

National population projections, background, methodology and assumption setting: 2020-based interim

Information on the data, methods and assumption setting process used to produce the 2020-based interim national population projections.

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1 . Introduction

We normally publish national population projections 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 a number of different fields.

We produce national population projections 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 Northern Ireland Statistics and Research Agency (NISRA). Information on our assumption-setting process can be found in [Section 4 of this article](#).

We occasionally produce additional “interim” projections. The 2020-based projections are being produced as an interim set for each constituent UK country and the UK as a whole. Only a principal projection is being produced; there are no variant projections. This is in response to the coronavirus (COVID-19) pandemic where users wish to have more information on the possible implications for the future population and to support the forthcoming State Pension age review.

The 2020-based national population projections (NPPs) have been defined as interim projections to reflect the interval between the 2020-based projections and subsequent projections which will incorporate data from the 2021 Census. This will include a new back series of mid-year estimates for the years 2012 to 2020 updated using Census 2021 data. The use of the interim and principal projection only approach taken also recognises this as a period of uncertainty in the mid-2020 base year (please see [Population estimates for the UK, England and Wales, Scotland and Northern Ireland: mid-2020](#)) and in setting long-term demographic assumptions following the coronavirus (COVID-19) pandemic. More information can be found in [Section 5 of this article](#).

The National Population Projections Committee comprising the Office for National Statistics (ONS), National Records of Scotland (NRS), Northern Ireland Statistics and Research Agency (NISRA) and the Welsh Government currently propose that, following the publication of the 2020-based interim NPPs, the next round of NPPs will be 2021-based. These will include Census 2021 data for England, Wales, and Northern Ireland, the latest mid-year population estimates for Scotland rolled forward from the 2011 Census, and an updated set of demographic assumptions and variant projections. We plan to publish these in early 2023.

The focus of the 2020-based interim NPPs is on the 25 years to 2045, though we produce projections to 2120. 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 the ONS projections meet users’ needs along with information on their fitness for purpose, please see the [National population projections QMI](#). For guidance on how to use variant projections (in previous rounds of NPPs), please see [Variant national population projections for the UK and subnational population projections and household projections for England: user guide](#). The 2020-based interim projections supersede the 2018-based projections published on 21 October 2019.

2 . Base population

Definition

We use estimates of the usually resident population of the UK and its constituent countries at mid-2020 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

2020-based interim national population projections (NPPs) are based on the mid-2020 population estimates for:

- [England and Wales](#), published by the Office for National Statistics (ONS) on 25 June 2021
- [Scotland](#), published by the National Records of Scotland (NRS) on 25 June 2021
- [Northern Ireland](#), published by the Northern Ireland Statistics and Research Agency (NISRA) on 25 June 2021

Population estimates use the 2011 Census as the starting population and then update these annually to account for population change.

Table 1: Base population estimates for 2020-based projections, UK

	Persons (millions)
England	56.6
Wales	3.2
Scotland	5.5
Northern Ireland	1.9
United Kingdom	67.1

Source: Office for National Statistics - National population projections

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 . 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 net migration 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 England and Wales, Great Britain and the UK.

4 . Summary of long-term assumptions

2020-based interim 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 Northern Ireland Statistics Research Agency (NISRA), the National Records of Scotland (NRS) and the Welsh Government. Table 2 also compares assumptions for the 2020-based interim projections with the assumptions for the previous 2018-based and 2016-based projections. 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 2020-based interim national population projections compared with assumptions for the 2018-based and 2016-based projections, UK

	UK	England	Wales	Scotland	Northern Ireland
Fertility - Average number of children per woman by mid-2045					
2020-based	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 in 2045 (note 1)					
Males 2020-based	82.2	82.5	81.4	80.1	81.7
Males 2018-based	82.8	83.1	82.1	81.0	82.3
Males 2016-based	83.9	84.2	83.4	82.3	83.3
Females 2020-based	85.3	85.6	84.7	83.4	84.9
Females 2018-based	85.7	86.0	85.2	84.1	85.3
Females 2016-based	86.7	86.9	86.2	85.1	86.3
Net international migration - Annual long-term assumption (note 2)					
2020-based	+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: Office for National Statistics - National population projections

Notes

1. Life expectancies are period expectations of life for the start of 2045. They do not account for future improvements in mortality projected after that point.
2. Net international migration does not include cross-border migration between the countries of the UK.

