

Small Area Population Estimates across the UK

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1. Introduction

Small area population estimates are produced separately for countries within the UK. There are many similarities but also some subtle differences between methods. This paper gives a broad description of the methodologies used in each country. This technical report has been collated by the Northern Ireland Statistics and Research Agency (NISRA) based on contributions from the Office for National Statistics (ONS) and National Records of Scotland (NRS).

Previously, population estimates for the smallest geographies around the UK were released under the publication title of “Small Area Population Estimates”. With the release of the 2011 Census, a new geographical area in Northern Ireland was termed “Small Areas”, replacing the Census Output Area. To avoid confusion, the Northern Ireland publication has been renamed “Population Estimates for Small Areas in Northern Ireland”.

For enquiries about the small area population estimates for each country please contact the following:

England & Wales

Office for National Statistics
Population Estimates Unit
Telephone: 01329 444661
pop.info@ons.gov.uk

Scotland

Statistics Customer Services
National Records of Scotland
Ladywell House
Edinburgh EH12 7TF
Telephone: 0131 314 4299
statisticscustomerservices@nrscotland.gov.uk

Northern Ireland

NISRA Customer Services
Northern Ireland Statistics and Research Agency
McAuley House
2-14 Castle Street
Belfast BT1 1SA
Telephone: 028 9034 8100
census.nisra@dfpni.gov.uk

2. Main uses of small area population estimates

In England & Wales small area population estimates are used by both central government departments and local authorities for a range of purposes including planning, monitoring of services and as denominators for the calculation of various rates and indicators. They are also included in the Neighbourhood Statistics suite of datasets.

In Scotland, small area population estimates are mainly used by local authorities for planning and resource allocation. They are also used as input to the Scottish Index of Multiple Deprivation, and form part of Scottish Neighbourhood Statistics along with other small area statistics that provide information at neighbourhood level. There are two different types of small area used to calculate annual population estimates, 2001 Data Zones and 2011 Data Zones. The 2001 Data Zones were created by aggregating the 2001 Census Output Areas, these have been in existence since 2004. The 2011 Data Zones were created following the 2011 Census by aggregating 2011 Census Output Areas, these boundaries were published by the Scottish Government in November 2014.

The main purpose of small area population estimates for Northern Ireland was to provide the requisite population inputs to the Multiple Deprivation Measure in 2005 and 2010. However, it is recognised that there is a wider interest for these statistics; indeed, it was flagged up in the 2009/2010 NISRA User Survey. There is a user need for small area figures to amalgamate into higher geographies. The small area population estimates are also included in the Northern Ireland Neighbourhood Information Service ([NINIS](#)), for example, through interactive maps.

3. Population definition

The standard mid-year population estimates are used as the population base for small area population estimates for all four UK countries. This means that usual residents away from home temporarily are included, but visitors are excluded, and that students are counted at their term-time address. Members of Her Majesty's (HM) and non-UK Armed Forces stationed in the UK are included; HM forces stationed outside the UK are excluded. This definition is identical to that used for the mid-year population estimates at country and Local Authority level.

4. Geographies

Small area geographies for which population estimates are available are summarised in the table below:

	Number of areas	Average population mid-2011
England & Wales – OA	181,408	310
England & Wales – MSOA	7,201	7,800
England & Wales – LSOA	34,753	1,600
Scotland – 2001 Data Zones	6,505	720
Scotland – 2011 Data Zones	6,976	670
Northern Ireland – SOA	890	2,000
Northern Ireland – Small Area	4,537	400

Further information on SOAs in England & Wales, including the revision to boundaries following the 2011 Census results can be found on the [Neighbourhood Statistics](#) website. Additional population estimates products are also available (either published or on request) for alternative small area geographies in England & Wales, such as wards and parishes.

Further information on Data Zones in Scotland can be found at:

<http://www.scotland.gov.uk/Topics/Statistics/sns/SNSRef>, and

<http://www.scotland.gov.uk/Topics/Statistics/sns/SNSRef/DZresponse>

Further information on Super Output Areas in Northern Ireland can be obtained from the NISRA website at: http://www.nisra.gov.uk/deprivation/super_output_areas.htm. Additional population estimates products are also available for alternative small area geographies in Northern Ireland, such as 2011 Census Small Areas, wards and Neighbourhood Renewal Areas.

5. Methodology

ONS produce population estimates for Lower Layer Super Output Areas in England & Wales using a Ratio Change methodology. This method uses the change in populations recorded on administrative sources as an indicator of change in the true population. A 'change ratio' is calculated from the administrative sources for each small area and applied to the previous year's population estimate to obtain an updated estimate. The method relies on the assumption that the relationship between the indicator of population and the true population has remained the same for the small area since the base year or latest estimated year. Population estimates for LSOAs are further broken down to Output Areas using the apportionment method. A detailed description of the methodology used for Small Area Population Estimates in England and Wales is available [here](#).

