National population projections, background, methodology and assumption setting: 2022-based

Information on the data, methods and assumption setting process used to produce the 2022-based national population projections.

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1 . Overview

We normally publish national population projections (NPPs) by age and sex for the UK and its constituent countries every two years. We base them on the latest mid-year population estimates together with assumptions of future levels of fertility, mortality and migration.

The primary purpose of the projections is to provide information on potential future population levels. They are used as a common framework for national planning in several different fields. The 2022-based NPPs have a wide range of variant projections and use new assumptions for fertility, migration and mortality.

We produce NPPs on behalf of the National Statistician and the Registrars General for Scotland and Northern Ireland. We agree the underlying assumptions in liaison with the devolved administrations: Welsh Government, National Records of Scotland (NRS) and the Northern Ireland Statistics and Research Agency (NISRA). Information on our assumption-setting process can be found in Section 4: Method of projection in this article.

Over the last few years, in response to user requests we have provided additional releases of the NPPs to reflect new data and expert views on international migration. These releases have not included a wide range of variant projections, which we typically publish in a release such as in this 2022-based release.

The focus of the 2022-based NPPs is on the 25 years to 2047, though we produce projections to 2122. Uncertainty in population projections increases the further they are made into the future and particularly so for smaller geographical areas and age-sex breakdowns.

For more information on how Office for National Statistics (ONS) projections meet users' needs along with information on their fitness for purpose, please see our National population projections quality and methodology information (QMI). For guidance on how to use variant projections, please see our Variant national population projections for the UK and subnational population projections and household projections for England: user guide. The 2022-based projections supersede the 2021-based interim NPPs published on 30 January 2024.

2 . Base population

Definition

We use estimates of the usually resident population of the UK and its constituent countries at mid-2022 as our starting population. The usually resident population is defined by the standard United Nations definition for population estimates and includes people who reside in the area for a period of at least 12 months whatever their nationality. Members of HM armed forces in the UK are included, but members of HM armed forces and their families who are abroad are excluded. Members of foreign armed forces in the UK are included, with any accompanying dependants.

Base populations for individual countries

2022-based national population projections (NPPs) are based on the mid-2022 population estimates for:

- England and Wales, published by the Office for National Statistics (ONS) on 15 July 2024 (a revised version of those previously released on 23 November 2023)
- Scotland, published by the National Records of Scotland (NRS) on 8 October 2024 (reflecting a revision to the mid-2022 estimates published on 26 March 2024)
- Northern Ireland, published by the Northern Ireland Statistics and Research Agency (NISRA) on 31 August 2023

Population estimates use the most recent census as the starting population and then update these annually to account for population change.

Table 1: Base population estimates for 2022-based national population projections, UK and constituent countries

	Persons (millions)
England	57.11
Wales	3.13
Scotland	5.45
Northern Ireland	1.91
United Kingdom	67.60

Source: National population projections from the Office for National Statistics

Notes

1. Figures may not add exactly because of rounding.

Estimates of the population aged 90 years and over

We prepare official mid-year population estimates by individual age to the age of 89 years, with an upper age band for all those aged 90 years and over. We produce estimates of the population aged 90 to 104 years by single year of age, and for those aged 105 years and over using the Kannisto-Thatcher survivor ratio method, constraining the results to the official estimates of all those aged 90 years and over.

3 . Population estimates and projections for mid-2021 to mid-2024

The projected population of the UK and its constituent countries for mid-2023 – within the 2022-based national population projections (NPPs) – does not match official mid-2023 population estimates, which were published in 2024. This is because, in the NPPs for England, Wales and Scotland, figures for mid-2023 use migration statistics from the release Long-term international migration, provisional: year ending June 2024 and other data, which were not part of the population estimates when they were last produced for mid-2023. For Northern Ireland, the NPPs differ from the mid-year population estimates because of the application of demographic assumptions in the NPPs from the base year, especially where cross-border migration between Northern Ireland and the rest of the UK is based on rates and informed by a five-year average of the years before mid-2022.

We recommend the continued use of mid-year population estimates for years up to and including mid-2023, for the UK and each of its constituent countries, until the mid-year estimates are revised as part of the mid-year population estimates publication for mid-2024, later in 2025.

Updated international migration estimates for years ending June 2021 and June 2022 have not yet been incorporated into the NPPs as there are no revised mid-year population estimates to use as an input. The latest provisional estimates of international migration for the year ending June 2024 have been included in year two of the projection as our international migration assumption.

