Comparing methods of producing estimates of those aged 90 and over by single year of age and sex, England, Wales, Scotland, Northern Ireland and the UK

Comparison of methods used to produce population estimates for people aged 90 years and over by the Office for National Statistics, the National Records of Scotland and the Northern Ireland Statistics and Research Agency.

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Release date:
25 September 2019

Next release:
To be announced

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1 . Introduction

The Office for National Statistics (ONS) produces population estimates of people aged 90 years and over by single year of age and sex up to age 105 years and over for both England and Wales. Corresponding estimates for Scotland are produced by the National Records of Scotland (NRS) and for Northern Ireland by the Northern Ireland Statistics and Research Agency (NISRA).

The ONS carries out additional quality assurance on the estimates produced by the NRS and NISRA. The ONS also compiles the 90 years and over estimates produced by the three statistical offices to produce a set of estimates for publication at UK level.

2 . Background

The mid-year population estimates published by the Office for National Statistics (ONS) include estimates by single year of age to 89 years, with a final category for ages 90 years and over.

Prior to 2007, population estimates for single years of age beyond 90 years were calculated for England and Wales (as a whole), Scotland, and Northern Ireland by the Government Actuary's Department for use in compiling national interim life tables and in producing the national population projections. The estimates were made available for research purposes but were not officially published. The ONS took over the production of these estimates in 2007.

In recognition of increased interest in population estimates at the oldest ages the ONS began to publish 90 years and over estimates by single year of age in 2007 as Experimental Statistics. The National Records of Scotland (NRS) took over the production of the estimates for Scotland in 2008 and the Northern Ireland Statistics and Research Agency (NISRA) took over the production of these estimates for Northern Ireland in 2010. The estimates have been published as National Statistics since 2011.

3 . Methodology

The Office for National Statistics (ONS), the National Records of Scotland (NRS) and the Northern Ireland Statistics and Research Agency (NISRA) all use a modified form of the survivor-ratio methodology proposed by Kannisto-Thatcher (PDF, 145KB) (the KT method) to produce single year of age population estimates for ages 90 years and over. In this method, population estimates are produced from death registration data. The ONS, the NRS and the NISRA all use the number of deaths that occur in the mid-year reference period by age at the start of the period. Applying the KT method to data in this format allows mid-year population estimates by age to be derived directly from the input data.

At high ages and for dates sufficiently far in the past, historic age-specific population estimates can be obtained directly from deaths data. Once all the members of a given birth cohort have died it is possible to reconstruct the numbers who were alive at earlier dates from their dates of birth and death.

For cohorts that are almost extinct, the ratio of the number of survivors who are still alive to the numbers in the cohort who died in the previous k years can be estimated from the experience of previous cohorts. This estimated survivor ratio can then be applied to the known number of deaths in the given cohort which occurred over the last k years. The past population for this cohort can then be recreated by adding back the deaths. If the highest age x, at which there is expected to be a survivor, is known, the whole process can be repeated to obtain survivor ratios to estimate the numbers aged x-1, then x-2 and so on, in an iterative process.

Applying this method directly assumes that the survivor ratio is the same as that in the immediately preceding cohort. However, this may be an atypical cohort for various reasons. To dampen fluctuations in the ratios, the average survivor ratio over the preceding m cohorts can be calculated, rather than just a single cohort.

In circumstances where mortality rates are changing over time, or where estimates are required down to ages as low as 90 years, Kannisto and Thatcher proposed various modifications to the survivor ratio method. To compensate for the fact that reduced mortality at higher ages may increase the size of the survivor ratio over time, a correction factor is applied to the survivor ratios calculated. This can be set to constrain the estimates to sum to the official population estimate for a given age group (for example, 90 years and over) or so that the estimates join to the official estimates in a specific way.

One consequence of this method is that each year the estimates for earlier years become more accurate as more death data becomes available to inform the age profiles.

The ONS, the NRS and the NISRA all follow the KT method described previously, with values k=5 and m=5 and a constraint that the total estimates derived for the most recent year being estimated sum to the official population estimate for those aged 90 years and over for that year.

4 . Differences

The Office for National Statistics (ONS) and the National Records of Scotland (NRS) round their estimates of the population aged 90 years and over by single year of age to the nearest 10 (except where the number is greater than zero but less than or equal to five, which is shown as five), reflecting the quality of data and methodology. Given the small population of Northern Ireland, the Northern Ireland Statistics and Research Agency (NISRA) publishes estimates to the nearest person.

Since the 2002 to 2018 estimates of the very old, including centenarians for England and for Wales, deaths are based on the age at beginning of the mid-year reference period, with the age calculated using the date of birth data on the death record. Prior to this time, England and Wales input deaths data were on a calendar year basis by age at death. This is the way deaths data for England and Wales were historically produced, and the estimates were initially calculated as input data for life tables which traditionally use calendar year deaths. It was then necessary to make assumptions about the distribution of births throughout the year to adjust the deaths data to the format required by the KT method.

The impact of the change to the format of the deaths input data for England and for Wales has been assessed and found to have a small but positive effect on the distribution of the resulting estimates. This change has resulted in improved quality of estimates of the very old for both England and Wales and, by implication, for the UK. These are an aggregation of the 90 years and over population estimates by single year of age and sex produced by the ONS for England and for Wales, by the NRS for Scotland and by the NISRA for Northern Ireland. This change also further aligns the KT methods used by the ONS, the NRS and the NISRA.

5 . Geographical breakdown

Estimates of the population aged 90 years and over by single year of age are only available using this methodology at country level. Below country level migration can become more significant, for example, for older people moving from a domestic property to a residential care home.

The Office for National Statistics (ONS) proposed an approach to producing population estimates for the 90 to 94 years and the 95 years and over age groups, by sex, for Lower layer Super Output Areas (LSOAs) in England and Wales using a different methodology and invited user feedback. Details can be found in the LSOA Population Estimates of the Very Old Research paper 17 (ZIP 11.6MB) . Experimental Mid-2002 to Mid-2012 LSOA Population Estimates of the Very Old, England and Wales, were published as supporting information to the paper.

The National Records of Scotland (NRS) published estimates for the population aged 90 years and over for council areas in Scotland for the first time on 30 September 2015. Community Health Index (CHI) data for single year of age for 90 years and over were used as an initial proxy for the distribution of these ages within each council area. This method is explained in more detail in the publication which is available in the Sub-national Population Estimates for ages 90 and over section of the NRS website. They are looking for feedback on the method and results of these developmental statistics.

6 . Related publications

Estimates of the very old, including centenarians – 90 years and over population estimates published by the Office for National Statistics.

Centenarians (and people aged 90 and over) population estimates – population estimates for people aged 90 years and over published by the National Records of Scotland (NRS).

Estimates of the Population aged 85 and over – estimates for those aged 85 to 89 years published by the Northern Ireland Statistics and Research Agency (NISRA).

7 . Timing of release

The Office for National Statistics (ONS), the National Records of Scotland (NRS) and the Northern Ireland Statistics and Research Agency (NISRA) co-ordinate a release date that is generally at the end of September, to be available prior to the United Nations International Day of Older Persons (1 October 2019).