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 which may influence future demographic behaviour.

The Office for National Statistics (ONS) agrees key decisions in the national population projections (NPPs) 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 the robustness and plausibility. More detailed information on our demographic assumptions is available in our individual assumption papers:

- [National population projections, fertility assumptions: 2020-based interim](#)
- [National population projections, mortality assumptions: 2020-based interim](#)
- [National population projections, migration assumptions: 2020-based interim](#)

5 . 2020-based projections in the context of the coronavirus (COVID-19) pandemic and Census 2021

[Stakeholder feedback](#) indicated a need for 2020-based national population projections (NPPs) and a growing interest in how projections might be affected by the coronavirus (COVID-19) pandemic. In combination, this helped the NPP committee to decide to produce 2020-based interim principal projections. In June 2021, we published an [update to our plans for the NPP release and future rounds of subnational population projections and household projections after Census 2021](#).

We have been monitoring the implications of the coronavirus pandemic across our demographic measures (including births, deaths and migration) and considering implications for future rounds of projections. The pandemic has disrupted the collection of several data sources used in the production of population projections and has changed some demographic behaviour in the short-term. It is not yet clear how these short-term changes in behaviour might affect long-term trends.

6 . Accuracy of projections

A broad 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. This gives users an indication of uncertainty. Figure 1 shows short-term comparisons between recent rounds of projections and the mid-year estimates ahead of a fuller review of projections to mid-year estimates. The figure compares the previous five sets of NPPs with the most recent mid-year population estimates since 2011 and demonstrates how the projections differ.

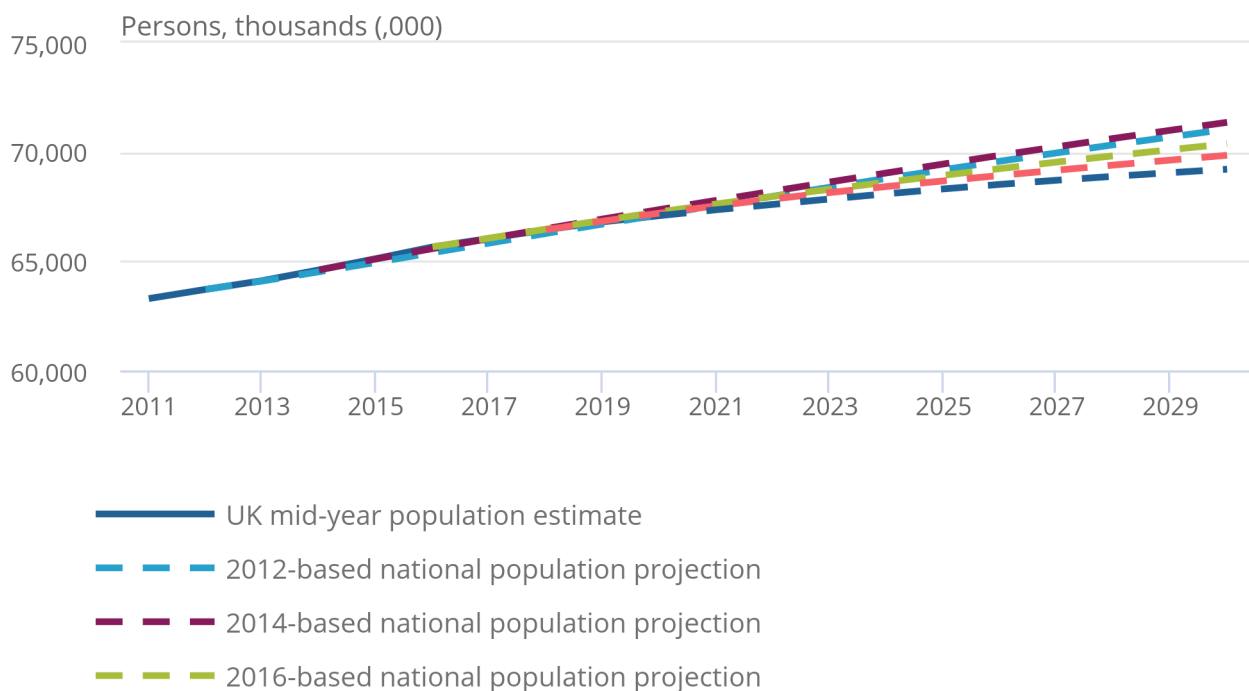
Each projection generally remained broadly consistent with the mid-year estimates for the following years, showing overall good relative accuracy over the short-term. In this comparison there is no inclusion of components of change (births, migration, and mortality) in what has been observed so the amount of difference, and the reason for differences, is not clear. Furthermore, given the short time period it is hard to determine whether recent observed changes in demographic behaviour are short-term fluctuations or the start of longer-term trends which have not yet unfolded.

