 74 years	1.2%	1.4%	1.3%	1.4%

Note: Analysis relates to England & Wales and shows average annual rates of improvement in age standardised mortality rates for ages 0 to 99. Historic estimates are based on comparison of the 2004–06 interim life tables with English Life Tables for 1930–32, 1960–62 and 1980–82.

For the UK as a whole, period life expectancy at birth, based on the mortality rates for the given year, is assumed to rise from 77.3 years in 2006–07 to 82.7 years in 2030–31 for males, and from 81.7 years to 86.2 years for females. Assumed expectations of life to 2030–31 for the individual countries are shown in Table 2. Current mortality levels differ between the individual countries. However, the same future improvements have been assumed for all countries of the UK, except that some differences (generally slightly smaller improvements) in the period to 2031 have been assumed at some ages for males in Scotland. Therefore, the relative differences in life expectancy between the four countries are approximately maintained throughout the projection period.

The expectations of life shown in Table 2 are based on the mortality rates applying to a single year and are examples of *period* expectations of life. However, expectations of life can also be calculated on a *cohort* basis, allowing for known or projected changes in mortality rates in later years. Box two gives further information on the differences between period and cohort expectations of life.

Migration

Table 2 also summarises the annual net migration assumptions for each country of the UK. These combine assumptions regarding the distribution of international migration with assumptions about cross-border migration between each country. The new long-term assumption for net migration to the UK is +190,000 each year compared with +145,000 a year in the 2004-based projections. This increase follows two years (2004 and 2005) where net migration into the UK has reached record levels. Methodological improvements to the estimation of international migration have also contributed to the increase.¹⁴

International migration data for 2006 were not available when these long-term assumptions were decided. Estimates for 2006 have subsequently become available and show that net migration to the UK was +191,000 in the calendar year 2006, lower than 2004 and 2005 but still part of a series of historically high levels of migration.¹⁵

Box two

Period and cohort expectations of life

Expectations of life can be calculated in two ways: either period life expectancy or cohort life expectancy.

Period life expectancy is the average number of years a person would live if he or she experienced the age specific mortality rates for that time period throughout his or her life. It makes no allowance for any later actual or projected changes in mortality. In practice, death rates are likely to change in the future and so period life expectancy does not give the number of years someone could actually expect to live.

Cohort life expectancies are worked out using age-specific mortality rates which allow for known or projected changes in mortality in later years and are thus regarded as a more appropriate measure of how long a person of a given age would be expected to live, on average, than period life expectancy.

For example, period life expectancy at birth in the year 2000 would be calculated using the mortality rate for age 0 in 2000, for age 1 in 2000, for age 2 in 2000, and so on. Cohort life expectancy at birth in 2000 would be calculated using the mortality rate for age 0 in 2000, for age 1 in 2001, for age 2 in 2002, and so on.

In most official statistics, period life expectancies are given. Figures for past years provide a useful measure of mortality *actually* experienced over a given period and provide an objective means of comparing trends over time, between areas of a country and with other countries. However, they are often mistakenly interpreted by users as allowing for subsequent mortality changes. If mortality rates are projected to decrease in later years, then cohort life expectancy will be greater than period life expectancy. For many years, the national projections reference volumes¹¹ have contained analyses of cohort life expectancy and the Pensions Commission has recommended the use of the cohort approach in describing current and future trends in longevity.¹²

Period and cohort life expectancies at individual ages for 1981 to 2056 for the UK and its constituent countries using historic mortality rates and projected mortality rates from the 2006-based national population projections are available from the GAD website.¹³ Expectations of life at birth and at age 65 for the UK for the years 2006 and 2056 are shown in the summary table below.

Table A Period and cohort expectation of life, United Kingdom

	2006		2056	
	Period	Cohort	Period	Cohort
Life expectancy at birth				
Males	77.2	88.1	85.5	94.4
Females	81.5	91.5	88.7	97.0
Life Expectancy at 65				
Males	17.2	20.6	23.9	25.5
Females	20.0	23.1	26.0	27.7

The table shows that male life expectancy at birth in 2006 was 77.2 years based on the mortality rates actually experienced in that year. However, allowing for the future improvements in mortality assumed in the 2006-based projections, a boy born in 2006 can actually expect to live for 88.1 years. For females, the corresponding period and cohort life expectancies at birth in 2006 are 81.5 years and 91.5 years respectively. For a person aged 65 in 2006, cohort life expectancy (i.e. taking account of assumed future improvements in mortality above age 65) is over three years higher than period life expectancy for both sexes. The differences between period and cohort life expectancies in 50 years' time are somewhat smaller. This is because mortality at most older ages is currently improving by more than the 1 per cent a year assumed for the second half of this century.

However, although 2006 migration data were not available in time to inform the long-term assumptions, the assumptions for the first few years of the projections were decided at a later stage than the long-term figures.

It was therefore possible to take account of provisional data for 2006 in setting the assumption for the first year (2006–07) of the projections. For the following few years, net migration is assumed to be above the long-term annual level of +190,000 because of an allowance for additional net migration from the accession countries which joined the European Union in May 2004 and January 2007, and also a small allowance for the return of Armed Forces and their dependants from Germany.¹⁶ The figures for the first three years (2006–07 to 2008–09) also assume a gradual transition from current cross-border migration levels (where net flows from England to Scotland are unusually high) to the assumed long-term levels.

