

Summary Quality Report for National Population Projections

1 Introduction

This report is part of a rolling programme of quality reports being introduced by the Office for National Statistics (ONS). The full programme of work being carried out on [Statistical Quality](#)¹ is available on the National Statistics website. Summary Quality Reports are overview notes which pull together key qualitative information on the various dimensions of quality as well as providing a summary of methods used to compile the output.

This report relates to the National Population Projections ([NPP](#))² and aims to provide users with information on the usability and fitness for purpose of these statistics. From 1954 these National Statistics were produced by the Government Actuary's Department ([GAD](#))³. A review of the UK actuarial profession recommended that responsibility for producing these projections should be transferred to ONS, and this transfer was completed on 31 January 2006.

Further details on the methods used to produce the projections NPP can be found in the [Report on the National Population Projections \(series PP2\)](#)⁴. A summary of the methods used and the detailed results from the most recent projection set can be found on the [NPP](#)² page on the National Statistics website.

2 Summary of Quality

2.1 Relevance

The degree to which the statistical product meets user needs for both coverage and content.

This product is the official set of national population projections for the UK and constituent countries. It provides projections of the future population for a period of 75 years into the future by single year of age and gender for England, Wales, Scotland and Northern Ireland plus the combinations of England & Wales, Great Britain and the UK. They are based on assumptions regarding future levels of fertility, migration and mortality considered to be the best that could be made at the time they are adopted. However, due to the inherent uncertainty of demographic behaviour, any set of projections will inevitably be proved wrong, to a greater or lesser extent, as a forecast of future demographic events or population structure. To give users of the projections an indication of this uncertainty, a number of variant population projections are produced, based on alternative assumptions of fertility, mortality and migration

The projections are produced at the request of the National Statistician and the Registrars General of Scotland and Northern Ireland. As such their content and method of production have been formally agreed, and are regularly revisited to see if changes are required by the statistical offices of the four countries. These details are set out in a formal NPP Agreement. The [NPP](#)² process is overseen by an [NPP](#)² committee, accountable to the UK Population Committee which includes the National Statistician and Registrars General. The same statistical offices use the national projections as the base for their sub-national projections, so are well placed to ensure that the product meets their user needs in terms of a base from which they can make an additional projection set at a more local level.

The projections are used as inputs, or as control totals, for other sets of projections produced both by ONS and other government departments. The marital status projections are controlled to the national projections, which in turn are used as an input for the household projections produced by Communities and Local Government ([CLG](#))⁵. They are also a basis for many other forecasts, such as the expected number of primary school age children and the expected number of recipients of state pensions.

Within the projection process the ONS and the Devolved Administrations consult key stakeholders, including representatives from relevant Government departments and other parties such as the Bank of England. Consultation meetings are held where stakeholders have the opportunity to discuss proposed assumptions, highlight potential new data requirements or request changes to presentation or the publication timetable. ONS takes into account stakeholder view and suggestions as far as possible, within the terms of the [NPP²](#) Agreement and the [Code of Practice for Official Statistics⁶](#).

For example, the Department for Work and Pensions and HM Treasury asked if the projections could be extended to run for 100 years, to better inform their work on the future cost implications of the state pension and long-term financial planning. After debating the problem of making sure people understand the increasing level of uncertainty in the later years of the projection period, it was agreed that the 2006-based projection set would be run for 100 years, but the 75 to 100 year data would only be available on request for modelling or research purposes.

2.2 Accuracy

The closeness between a projected result and the (unknown at the time of projection) true value.

[NPP²](#) use the latest available official population estimates as their base year and are inevitably dependent on the accuracy of these estimates. The population estimates are calculated using the internationally recognised cohort component method - starting with the population data from the last decennial census and updating them each year with the available data on births, deaths and migration. The publication [Making a population estimate in England and Wales⁷](#) provides an in depth explanation of the population estimates methodology.

This product produces projected figures so it is impossible to quantify, at the time of their publication, how accurate the most recent (currently 2008-based) population projections will prove to be. Each element of the projections, fertility, migration and mortality, is considered very closely to try to ensure that the best possible assumption is made. However, inherent uncertainty of future demographic behaviour means that from some point in the projection, assumptions of key variables are often held constant. How far into the future this occurs is likely to depend on the stability of that particular measure.