Figure 1: UK-level projections align well with mid-year population estimates over the short-term

Comparison of national population projections (mid-2012, mid-2014, mid-2016, mid-2018 and mid-2020 principal projections) with mid-year population estimates

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Comparison of national population projections (mid-2012, mid-2014, mid-2016, mid-2018 and mid-2020 principal projections) with mid-year population estimates



Source: Office for National Statistics – Mid-year population estimates and national population projections

Notes:

1. Some cells in the data download are empty because data is not available for these time points.

7 . Datasets available

We have published projections to 100 years ahead. For each country we have made two summary tables and a zipped open data file (XML format) 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.

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

The second summary table contains the projected population in five-year age groups for all years of the projection.

The XML open data files contain more detailed tables including single year of age and sex, assumptions including cross-border, and international migration rates by single year of age and sex.

8 . Changing State Pension age

State Pension age is currently 66 and two further increases are currently in legislation: a gradual rise to 67 between 2026 and 2028 for those born on or after April 1960; and a gradual rise to 68 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 release is meeting their requirements. In summer 2021 we engaged with government NPP users 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 July 2021 we published [Future plans for research on population estimates and projections](#), which contains an outline of our work plan to address the recommendations in the Office for Statistics Regulation (OSR) review of [Office for National Statistics \(ONS\) population estimates and projections](#). Updates will be given in our regular [Population Statistics newsletter](#).

In October 2020, we [invited feedback on timescales for future national and subnational population projections](#). More information on this can be found in [Section 7 of the National population projections QMI](#). Feedback received helped the NPP committee make the decision to produce 2020-based interim projections. Decisions on future subnational population projections have been taken for each country by the ONS, National Records of Scotland (NRS), Northern Ireland Statistics and Research Agency (NISRA), and the Welsh Government and were informed by the feedback received as well as local consultations which took part in each country.

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 popinfo@ons.gov.uk.

10 . Related links

[National population projections: 2020-based interim](#)

Bulletin | Released 12 January 2022

The potential future population size of the UK and its constituent countries.

[National population projections Quality and Methodology Information \(QMI\)](#)

Article | Released 12 January 2022

Quality and methodology information for national population projections, detailing the strengths and limitations of the data, methods used, data uses and users.

[National population projections, subnational population projections and household projections for England -future plans:June2021](#)

Article | Released 25 June 2021

An update on plans to publish 2020-based national population projections and for England, future rounds of subnational population projections and household projections after Census 2021.

[National and subnational population projections – user feedback: April 2021](#)

Article | Released 19 April 2021

Overview of responses to our invitation to provide feedback on the future timescales for national population projections (NPPs) and subnational population projections (SNPPs) for the UK.