Results of the 2006-based national population projections

Total population

The results of the new projections are summarised for the constituent countries of the UK in Table 3 and Figure 2. Figure 2 shows the UK and England populations up to 75 years ahead i.e. to 2081 but, in view of the greater uncertainty for smaller areas noted above, only shows results up to 50 years ahead for Scotland, Wales and Northern Ireland.

The population of the UK is projected to increase from 60.6 million in 2006 to reach 71.1 million by 2031. This is equivalent to an average annual rate of growth of 0.64 per cent during this period. In the longer term, the projections suggest the population will continue rising beyond 2031 although at a lower rate of growth.

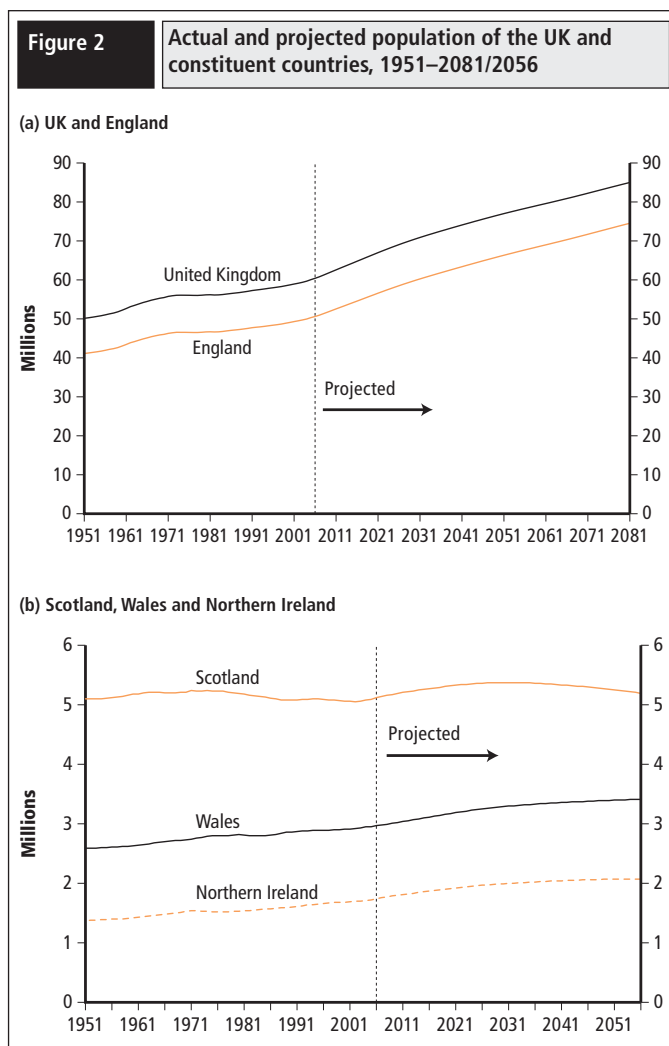


Table 3 Components of change: five year summary 2006–2031

	annual averages (thousands)				
	2006–2011	2011–2016	2016–2021	2021–2026	2026–2031
UK					
Population at start	60,587	62,761	64,975	67,191	69,260
Births	780	799	805	796	788
Deaths	565	549	552	573	610
Natural change	215	250	253	224	178
Net migration	220	193	190	190	190
Total change	435	443	443	414	368
Population at end	62,761	64,975	67,191	69,260	71,100
England					
Population at start	50,763	52,706	54,724	56,757	58,682
Births	664	683	690	685	682
Deaths	466	453	455	472	503
Natural change	198	230	235	214	178
Net migration	191	174	172	172	172
Total change	389	404	407	385	350
Population at end	52,706	54,724	56,757	58,682	60,432
Wales					
Population at start	2,966	3,038	3,113	3,186	3,248
Births	35	36	35	34	33
Deaths	31	30	30	31	33
Natural change	4	5	5	3	0
Net migration	11	10	10	10	10
Total change	14	15	15	13	9
Population at end	3,038	3,113	3,186	3,248	3,296
Scotland					
Population at start	5,117	5,206	5,270	5,326	5,363
Births	57	56	55	53	51
Deaths	54	52	53	54	57
Natural change	3	4	3	-1	-6
Net migration	15	9	9	9	9
Total change	18	13	11	7	2
Population at end	5,206	5,270	5,326	5,363	5,374
Northern Ireland					
Population at start	1,742	1,812	1,868	1,922	1,966
Births	24	25	25	24	23
Deaths	14	14	14	15	16
Natural change	10	11	10	8	6
Net migration	4	1	1	1	1
Total change	14	11	11	9	7
Population at end	1,812	1,868	1,922	1,966	1,999

The population of England is projected to increase by 19 per cent by 2031, Northern Ireland by 15 per cent and Wales by 11 per cent. The projected increase for Scotland, where fertility and life expectancy levels are assumed to remain lower than in the rest of the UK, is five per cent. Consequently Scotland's population is projected to increase until the early 2030s and then start to fall. The Northern Irish and Welsh populations are both projected to continue growing until around 2050, after which Northern Ireland will plateau whereas the population

of Wales is projected to continue increasing, but at a very low rate of growth. The population of England is also projected to continue rising throughout the projection period, but much more strongly.

The UK population is projected to pass 65 million in 2016 and 70 million in 2028. It is estimated to have reached 55 million in 1968 and 50 million in the late 1940s.

Of the expected 10.5 million increase in the UK population between 2006 and 2031, some 5.6 million (53 per cent) is projected natural increase (more births than deaths) while the remaining 4.9 million (47 per cent) is the assumed total number of net migrants. However, the projected numbers of future births and deaths are themselves partly dependent on the assumed level of net migration. The overall effect of net migration on future population growth is considered in Box three.