Migration numbers are particularly unpredictable, with recent actual figures varying widely, so a constant annual net migration assumption is usually assumed just a few years into the projection period. Fertility measures are less volatile, although as a period measure the Total Fertility Rate (TFR) is affected by when women choose to have their children as well as the number that they choose to have. The TFR is usually assumed to be static about 10 to 15 years into the projection. Mortality is measured in terms of improvements in mortality rates and, as changes are more gradual and stable, the current rates are assumed to gradually converge to a standard rate of improvement (at the same level for all but the oldest ages) 25 years into the projection. All these time periods are reconsidered for each projection set.

The assumptions are largely based on extrapolation of past trends with established models of, for example, the International Passenger Survey (IPS) component of migration flows and the distribution of births by birth order. Inevitably, there is some element of subjective judgement and choices of key assumptions are also informed by the views of an Expert Advisory Panel this is discussed in section 11 of the online results report for the current projections published on the [NPP²](#) page on the National Statistics website.

It would be impossible for any projections to be entirely correct – changes in the economy, in individual, family and household behaviour and events outside the UK will occur and will influence the three main components of population change. Possible effects of this uncertainty are shown by producing both a principal projection and a number of variant projections. These variants give alternative plausible scenarios according to high or low assumptions about the trajectories of fertility, migration and mortality; they can also be

combined to see the effect on the projections of, for example, a 'young' population assumption (high fertility, high migration and low life expectancy assumptions). The variant projection results are also made available on the [NPP²](#) page on the National Statistics website.

The cohort component method used to produce the projections does not enable statements of probability to be attached to them, or for confidence intervals to be ascribed to the variant projections described above. Thus the levels of uncertainty for the fertility, mortality and migration assumptions are not directly comparable. However, it is possible to make some general comments about the relative importance of fluctuations in fertility, mortality and migration at different points in the projection period. This is illustrated in the Variant chapter of the [Report on the National Population Projections \(series PP2\)⁴](#).

Important lessons can be learnt by looking back at earlier projection sets and comparing them with what subsequently happened. In 2006/7 ONS completed a detailed analysis looking back over fifty years of projections, and the results were published in an article in [Population Trends⁸](#) no. 128. A previous analysis covering the projections made during the period 1971 to 1991 was published in [Population Trends⁸](#) no. 77, details of which can be found in the [Index to Articles 1975-2003⁹](#). Both articles consider how accurate the national population projections have been, the errors for each of the three individual assumptions, and whether accuracy has improved in more recent projections. They also discuss the variant projections. These analyses are inevitably dependent on comparisons with the latest population estimates. Revisions to estimates of the past and current size of the population (for example, the revisions made to population estimates following the 2001 Census) also play a part in explaining projection error. This is likely to be a continuing factor as getting accurate results from traditional censuses becomes more difficult (for example, because of higher non-response levels). This issue needs to be taken into account when considering projection error, as revisions may otherwise have the effect of making the projections look more or less accurate than they really were.

The recent [Population Trends⁸](#) article on the accuracy of UK projections was complemented by an article in [Population Trends⁸](#) no. 129 by an international expert in population projections which considered the accuracy of projections across a number of European countries.

One of the limitations of the traditional deterministic approach to projecting the population is that no probabilities are attached to the principal and variant projections, so users are not given information about the uncertainty associated with them. ONS is addressing this issue by developing a stochastic forecasting model for the United Kingdom. A recent [Progress Report¹⁰](#) on this work describes how uncertainty about future demographic behaviour can be taken into account by expressing fertility, mortality and migration assumptions in terms of their assumed probability distributions. It discusses how these can be derived using a combination of three recognised approaches: analysis of past projection errors, expert opinion and time series analysis. The progress report outlines the early findings of this research, and further work is planned by ONS in this area.

2.3 Timeliness and Punctuality

Timeliness refers to the lapse of time between publication and the period to which the data refer. Punctuality refers to the time lag between the actual and planned dates of publication.

[NPP²](#) are currently published in two parts. The first part, published in the October following the reference year, consists of the principal projections and the nine main variant projections, while the remaining combination and 'special case' variant projections are published a month later, in November. The starting point, or base year, for the projections are the population estimates for [England & Wales¹¹](#), [Scotland¹²](#) and [Northern Ireland¹³](#), which are produced by ONS, the General Register Office for Scotland (GROS) and the Northern Ireland Statistics and Research Agency (NISRA) respectively. The last of these estimates become available at the end of August of the year following the reference year. Thus publication of the national population projections is approximately two months after receipt of the final set of data required for production.