4 . Method of projection

We produce projections for successive years running from one mid-year to the next. For each age we take the starting population, then account for assumed net migration (using inflows and outflows), less the number of deaths, to produce the number in the population, one year older, at the end of the year. We then add survivors of those born during the year. Age is defined as completed years at the last birthday.

We assume migration occurs evenly throughout the year. For computing purposes, this is equivalent to assuming that half the migrants in a given year at a given age migrate at the beginning of the year and half at the end of the year. The number of net migrants we add to obtain the population aged x plus 1 at the end of the projection year therefore consists of half of those migrating during the year at age x and half of those migrating during the year at age x plus 1.

We obtain the number of deaths in a year by adding half of the net inward migrants at each age to the number in the population at the beginning of the year and applying the mortality rate $q_{x+1/2}$, which is the probability of death between one mid-year and the next. The mortality rates we use in the projections represent the probabilities of death between one mid-year and the next, according to a person's age at their last birthday at the beginning of the period. We also give the appropriate rate of infant mortality (that is, the probability of a newborn child not surviving until the following mid-year). This is about 85% of the full, first year of life infant mortality rate more generally used in official statistics.

We calculate the number of births in the year by multiplying the average number of women at each single year of age during the year (taken as the mean of the populations at that age at the beginning and end of the year) by the fertility rate applicable to them during that year. We assume the total number of births in a year is divided between the sexes in the ratio of 105 males to 100 females, in line with recent experience. We calculate the number of infants aged zero years at the end of the year by taking the projected number of births, deducting the number of deaths, which is found by applying the infant mortality rate, and adding half the number of net migrants aged zero years at their last birthday.

We compute principal projections for each of the constituent countries of the UK and add together the results to produce projections for Great Britain and the UK.

5 . Summary of long-term assumptions

Our 2022-based national population projections (NPPs) are based on the long-term assumptions of future fertility, mortality and net migration (that is, immigrants minus emigrants), summarised in Table 2.

We agree the long-term assumptions with the NPP Committee. The NPP Committee oversees the projections process. This committee includes representatives from the Office for National Statistics (ONS) and the devolved administrations, and is accountable to the National Statistician and Registrars General. Table 2 also contains assumptions used in previous projections releases. These assumptions should not be interpreted as predictions of the future, but as plausible scenarios based on what has happened in the past.

Table 2: Long-term assumptions for the 2022-based national population projections compared with assumptions for the 2021-based interim, 2020-based interim, 2018-based and 2016-based projections, UK and constituent countries

	UK	England	Wales	Scotland	Northern Ireland
Fertility - Average number of children per woman by mid-2047					
2022-based	1.45	1.46	1.40	1.29	1.65
2021-based interim	1.59	1.62	1.47	[Note 1]	1.74
2020-based interim	1.59	1.62	1.47	1.30	1.74
2018-based	1.78	1.81	1.71	1.50	1.92
2016-based	1.84	1.85	1.85	1.65	2.00
Mortality - Expectation of life at birth by 2047 [note 2]					
Males 2022-based	82.0	82.2	81.5	80.1	81.9
Males 2021-based interim	82.4	82.6	81.6	[Note 1]	81.8
Males 2020-based interim	82.4	82.6	81.6	80.3	81.8
Males 2018-based	83.0	83.3	82.3	81.1	82.4
Males 2016-based	84.1	84.3	83.5	82.5	83.5
Females 2022-based	85.6	85.9	85.0	83.7	85.4
Females 2021-based interim	85.5	85.8	84.9	[Note 1]	85.1
Females 2020-based interim	85.5	85.8	84.9	83.6	85.1
Females 2018-based	85.9	86.1	85.4	84.3	85.4
Females 2016-based	86.8	87.0	86.4	85.2	86.4
Net international migration - Annual long-term assumption [note 3]					
2022-based	+340,000	+308,000	+9,500	+19,500	+3,000
2021-based interim	+315,000	+280,000	+8,500	[Note 1]	+3,000
2020-based interim national population projections: year ending June 2022 estimated international migration variant	+245,000	+222,500	+8,000	+13,000	[Note 4]
2020-based interim	+205,000	+186,500	+6,500	+10,000	+2,000
2018-based	+190,000	+173,000	+6,000	+9,500	+1,500
2016-based	+165,000	+152,000	+4,500	+7,000	+1,500

Source: National population projections from the Office for National Statistics

Notes

1. No 2021-based projections were published for Scotland because reconciliation and rebasing of population statistics including international migration statistics for 2012 to 2022 incorporating insights from Scotland's Census 2022 was yet to be finalised. The data have been incorporated into the 2022-based NPPs.