By comparing some of the special case scenario variants with the principal projection, it is possible to attempt a more detailed decomposition of future population change, distinguishing the separate effects of the fertility, mortality and migration assumptions and also the effect of 'population momentum' arising from the current age structure of the population. This is considered in Box four.

Box three

Migration and population growth

The population of the UK is projected to rise both because of positive natural change (that is, more births than deaths) and because of positive net migration. However, the components of population change are not independent of each other. In particular, the projected numbers of future births and deaths are themselves partly dependent on the assumed level of net migration.

An understanding of the overall effect of migration on population growth can be obtained by comparing the results of the principal projection with those of the zero migration variant projection. The zero migration variant assumes that net migration will be zero at all ages in future, but makes the same assumptions about fertility and mortality as the principal projection. In the analysis below the effect of net migration on population growth in the period to 2031 is considered.

Clearly, if annual net inward migration to the UK was to average 190,000 a year (the long-term assumption in the principal projection), this would lead to a total net inflow of 4.75 million migrants in the period between 2006 (the base year of the projections) and 2031. In fact, the projected total number of net migrants during this period in the principal projection is slightly higher (4.9 million) due to the higher migration assumptions in the first few years of the projection.

The assumed fertility and mortality rates are the same in the principal projection and the zero migration variant projection. However, because migration is concentrated at young adult ages, the assumed number of migrants affect the number of women of childbearing age and hence the future number of births.

There is no comparable effect on deaths, at least in the period to 2031. At ages over 45, assumed net migration flows are close to zero in the principal projection. Indeed, small net migration *outflows* are assumed at some older ages. So the effect of the assumed level of net migration on the number of deaths over the period to 2031 is very small.

Table A below shows the projected components of population change in the period to 2031 in the principal projection and the zero migration variant projection.

Table A Projected population change, United Kingdom 2006-31
thousands

	Principal projection	Zero migration variant
Population at mid-2006	60,587	60,587
Population change (2006-31)		
Births	19,847	17,458
Deaths	14,247	14,244
Natural change	5,601	3,214
Net migration	4,912	0
Total change	10,513	3,214
Population at mid-2031	71,100	63,801

Table B shows how the projected population growth in the principal projection is broken down between the assumed level of net migration and projected natural change.

Table B Projected population growth by component, United Kingdom, 2006-31
thousands

Total population increase between 2006 and 2031	10,513
Resulting from:	
Assumed net migration	4,912
Natural change assuming no migration	3,214
Additional natural change from assumed level of net migration	2,387

The population of the UK is projected to grow by 10.5 million between 2006 and 2031. Some 4.9 million of this increase is directly due to the assumed number of net migrants. Natural change accounts for a further 5.6 million (the difference between 19.8 million births and 14.2 million deaths). Some 3.2 million of this natural increase would occur in the absence of migration. The remaining 2.4 million is, therefore, the net effect of the assumed annual level of net migration on natural change (almost entirely the effect on births).

Some 46.7 per cent of population growth in the principal projection is therefore directly attributable to the assumed number of net migrants. The remaining 53.3 per cent is attributable to projected natural increase (of which 30.6 per cent would occur in the absence of net migration and 22.7 per cent arises from the effect of net migration on natural change). In total, therefore, some 69 per cent of population growth in the period to 2031 is attributable, directly or indirectly, to future net migration.

It should be emphasised that these calculations are based on comparing alternative projections which make the same assumptions about future fertility and mortality rates, irrespective of the assumed level of net migration. In practice, fertility and mortality rates are likely to differ, to some extent, from those for the existing population.

Box four

Components of population growth

By comparing some of the special case scenario variants with the principal projection, it is possible to provide a more detailed decomposition of projected future population change, distinguishing the separate effects of the fertility, mortality and migration assumptions and also the effect of 'population momentum' arising from the current age structure of the population.

The following four projections are used for this analysis:

Projection	Fertility assumption	Mortality assumption	Migration assumption
Stationary variant	Replacement	Constant	Zero
Zero migration & constant mortality variant	Principal	Constant	Zero
Zero migration variant	Principal	Principal	Zero
Principal projection	Principal	Principal	Principal

The stationary variant assumes 'replacement level' fertility. This is the level of fertility required for the population to replace itself in size in the long-term given constant mortality rates and in the absence of migration.¹⁷ Replacement level is now around 2.075 in the UK, i.e. women would need to have, on average, 2.075 children each to ensure the long-term 'natural' replacement of the population. Under these conditions, the stationary variant eventually produces a population with an unchanging size and age structure. This situation may take several decades to occur. The phenomenon by which a population continues to rise or fall under stationary population conditions is known as 'population momentum' and is a consequence of the initial age structure of the population.

By changing the assumptions one at a time from those used for the stationary variant to those used in the principal projection, the separate effects of the fertility, mortality and migration assumptions, and also population momentum, can be distinguished.¹⁸ This is done in Chart A and Table A below. Although the fertility assumption has been increased, compared with the previous (2004-based) projections, the long-term assumption remains well below replacement level. So, alone amongst these four factors, fertility is still acting as a downward influence on total population size.

