

Methodology used to produce the national population projections

Contact:

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1 . Overview

The NPPs are made for successive years using a standard demographic cohort component method. This is the method that is also used to produce national population estimates.

2 . Summary of cohort component method

Population (year x) (population at the beginning of the year)

- plus births (between yrs x and y) (plus births in year)
- minus deaths (between yrs x and y) (minus deaths in year)
- plus net-migrants (between yrs x and y) (plus or minus adjustment for migrants)

equals population (year y) (gives population at the end of the year)

For each age, the starting population plus net inward migrants less the number of deaths produces the number in the population, 1 year older, at the end of the year. To this has to be added survivors of those born during the year. Age is defined as completed years at the last birthday. Migration, deaths and births are all assumed to occur evenly throughout the year and are known as components of change. Greater detail about the methods used is available in the NPPs reference volume [Series PP2: Chapter 1. Background and methodology](#).

To make a projection, the mid-year population estimates from each country are used as the starting population. The numbers of births, deaths and migrants are calculated using assumptions of future levels of fertility, mortality and migration, considered to be the best that could be made at the time they are adopted. They are determined by a mixture of trend observation and extrapolation, and consideration of expert opinion, with actual data included in the calculation for the first year of the projection.

Variant projections are also calculated using the cohort component method. They are based on alternative assumptions of future fertility, mortality and international migration to those used in the principal projection and are intended to provide users with an indication of the uncertainty surrounding projections. Details about the [variant projections and associated assumptions](#) are published alongside the results and in the NPP reference volume [Series PP2: Chapter 6. Variants](#).

In general, the projections are computed for each of the constituent countries of the UK and the results are added together to produce projections for England and Wales, Great Britain and the UK.

3 . Base population

The starting point for the projections is the base population. This is taken as the mid-year population estimates from each country, England, Wales, Scotland and Northern Ireland and the UK. Details on the [population estimates methodology](#) are available.

4 . Births

The number of births in the year is calculated 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. The total number of births in a year is assumed to be divided between the sexes in the ratio of 105 males to 100 females, in line with recently observed trends. The number of infants aged 0 at the end of the year is calculated by taking the projected number of births, deducting the number of deaths found by applying the special infant mortality rate and adding half the number of net migrants aged 0 last birthday.

Details about the [fertility assumptions](#) and how they are constructed are published in a report alongside the data release and in the NPP reference volume [Series PP2: Chapter 3. Fertility](#).

5 . Deaths

The number of deaths in a year is obtained 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 (known as the initial mortality rate, or the probability of dying). The number of deaths of infants aged 0 is calculated by applying a special 'infant mortality rate' to the projected number of births, and adding half the number of net migrants aged 0 last birthday. This special mortality rate is equivalent to about 85% of the conventional full first year of life infant mortality rate used in Official Statistics.

Details about the [mortality assumptions](#) and how they are constructed are published in a report alongside the data release and in the NPPs reference volume [Series PP2: Chapter 4. Mortality](#).

6 . Migration

In the national population projections, assumptions are made regarding future levels of migration to or from the UK and its constituent countries. This is broken down into international migration (the movement of people to or from countries outside the UK) and cross border migration (the movement of people between countries of the UK).

In 2012, the Economic and Social Research Council (ESRC) Centre for Population Change (CPC) carried out a [review of the migration assumptions setting methodology for the national population projections](#).

In response to this review changes were implemented to the way in which migration assumptions were set. In the 2012-based projections, in addition to a general streamlining of the methodology, there was a move to [modelling migration inflows and outflows separately rather than net migration](#). In the 2014-based projections, a new SAS-based system was developed enabling the setting and applying of the [cross border \(intra-UK\) migration assumptions as rates rather than fixed numbers of migrants](#).

A number of data sources are used to derive the migration assumptions. International migration flows are primarily sourced from the International Passenger Survey (IPS). Estimates of flows of asylum seekers, most of which are not captured by the IPS, are provided by the Home Office. Movements between the countries of the UK are based on National Health Service Central Register (NHSCR) trend data.

Assumptions of future international migration are derived from modelling recent trends. As trends can be fairly volatile, a short-term assumption is implemented for the first few years of the projection, after which constant annual migration flows are adopted for the longer term. Assumptions of future cross border rates are calculated as an average of the last 5 years of actual data. An adjustment is applied to the rates to take the population of the country of destination into account, ensuring that net migration levels between countries of the UK are stabilised over the course of the projection.

Details about the [migration assumptions for the 2014-based projections](#) were published in a report alongside the data release and in the national population projections reference volume [Series PP2: Chapter 5. Migration](#).

7 . Variant projections

In addition to the principal projection, variant projections are produced using the same model and base population as the principal, but different sets of fertility, mortality and migration assumptions. These variant assumptions are intended as plausible alternatives to the principal assumptions and not to represent upper or lower limits for future demographic behaviour.

In the 2014-based population projections, 16 additional variants were produced. These included the 6 possible 'single component' variants (that is, varying only 1 component at a time from principal assumptions); 4 'combination' variants and 6 special-case scenarios.

Details about the variants and how they are constructed are published in a report alongside the data release and in the national population projections reference volume [Series 2: Chapter 6 Variants](#).

The [NPP reference volume Series PP2](#) can be found on the ONS website along with the latest published data.