2. Life expectancies are period expectations of life for mid-2047. They do not account for future improvements in mortality projected after that point.

3. Net international migration does not include cross-border migration between the countries of the UK.

4. Northern Ireland projections were excluded from the release at the request of NISRA due to the division of the provisional international migrant estimates.

Setting the assumptions

We produce assumptions for future levels of fertility, mortality and migration by reviewing what has happened in the past and modelling plausible future scenarios. We also consult with a panel of independent academic experts working in the field of demography to discuss the possible forces that may influence future demographic behaviour.

The ONS agrees the main decisions in the NPP production process with the NPP Committee. Final demographic assumptions are produced by the ONS and are approved by the NPP Committee once they are satisfied with their robustness and plausibility. More detailed information on our demographic assumptions is available in our individual assumption articles:

- National population projections, fertility assumptions: 2022-based
- National population projections, mortality assumptions: 2022-based
- National population projections, migration assumptions: 2022-based

6 . Accuracy of projections

An indication of the short-term accuracy of past rounds of national population projections (NPPs) can be drawn from comparing projections with subsequent mid-year population estimates. On a regular basis we have published a comparison of population projections, population estimates and fertility, migration and mortality data. This gives users an indication of uncertainty.

Accompanying the release of the 2022-based NPPs we have released a new version of this covering the UK, constituent countries and a long time series of data. Please see our Comparing national population projections to estimates report detailing our findings from the latest comparisons we have made.

7 . Datasets available

We have published projections to 100 years ahead. For each country we have made one type of summary table and machine-readable data available to download. You can use our table of contents tool to navigate through this release. The tool contains links to our full range of data and documentation.

For this release we have also developed and released a webpage where users can adjust demographic assumptions and see the resulting projections compared with our principal and variant projections. Please see UK population projection explorer.

The summary table contains the total projected population for all years of the projection, the components of change and other summary statistics.

The machine-readable data files were formally known as "XML open data edition" and contain more detailed tables including single year of age and sex, and assumptions including cross-border and international migration rates by single year of age and sex. These also include population change by five-year age group, which was previously released as a separate (third) dataset type "Population in age groups".

8 . Changing State Pension age

The State Pension age is currently 66 years and two further increases are currently legislated: a rise to 67 years between 2026 and 2028 for those born on or after April 1960; and a rise to 68 years between 2044 and 2046 for those born on or after April 1977.

The section on changing State Pension age in the 2018-based national population projections (NPP) methodology explains how the legislated increases in State Pension age will be phased in. The published national projections output tables (see components of change summary tables in the table of contents tool) include the projected number and percentage of those of working age and pensionable age based on this phasing.

9 . Meeting user needs

We regularly engage with users of the national population projections (NPPs) to ensure our releases meet their requirements. For the 2022-based set of projections releases, this took the form of the engagement User needs from 2022-based national, subnational and household projections, which ran from 30 January to 12 March 2024.

Since then, we have continued to engage with NPP users, especially those seeking to use the NPPs for national policy, planning and forecasting purposes to seek feedback on the planned release contents and ensure that this meets their requirements. We would like to thank those who provided feedback in any of these engagements.

How you can also feed back

We are always interested in hearing how our users use our statistics and ways we can improve our outputs. You can email us with any comments about this release at pop.info@ons.gov.uk.

10 . Related links

National population projections: 2022-based
Bulletin | Released 28 January 2025
The potential future population size of the UK and its constituent countries.

National population projections Quality and Methodology Information (QMI)
Methodology | Released 28 January 2025
Quality and methodology information for national population projections, detailing the strengths and limitations of the data, methods used, data uses and users.

Variant national population projections for the UK and subnational population projections and household projections for England: user guide
Article | Released 4 November 2021
The aims of this user guide are to provide guidance and examples for those wishing to understand and use variant projections in policy and planning.

Comparing national population projections to estimates report
Methodology | Released 28 January 2025
Methodology on the comparison of national population projections from 1971 to 2022 with population estimates, births, long-term international migration, and deaths, including measures of error.

UK population projection explorer
Interactive tool | Released 28 January 2025
An interactive tool that shows how changes in life expectancy, net migration, and fertility could affect the population over the next 50 years.

11 . Cite this methodology

Office for National Statistics (ONS), released 28 January 2025, ONS website, methodology, National population projections: 2022-based, background, methodology and assumption setting