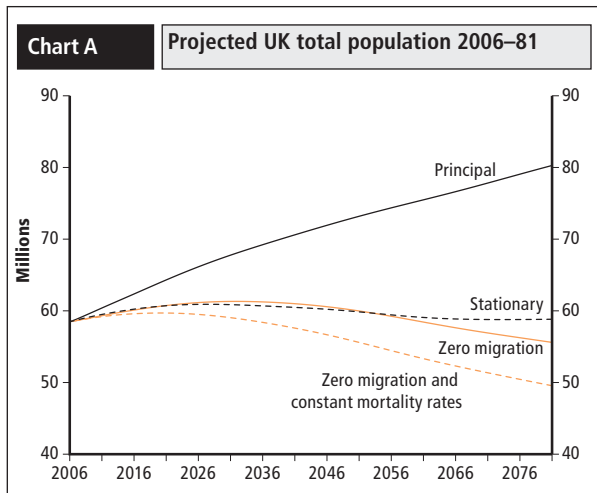


Table A Projected population growth by component, UK

	millions			
	2016	2031	2056	2081
Total population growth compared with 2006	4.4	10.5	18.0	24.7
Due to:				
population momentum from current age structure	2.0	2.7	1.1	0.4
assumed below replacement fertility	-0.7	-2.1	-5.6	-10.5
assumed mortality improvement	0.6	2.6	5.4	6.8
assumed inward net migration	2.5	7.3	17.1	27.9

Chart A shows that under the stationary variant conditions, the UK population would eventually stabilise at around 61 million. However, this would not happen immediately. Indeed, in the stationary variant, the UK population is projected to continue growing until the late 2020s, and would be 2.7 million higher in 2031 than in 2006. The fact that the population increases in the medium-term with replacement fertility, even with constant mortality rates and no migration, is because of the present age structure of the UK population. Births would continue to exceed deaths under these conditions over the next 20 years.

The 'zero migration & constant mortality' variant uses the principal fertility assumption of a long-term average of 1.84 children per woman but is otherwise the same as the stationary variant. Comparison

of these two variants therefore shows the effect of assuming that long-term fertility will be about 10 per cent below replacement level. Compared with the stationary variant, the projected population of the UK at 2031 is 2.1 million lower because of the assumption of below replacement level fertility.

Similarly, the 'zero migration' variant differs from the 'zero migration & constant mortality' variant only in the mortality assumption used. Comparison of these two variants therefore shows the effect of assuming that mortality rates will not remain constant, but will continue to improve as envisaged in the principal projection. The effect of the mortality improvement assumed in the principal projection is to add about 2.6 million to the population at 2031.

Finally, the impact of the assumed level of net migration in the principal projection can be assessed by comparing the principal projection with the zero migration variant. This shows that the effect of the principal migration assumption is to add a further 7.3 million to the population at 2031. This represents 69 per cent of the total projected population growth between 2006 and 2031. The impact of migration on population growth is considered in more detail in Box three.

Births and deaths

Projected numbers of births and deaths are shown in Figure 3. With the single exception of 1976, the UK gained population through natural increase (births less deaths) throughout the 20th century. In the 2004-based projections it was projected that deaths would begin to outnumber births in the 2030s. However, the increase in the long-term fertility assumption, the effect that the higher migration assumption has on births and the reduction in assumed mortality rates means that, in the 2006-based projections, natural increase remains positive throughout the projection period. Of course, these projections are subject to considerable uncertainty. In particular, the projected trend in births depends on the assumed future level of fertility (including that for women not yet born) and has much greater uncertainty attached to it than the projected trend in deaths which is largely determined by the age structure of the population alive today.

Age distribution

Table 4 and Figure 4 summarise the projected age structure of the population. The age structure will become gradually older with the median age of the population projected to rise from 39.0 years in 2006 to 41.8 years by 2031. Longer-term projections show continued ageing with

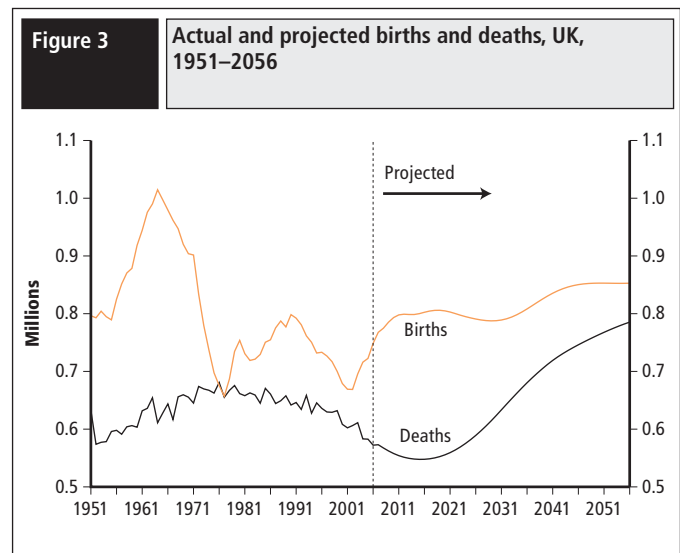
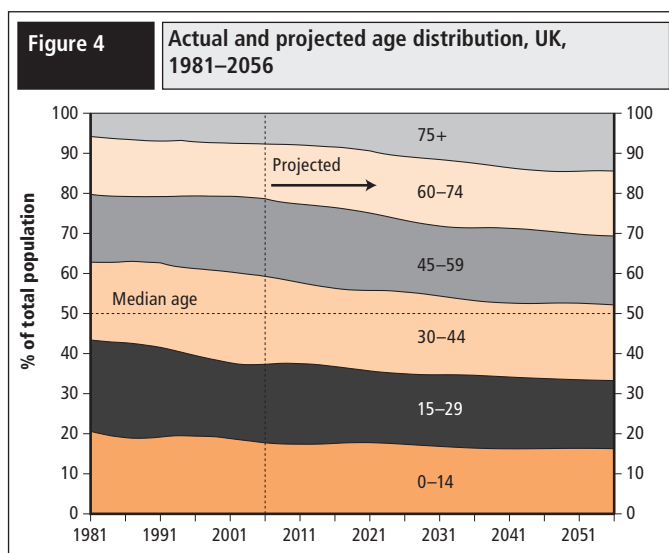