The planned date of publication is calculated at the start of each projection process and would only not be met if essential data from another party was delayed significantly, for example if population estimate data was not received. The planned publication date, as entered into the [National Statistics Release Calendar](#)¹⁴ has always been met. In the unlikely event of a change to the pre-announced release schedule, public attention should be drawn to the change and the reasons for the change should be explained fully at the same time, as set out in the [Code of Practice for Official Statistics](#)⁶

The [Report on the National Population Projections \(series PP2\)](#)⁴ contains full details of the results of the projections, the assumptions made for future fertility, mortality and migration, and also the methodology behind the calculations. This takes longer to prepare and is published in June of the year following the publication of the projection results, or about 24 months after the end of the reference year. For the 2008-based projections the report will be available online in Spring 2010 and will no longer be available in hard copy.

2.4 Accessibility and Clarity

Accessibility is the ease with which users are able to access the data, also reflecting the format(s) in which the data are available and the availability of supporting information. Clarity refers to the quality and sufficiency of the metadata, illustrations and accompanying advice.

Full results of the current 2008-based national population projections are published on the [NPP](#)² page on the National Statistics website. Data can be accessed using the online results report which allows users to access tables (downloadable in excel format) charts and textual information.

Access to historic sets of projections (2006-based and earlier) is available through the [GAD](#)³ website; at least some data is available for projections all the way back to 1955. This also includes for some sets: datasets, graphs and textual background information, and where available information on both the principal projection and variant projections.

A volume on each main projection set [Report on the National Population Projections \(series PP2\)](#)⁴ is published about five months after the principal projections, giving further information on the results and methodology by which the projections are produced.

Most queries can be answered from the online datasets, for additional queries please email: NatPopProj@ons.gov.uk¹⁵, telephone: (01329 444652) or write to National Population Projections Unit, ONS, Segensworth Road, Fareham, Hants PO15 5RR.

2.5 Comparability

The degree to which data can be compared over time and domain.

Each set of national population projections is unique, comprising assumptions made using the best information available at that point in time. Thus each new set of projections, using the most up-to-date background data available, supersedes the previous set. Although the results of subsequent projections can be compared, this will not be comparing like-with-like but instead observing what effect the most recent demographic trends, when built into projections for the future, will have on the expected future population of the country.

Data from most of the projection sets made by [GAD](#)³ and ONS between 1955 and 2006 are available on the [GAD historic projections database](#)¹⁶, the current 2008-based projections are available [NPP](#)² page on the National Statistics website.

An article in [Population Trends](#)⁸ no. 128, published in June 2007, looks at the accuracy of national population projections produced over the last 50 years. It compares the projected populations with subsequent population estimates and also considers the assumptions for fertility, mortality and migration, looking at how the assumptions have changed over time and again comparing them with the subsequent estimates of fertility, mortality and migration.

The datasets produced within the national population projections include standard demographic figures. As well as overall population totals, figures provided are: the projected number of births, deaths and net migrants; age specific fertility rates (and births by age of mother on request); mortality rates (and deaths by age on request) and expectation of life; migration by age; and dependency ratios. These are all datasets which would be produced as part of any population projection created by the cohort component method. However, a producer may choose to publish only the population figures rather than the full sets made available by ONS.

2.6 Coherence

The degree to which data that are derived from different sources or methods, but which refer to the same phenomenon, are similar.

[NPP²](#) are used both within, and outside, Government as the definitive set of projection figures for the UK and constituent countries. They are used as the base for other official population projections such as marital status projections, sub-national projections and household projections and are also used to calculate rates such as birth and death rates (when population estimates are not yet published) and in the calculation of life tables. Other Government departments use the projections directly to calculate information such as future school place requirements, expected future cost of state pensions and potential demand for health services. Throughout the UK the projections are considered the authoritative set of information on future population levels and therefore no other national projections are, to ONS's knowledge, produced.

The only known population projections for the UK apart from [NPP²](#) are those produced by Eurostat and the United Nations(UN). [Eurostat projections](#)¹⁷ refer to population as at 1 January, rather than at mid-year as for NPP. Each time Eurostat creates a projection, ONS supplies a 1 January population estimate by single year of age and sex to use as the base population. Responsibility for the production of these base estimates falls within the Population Estimates Unit of ONS. Eurostat has no fixed timetable for their population projections, but their stated aim is to produce a projection set every 3-4 years. The most recently published are 2008-based population projections, 'EUROPOP 2008', published (April 2008).