ONS identified three potential methods for producing small area population estimates for England & Wales; Ratio Change, Cohort Component and Apportionment. An [evaluation](#) of these methods undertaken in 2006 (that examined test estimates produced from each method over a three-year period) identified Ratio Change as the preferred method. However, it was recognised that there wasn't overwhelming evidence for this method over the Cohort Component method.

In Scotland, both 2001 and 2011 Data Zones use the Cohort Component methodology to create small area population estimates. It uses the following steps from the starting population:

- Remove Armed Forces and Prisoner populations;
- Age on the resultant population;
- Add on Births;
- Subtract Deaths;
- Adjust for Migration;
- Add in Asylum Seekers;
- Add in new Armed Forces and Prisoner populations;
- Make consistent with the Mid-Year Estimate for council areas.

This methodology is also used to create the mid-year population estimates for Scotland and its administrative areas. A detailed description of the methodology used for Small Area Population Estimates in Scotland is available [here](#).

Population estimates for Super Output Areas in Northern Ireland are created from an average of the Ratio Change and Cohort-Component methods. The two methods approach the measurement of population change from two separate but complementary perspectives (stocks versus flows). This provides a strong rationale for a combined approach that draws on the strengths of both methods. Furthermore, the complementarities between the two methods mean that the mixed approach makes maximum use of the available information. A detailed description of this method is available [here](#). For 2011 Census Small Areas, the apportionment method is used to disaggregate the Super Output Area-level estimates based on a combination of the cohort-component results and administrative data sources. A detailed description of this method is available [here](#).

In Northern Ireland, the Super Output Area-level estimates are constrained to the mid-year population estimates for Northern Ireland, and in turn become building blocks to create estimates for larger geographies such as Local Government Districts and Parliamentary Constituencies. For the other UK countries, small area population estimates are constrained to the mid-year population estimates for Local Authorities. Therefore, small area population estimates around the UK are consistent with the mid-year population estimates in terms of both numbers and definition of usual residency.

6. Data sources

To estimate populations of small areas in England & Wales, ONS uses NHS patient registers. Additional data sources are used to account for special populations such as armed forces and prisoners.

ONS has stopped using other sources that are still being used in Northern Ireland. The Older Persons Datasets (from Department for Work and Pensions: persons aged 65 and over in receipt of specific benefits) has not been used from mid-2006 onwards due to issues with data availability. Child benefit data (from HM Revenue and Customs) has not been used from mid-2013 due to changes in the dataset following the government policy introduced in 2013 to restrict the availability of child benefit depending on family income.

The data sources used for small area population estimates in Scotland are tightly linked to the methodology. Data on births and deaths are supplied by the National Records of Scotland. To estimate migration, a combination of data sources are used, including the National Health Service Central Register, the Community Health Index, and the International Passenger Survey. Additional data sources are used to account for special populations such as armed forces, asylum seekers and prisoners.

The methodology for the small area population estimates in Northern Ireland is generally the average of estimates by the ratio change method (used for England & Wales) and the cohort component method (used for Scotland). Hence, it is a very data-hungry methodology with a high degree of overlap between data sources used by ONS and NRS respectively. For the ratio change method, indicator data sets include the Medical Card Register, Child Benefit, and Older Persons' database, but also the School Census (which was not used for England & Wales). For the cohort component method, births and deaths from the General Registry Office in Northern Ireland was used, alongside with the Medical Card Register to estimate migration. Additional data sources are used to account for special populations such as armed forces and students (Higher Education Statistics Authority). NISRA also identified several other data sources such as the electoral roll, dwelling stock and persons in receipt of means-tested benefits, which did not comply with the requirements to be included as an indicator dataset, but were used in the quality assurance of population estimates.

7. Special Populations

7.1. Students

In Scotland, a student area is identified as an area whose population during the 2011 Census was made up of 20% or more students. For these areas, separate quality assurance is carried out to compare the population count and the age-sex distribution with data from the 2011 Census and other information collected by National Records of Scotland. Adjustments may be required to these areas, with counteracting adjustments to other data zones within the same council area, sex and age group so that the aggregated data zones are consistent with the mid-year estimate council totals.

In England & Wales, students are not treated as a special population.

In Northern Ireland, information from the Higher Education Statistics Authority is combined with that of the Medical Card Register to account for student flows within Northern Ireland. Therefore, student areas are not treated differently.

7.2. Armed Forces

For England & Wales, armed forces are treated as a special population. Before applying the change ratios, armed forces population counts are subtracted. After these counts are constrained to the local authority mid-year estimates minus the special population, armed forces are added again. This method also applies to foreign armed forces and their dependents.

In Scotland, armed forces are treated as a special population. Before the population is aged-on, the armed forces population for the previous year is removed. The updated armed forces population is added back in after other adjustments for births, deaths and migration have been made. The armed forces estimates at council area level are apportioned to data zones, based on the data zone distribution of the previous year. Aggregated data zones are made consistent with the age-sex distribution of armed forces at council area level.