Table 4 Projected population by age, UK, 2006–2031

Age Group	thousands					
	2006	2011	2016	2021	2026	2031
All ages	60,587	62,761	64,975	67,191	69,260	71,100
0–14	10,737	10,912	11,428	11,947	12,026	11,974
15–29	11,876	12,614	12,458	12,024	12,191	12,706
30–44	13,302	12,699	12,691	13,492	14,132	13,975
45–59	11,744	12,295	13,094	12,986	12,398	12,420
60–74	8,269	9,265	9,824	10,432	11,035	11,802
75 & over	4,659	4,975	5,480	6,309	7,477	8,223
<i>Median age (years)</i>	<i>39.0</i>	<i>39.7</i>	<i>40.0</i>	<i>40.2</i>	<i>40.9</i>	<i>41.8</i>
Under 16 (A)	11,537	11,643	12,096	12,687	12,828	12,781
Working age* (B)	37,707	38,934	40,386	41,604	43,000	43,393
Pensionable age* (C)	11,344	12,184	12,493	12,900	13,431	14,927
<i>Support ratios</i>						
Young (B/A)	3.27	3.34	3.34	3.28	3.35	3.40
Old (B/C)	3.32	3.20	3.23	3.23	3.20	2.91
Total (B/(A+C))	1.65	1.63	1.64	1.63	1.64	1.57

*Working age and pensionable age populations based on the state pension age for given year. Between 2010 and 2020, state pension age will change from 65 for men and 60 years for women, to 65 years for both sexes. Between 2024 and 2026, state pension age will increase from 65 to 66 for both sexes.



the median age exceeding 43 years by 2056. Although this represents a considerable ageing of the population, it is less than expected in the 2004-based projections where the median age projection reached nearly 45 years by 2056. This is due to the increased fertility assumption for the 2006-based projection and also the increases in the assumed level of migration, as the migrant population has a younger age distribution than the existing population.

The number of children aged under 16 is projected to increase by 4.8 per cent from 11.5 million in 2006 to 12.1 million in 2016, and then to increase further to 12.8 million by the late 2020s. After levelling off for a few years, the increase is expected to resume around 2040.

The number of people of working age (currently defined as 16 to 64 for men and 16 to 59 for women) is projected to rise by 2.3 per cent from 37.7 million in 2006 to 38.6 million in 2010. Allowing for the forthcoming change in women's state pension age from 60 to 65 between 2010 and 2020, the working age population will increase further to around 41.5 million by 2020. With the subsequent increase to a state pension age of

66 for both sexes between 2024 and 2026, the working age population is projected to increase further to 43.4 million in 2031. Details of all the future changes to state pension age are available on the GAD website.¹⁹

The working age population will become much older as the baby boom generations of the mid 1960s age. In 2006, there were 1.7 million (10 per cent) more working age adults aged below 40 than were aged 40 and above. However, by 2020, influenced by the change in women's state pension age, there will be more aged 40 and above than below 40. By 2031, when state pension age will have increased to 66 for both sexes, there are projected to be 1.4 million (7 per cent) more working age people above 40 than below 40.

The number of people of state pensionable age is projected to increase by 7.2 per cent from 11.3 million in 2006 to 12.2 million in 2010. However, allowing for the change in women's state pension age, the population of pensionable age will then rise more slowly, reaching an estimated 12.7 million by 2020. A faster increase will then resume, tempered by the increase in state pension age between 2024 and 2026, with the number over state pensionable age expected to reach almost 15 million by 2031. In the longer-term, further increases in state pension age to reach 68 by 2046 will curb the increase in the population of pensionable age, although a faster increase will again return after the changes in state pension age are complete.

In 2006 there were just under 0.2 million (2 per cent) more children aged under 16, than people of state pensionable age. However, from 2007 the population of state pensionable age is projected to exceed the number of children and by 2031, despite the increases to state pension age, is projected to exceed it by over two million (17 per cent).