Eurostat also use the cohort component approach to calculate their projections, but use their own methods to decide their assumptions for fertility, mortality and migration. Results of the (1 January) 2008-based [Eurostat projections](#)¹⁷ can be compared against the [NPP²](#), (mid-year) 2008-based results. Long-term fertility assumptions are very similar, but Eurostat have assumed lower life expectancy and net migration than [NPP²](#) and therefore their projections give lower population results. At 2033, for example, the [NPP²](#) project a UK total population of 71.6 million, compared to a Eurostat figure of 70.1 million. Both Eurostat and [NPP²](#) project that the UK population will rise steadily throughout their projection periods. The Eurostat projection runs to 2061, at which point they project a UK total population of 76.9 million, compared to the [NPP²](#) projection of 79.7 million for the same year. The Eurostat projection does not divide the UK into constituent countries.

The UN produce [worldwide population projections](#)¹⁸ every two years. They publish a combination of population estimates and projections under the banner 'Population Revisions'. They also use the cohort component method for making their projections (except for countries with a population of less than 100,000) and base their results at 1 January.

Individual countries such as the UK have no input into the UN population projections, for which the assumptions are decided on a more general basis. For example, the fertility assumptions are made for just 9 regions of the world – so all of the countries of Europe have the same fertility rate assumption, despite the differing fertility experiences across Europe at the current time. Thus their usefulness is in terms of a broad view across a number of countries, or where individual country projections cannot be obtained.

Recent UN population projections have been published for 2004, 2006 and 2008. The 2008 Revision, published in March 2009, can be compared to the 2008-based [NPP²](#). For 2050, the UN projects a UK population of 72.4 million, compared to an [NPP²](#) figure of 76.8 million. This large difference arises from the UN assuming lower levels of long-term net migration and significantly lower life expectancy. In previous UN Revisions, they had made the same long-term migration assumption as for [NPP²](#). It is possible, therefore, that this discrepancy is simply due to a time lag in catching up with the ONS assumptions. With life expectancy, however, the UN has tended to adopt more pessimistic assumptions than ONS.

3 Summary of Methods Used to Compile the Output

The national population projections are calculated using a number of standard demographic methods. Full details can be found in Chapter 10 of the [Report on the National Population Projections \(series PP2\)⁴](#) and also in section 2 of the online results report for the current projections published on [NPP²](#) page on the National Statistics website.

Some of the main methodological points are detailed below.

The projections are made for successive years running from one mid-year to the next using the cohort component method, which can be summarised as:

Population (year x) + Births (between yrs x and y) – Deaths (between yrs x and y) + In-Migrants (between yrs x and y) – Out-Migrants (between yrs x and y) = Population (year y).

For each age, the starting population plus net inward migrants less the number of deaths produces the number in the population, one 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.

The mid-year population estimates from each country are used as the starting population. The numbers of births, deaths and migrants are calculated using the assumptions of fertility, mortality and migration which are determined by a mixture of, trend observation & extrapolation, and consideration of expert opinion, with actual data included in the calculation for the first year of the projection.

The projections are computed for each of the constituent countries of the UK and the results are added together to produce projections for England & Wales, Great Britain and the UK. Variant projections are produced using the same method but using alternative assumptions of fertility, mortality or migration.

4 References

	Title of Reference	Website Location
1	Statistical Quality	http://www.ons.gov.uk/about-statistics/methodology-and-quality/quality/index.html
2	National Population Projections (NPP)	http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=8519
3	Government Actuary's Department (GAD) website	http://www.gad.gov.uk
4	National Population Projections (Series PP2).	http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=4611
5	Communities and Local Government (CLG) Household Projections	http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/householdestimates
6	Code of Practice for Official Statistics	http://www.ons.gov.uk/about-statistics/ns-standard/cop/index.html
7	Making a population estimate in England and Wales	http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=575
8	Population Trends	http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=6303&Pos=&ColRank=1&Rank=422
9	Index to Articles 1975-2003	http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=1634&Pos=6&ColRank=1&Rank=272
10	Progress report on stochastic forecasting	Progress report on developing stochastic population forecasts for the UK - August 2009
11	Population estimates for England & Wales	http://www.statistics.gov.uk/statbase/Product.asp?vlnk=601
12	Population estimates for Scotland	http://www.gro-scotland.gov.uk/statistics/publications-and-data/population-estimates/index.html
13	Population estimates for Northern Ireland	http://www.nisra.gov.uk/demography/default.asp17.htm
14	National Statistics Release Calendar	http://www.statistics.gov.uk/hub/release-calendar/index.html
15	Email: ONS NPP unit	mailto:NatPopProj@ons.gov.uk
16	GAD historic projections database	http://www.gad.gov.uk/Demography%20Data/Population/index.aspx?dp=Past+projections
17	Eurostat: EU projections	http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Population_projections
18	UN: World projections	http://esa.un.org/unpp/

Last Revised - October 2009