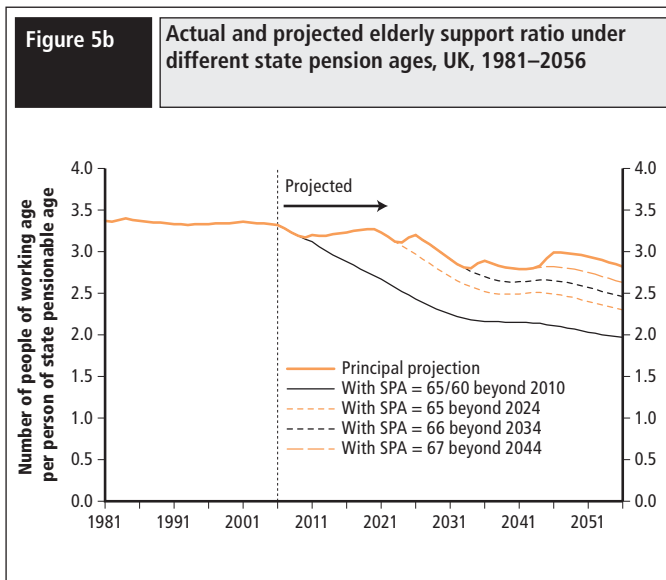
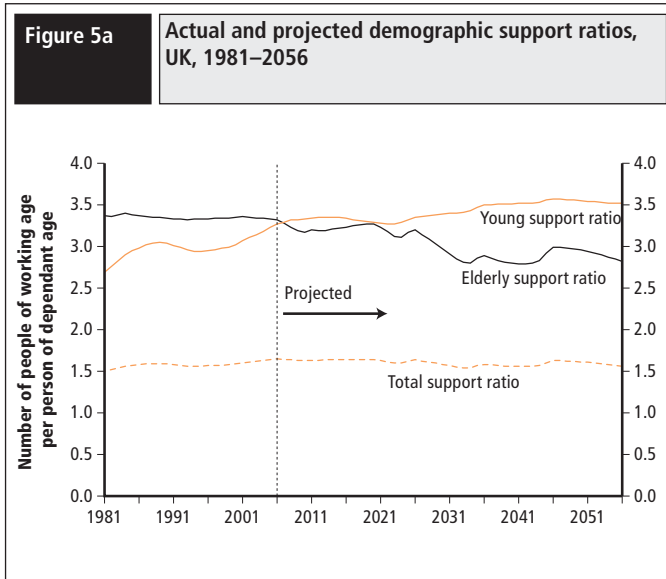
As the population ages, the numbers in the oldest age bands will increase the fastest. In 2006, there were 4.7 million people in the UK aged 75 and over. The number is projected to increase to 5.5 million by 2016 and to 8.2 million by 2031, a rise of 76 per cent over 25 years.

Support ratios

These changes in age structure will, in time, have a marked effect on the future proportion of dependants in the population. Figure 5a shows projected demographic support ratios. The young support ratio is the ratio of persons of working age to those aged under 16, and the elderly support ratio is the ratio of persons of working age to those of state pensionable age. The total support ratio is the ratio of persons of working age to all those of dependant ages (young or old). The working age and pensionable age populations used to calculate the support ratios in Figure 5a are based on the state pension age for the given year and take account of the planned future changes to that age.¹⁹ It should be emphasised, however, that demographically defined support ratios such as these, whatever age boundaries are used, take no account of workforce participation rates and therefore do not represent real levels of economic dependence. In reality, full-time education ends and retirement starts, at a range of ages.

In 2006, there were 3.32 persons of working age for every person of state pensionable age. By 2010, this elderly support ratio is projected to fall to 3.17. Allowing for the change in women's state pension age, it will then rise to 3.27 by 2020 before declining again to 2.91 by 2031. The young support ratio is also affected by the changes to state pension age as these changes increase the working age population. The projected increase in births over the next decade (see Figure 3) also contributes to the young support ratio rising in the 2020s as they move into the working age population.

Although the elderly support ratio will fall in the future, Figure 5b shows how the various future changes to state pension age help to moderate the decline. Allowing for all the changes, the elderly support ratio is projected to decline from 3.32 persons of working age for every person



of state pension age in 2006 to 2.91 in 2031 and 2.82 by 2056. However, were state pension ages to have remained as they are today (65 years for men and 60 years for women), the ratio would have fallen considerably further – to under two by 2056. The staged increases in state pension age from 65 to 66, from 66 to 67 and from 67 to 68 all have the effect of raising the elderly support ratio by around 0.15–0.20.

Comparison with 2004-based national projections

The projected total population of each country is compared with the 2004-based projections in Table 5, and the difference between the two projections is broken down into changes in the base population and changes in the projected numbers of births, deaths and net migrants. Decreases in the projected numbers of deaths (as compared with the previous projections) are shown as positive numbers in the table as they contribute to increases in the size of the population.

The projected population of the UK at 2031 is 4.1 million (6.1 per cent) higher than in the 2004-based projections. This is due to a combination of more births, more migrants and fewer deaths. The assumed annual number of migrants is higher than in the previous projections. The projected number of births is significantly larger both because of higher

Table 5 Change in projected population compared with the 2004-based projections

Country	2006-based projections	2004-based projections	Total change	Change due to			
				base population*	projected births	projected deaths**	projected migrants
Population at 2011							
England	52,706	51,967	739	49	347	59	285
Wales	3,038	3,037	0	-11	13	4	-6
Scotland	5,206	5,120	86	8	26	4	48
Northern Ireland	1,812	1,767	44	9	14	1	20
UK	62,761	61,892	870	55	399	68	348
Population at 2021							
England	56,757	54,605	2,152	49	1,106	285	712
Wales	3,186	3,165	20	-11	37	20	-25
Scotland	5,326	5,127	200	8	71	26	94
Northern Ireland	1,922	1,830	92	9	44	8	31
UK	67,191	64,727	2,464	55	1,258	339	812
Population at 2031							
England	60,432	56,832	3,600	49	1,824	600	1,127
Wales	3,296	3,256	40	-11	52	43	-45
Scotland	5,374	5,065	309	8	107	54	139
Northern Ireland	1,999	1,860	139	9	73	16	41
UK	71,100	67,013	4,087	55	2,056	714	1,262

* Difference between the estimated population at mid-2006 and the 2004-based projection of the population at mid-2006 (see Table 1).

**Decreases in the projected number of deaths (compared with the previous projections) are shown as positive numbers as they contribute to an increase in the size of the population.

fertility rate assumptions (the first time fertility assumptions have been increased in many years) and because the higher assumption of net migration increases the number of women of childbearing age. The change in the projected number of deaths is less significant, but still contributes to the large difference in the projected population for 2031 between these two sets of projections.

In the longer-term, as noted above, the UK population is projected to continue increasing strongly throughout the projection period. In the 2004-based projections the rate of growth was projected to slow from the 2020s and, although the population continued to increase, the projected rate of growth fell to around 0.1 per cent per annum from the 2050s. In the 2006-based projections, however, the rate of growth is still over 0.3 per cent per annum at 2081. This change is due primarily to the increase in the fertility and migration assumptions. The higher assumed fertility rates increase the population in two ways: immediately with the greater number of births and, in the longer-term, as these 'extra' children grow up and increase the population of childbearing age.

Populations are higher than in the 2004-based projections for each country. The largest increase at 2031 is for Northern Ireland (7.5 per cent), with England and Scotland increasing slightly less at 6.3 per cent and 6.1 per cent respectively. Wales increases by a much smaller margin, 1.2 per cent. This is because Wales' migration assumptions for the 2006-based projections are lower than those used in the 2004-based projections.

As Table 6 shows, compared with the previous projections, the UK population at 2031 is higher in all age groups. Increases are greatest for children and the younger working ages, because of the higher fertility and migration assumptions. The population aged 75 and over is higher because of the higher assumptions of life expectancy. The population aged 60–74 is only slightly higher at 2031 than previously projected. This is because this particular age group is not significantly affected by any of the assumption increases.

Table 6 Change in projected population by age compared with the 2004-based projections, UK

Age group	thousands/percentages							
	2006		2011		2021		2031	
	000s	%	000s	%	000s	%	000s	%
Under 16	6	0.1	414	3.9	1,264	11.8	1,214	11.3
16–29	83	0.7	363	3.0	325	2.8	1,179	10.2
30–44	3	0.0	112	0.9	671	5.2	840	6.4
45–59	-13	-0.1	-14	-0.1	41	0.3	402	3.3
60–74	-28	-0.3	-42	-0.4	-15	-0.1	24	0.2
75 & over	3	0.1	37	0.7	180	2.9	427	5.5
All ages	55	0.1	870	1.4	2,464	3.8	4,087	6.1

Sensitivity

The one certainty of making population projections is that, due to the inherent unpredictability of demographic behaviour, they will turn out to be wrong as a forecast of future demographic events or population structure. One way of giving users an indication of uncertainty is by considering the performance of past projections. An analysis of the accuracy of UK national population projections made over the last 50 years was published in Population Trends 128 in summer 2007.⁹ This analysis was based on a historical projections database available on the GAD website.²⁰ A second article looking at the accuracy of population projections made by 14 European countries, including the UK, was published in Population Trends 129 in autumn 2007.²¹

Another way of illustrating uncertainty is by preparing variant projections based on alternative assumptions of future fertility, mortality and migration. Since the 2000-based projections, an extensive range of variant projections, at both UK and individual country level, has been produced for each ‘full’ set of projections. Full details of the latest such set, from the 2006-based projections, are available on the GAD website.²²

Compared with the principal projection assumptions, the high and low fertility variants assume long-term family sizes of ± 0.2 children per woman. In the high and low mortality variants, projected life expectancy at birth at 2031 differs by ± 2.0 years for males and by just under ± 1.3 years for females from the principal projection. Finally, in the high and low migration variants, the long-term annual net migration inflows are assumed to be 60,000 persons above and below the principal projection. These variant assumptions are intended as plausible alternative scenarios and *not* as upper or lower limits for what might occur in the future. Figures 6 and 7 show the total population of the UK and the percentage of the population aged over 65 under these alternative assumptions.

It is clear from Figure 6 that there is considerable uncertainty regarding the future size of the population. Under these alternative, but still plausible, fertility and migration assumptions, the population at 2031 differs from the principal projection by around ± 2 million. The uncertainty widens with time and by 2081 the population would be about 96 million under the high fertility assumptions compared with 85 million in the principal projection, but only about 75 million with the low fertility assumptions.

As noted above, the principal projections now see the population increasing throughout the projection period much more strongly than in the previous 2004-based projections. Indeed, Figure 6 shows that the population continues to grow under all of the main variant projections. However, because the variant assumptions are plausible alternatives rather than upper or lower limits, continued population growth is not a certainty. Indeed, with the lower assumptions used in the 2004-based projections, the population reached a peak around the middle of the century in each of the low variant projections.

Figure 7 demonstrates that significant population ageing will occur under any plausible set of future assumptions. In 2006, some 16 per cent of the population were aged 65 and over. With the higher fertility and migration

Figure 6 Population of the UK according to principal and variant 2006-based projections, 1981–2081

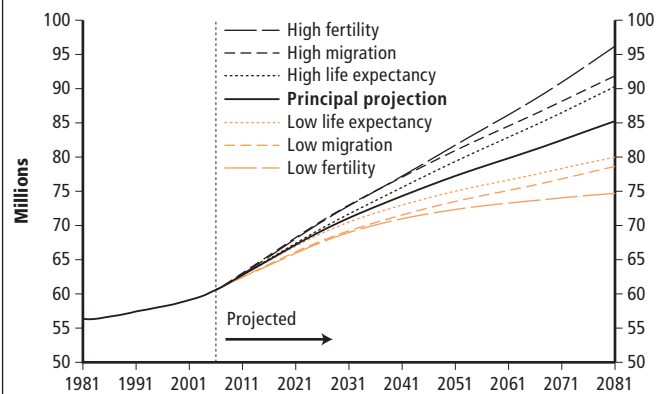
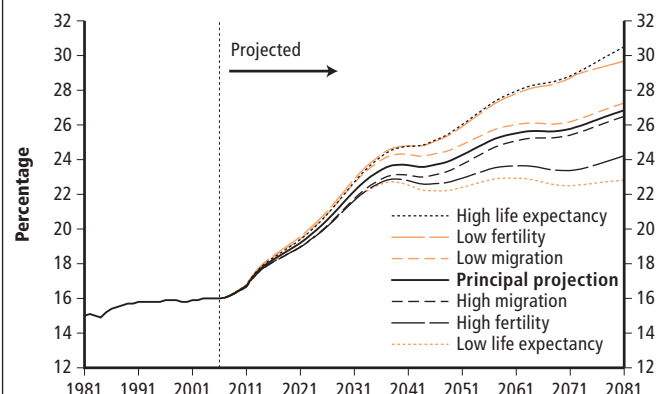


Figure 7 Proportion of the population aged 65 or over according to principal and variant 2006-based projections, 1981–2081



assumptions used for the 2006-based projections, the population is not projected to age quite as much as in the 2004-based projections. Despite this, the proportion aged over 65 is projected to increase to between 21.6 per cent and 22.9 per cent by 2031. In the principal projection, the proportion would continue increasing, reaching nearly 27 per cent by 2081. But, in the high life expectancy variant, the proportion over 65 would be over 30 per cent in 75 years’ time.

The pattern and inevitability of population ageing is a consequence of the current age structure of the population. This, in turn, is a result of changes in the past numbers of births. Thus in a few years’ time the number of older people will start to rise rapidly as the relatively large cohorts born after the Second World War and during the 1960s baby boom enter the 65 and over age group and replace the much smaller cohorts born before 1945. Conversely, at younger ages, the relatively small cohorts born since the mid 1970s will replace the baby boomers.

National population projections on the internet

Further information and key results on the national population projections can be accessed via the National Statistics website at: www.statistics.gov.uk/cci/nugget.asp?id=1352. The NS website link also provides relevant links to UK subnational population projections, other demographic projections produced by UK government and population projections produced by international organisations.

Full details of the results of the 2006-based national population projections for the UK and constituent countries are available on the GAD website (www.gad.gov.uk/Demography_Data/Population/). Tables and charts for the individual countries, corresponding to most of the UK level analyses given in this article, are also available on the GAD website. It is planned that the full projection results will be added to the National Statistics website during 2008.

The developed administrations undertake their own analysis on the results for their country. The Welsh Assembly produced a Statistical Bulletin which can be found on their website at <http://new.wales.gov.uk/topics/statistics/headlines/pop-2007/hdw20071023/?lang=en>. The General Register Office for Scotland's report on the projections is available at [www.gro-scotland.gov.uk/statistics/publications-and-data/popproj/projected-population-of-scotland-\(2006-based\)/index.html](http://www.gro-scotland.gov.uk/statistics/publications-and-data/popproj/projected-population-of-scotland-(2006-based)/index.html). Key

Key findings

Based on the assumptions underlying the principal projections:

- The UK population is projected to increase gradually from an estimated 60.6 million in 2006, passing 65 million in 2016 and 70 million in 2028, to reach 71.1 million by 2031
- The projected total population of the UK at 2031 is 4.1 million (6.1 per cent) higher than in the previous (2004-based) projections. This is due to a combination of higher birth rate assumptions, higher assumed levels of net migration and higher life expectancy assumptions
- Of the 10.5 million increase between 2006 and 2031 in the principal projection, some 5.6 million (53 per cent) is projected natural increase (more births than deaths) while the remaining 4.9 million (47 per cent) is the assumed total number of net migrants. However, projected births and deaths are partly dependent on the assumed level of net migration. Allowing for the additional impact of migration on natural change, it is estimated that some 69 per cent of projected population growth in the period to 2031 is attributable, directly or indirectly, to migration
- The population will gradually become older with the median age expected to rise from 39.0 years in 2006 to 41.8 years in 2031
- The number of people of state pensionable age is projected to increase by 9.3 per cent from 11.3 million in 2006 to 12.2 million in 2010. Allowing for the change in women's state pension age over the following ten years, the population of pensionable age will then rise more slowly, reaching 12.7 million by 2020. Even with the further increase to the state pension age from 65 to 66 for both sexes between 2024 and 2026 the population of state pensionable age is expected to reach nearly 15 million by 2031
- In 2006 there were 3.32 persons of working age for every person of state pensionable age. By 2010, this demographic support ratio will decline to 3.17. Allowing for the planned changes in state pension age, the ratio will then rise slightly to 3.27 by 2020 before dropping again to 2.91 by 2031
- Due to differences in demographic patterns, projected trends differ for the four countries of the UK. The population of England is projected to increase by 19 per cent by 2031, Northern Ireland by 15 per cent and Wales by 11 per cent. The projected increase for Scotland, where fertility and life expectancy levels are assumed to remain lower than in the rest of the UK, is 5 per cent

results on the population projections for Northern Ireland were published in the Annual Report of the Registrar General 2006 which can be found at www.nisra.gov.uk/demography/default.asp?cmsid=20_45_100&cms=demography_Publications_Registrar+General+Reports&release=

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