In Northern Ireland, nine SOAs were identified as containing Army Barracks. For these areas, the ratio change method is less reliable for younger ages as there is a weak relationship between population and indicator variables. As a result, the cohort component estimates are used, in which armed forces based in Northern Ireland are subtracted in the previous year's estimates before ageing on the civilian population and then adding in the armed forces after the ageing on is complete. The Defence Analytical Services Agency of the Ministry of Defence provide details on the number of forces stationed in Northern Ireland by age, sex and area.

7.3. Prisoners

For England & Wales and Scotland, prisoners are treated as a special population, similarly to the treatment of armed forces. In Northern Ireland, prisoners are not treated as a special population.

7.4. Asylum Seekers

In Scotland, in 2012 the Home Office provided the National Records of Scotland with the postcodes for the head of households for asylum seekers within Scotland. Using the Council area estimates this data is then apportioned to data zone level, according to head of household postcode. All asylum seekers are contained within Glasgow City. For later years, asylum seeker estimates are apportioned to data zones in Glasgow City, based on the data zone distribution of the previous year. Aggregated data zones are made consistent with the age-sex distribution of asylum seekers.

In England & Wales, asylum seekers are not treated as a special population. There are very small numbers of asylum seekers in Northern Ireland; there is no special treatment for this population.

8. Published statistics

For all four UK countries, small area population estimates are available for the period mid-2001 to mid-2014. In Scotland, population estimates for the 2001 data zone level are available for each year in the period 1996-2013. This geography has now been replaced with 2011 data zones, with estimates available between mid-2011 and mid-2014.

Population estimates for 2001 Scottish data zones are published for 5-year age bands, with the exception of the 10-15 and 16-19 age bands. This was done to allow the creation of child population (aged 0-15 years) and working age population. Single year of age population estimates for 2001 data zones in Scotland are available on request. Population estimates for the new 2011 data zones are publically available by single years of age.

For LSOAs and MSOAs in England & Wales, data are published by single year of age and sex.

For Northern Ireland at Super Output Area level, population estimates are available by sex and four broad age groups: children (0-15 years), young working age (16-39), older working age (40-64) and older population (aged 65 and over). There is no breakdown by age and sex for population estimates of Small Areas. User-defined requests for alternative age-sex breakdown or grouping of small geographical areas can be discussed with the production team and will be considered on an individual basis.

Population estimates for small areas in England & Wales are available at:

<http://www.ons.gov.uk/ons/rel/sape/small-area-population-estimates/mid-2014-and-mid-2013/index.html>

Population estimates for small areas in Scotland are available at:

<http://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/2011-based-special-area-population-estimates>

and

<http://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/special-area-population-estimates>

In Northern Ireland, population estimates for Super Output Areas and Small Areas are available at:

<http://www.nisra.gov.uk/demography/default.asp125.htm>

9. Publication timelines, revisions and designation

Small area population estimates for England & Wales were first published for MSOAs and LSOAs in 2006 (mid-2001 to mid-2004) as 'experimental statistics'. New estimates are published on an annual basis, most recently on 25 November 2015 for mid-2014, five months after the publication of the mid-year population estimates. The estimates for mid-2002 to mid-2008 were revised in September 2010 following revisions to the mid-year population estimates in May 2010 to incorporate improvements resulting from the Migration Statistics Improvement Programme (see [revision policy](#)). The estimates for Mid-2002 to Mid-2010 were revised in November 2013 following the 2011 Census. ONS have published an [evaluation report](#) on the accuracy of the 2011 Small Area Population Estimates compared to the 2011 Census population.

The assessment by the UK Statistics Authority of Statistics on ONS Population Estimates and Projections granted National Statistic status to small area population estimates at LSOA and MSOA level in England & Wales. However, further enhancements need to be implemented by ONS as listed in the latest [ONS population statistic assessment report](#) for small area population estimates in England and Wales to maintain National Statistic status.

The Scottish population estimates for the years 2002 to 2010 on the 2001 Data Zone boundaries were revised following the 2011 Census, these were published in 22 May 2014 (see [revision policy](#)). The mid-2001 to mid-2010 population estimates based on the 2011 Data Zone boundaries will be published later 2016. The latest small area population estimates for mid-2011 to mid-2014, based on 2011 Data Zone boundaries were published on 27 August 2015, four months after the Scottish mid-year population estimates were released. The mid-2014 small area population estimates, based on 2001 Data Zones, will be published in December 2015. Going forwards it is intended that population estimates for 2011 Data Zones only will continue to be published and that population estimates for 2001 Data Zones for 2014 will be the last estimates on that geography produced.

Following the assessment by the UK Statistics Authority of Statistics on Population Statistics in Scotland¹, small area population estimates in Scotland will maintain National Statistic status subject to NRS implementing the requirements listed in the assessment report.

Small area population estimates for Northern Ireland – relating to mid-2003 – were first published in 2005, as part of the Multiple Deprivation Measure 2005². The update of this Measure in 2010 led to small area population estimates to be derived for each year in the period mid-2001 to mid-2008, including revised estimates for mid-2003. Subsequent estimates for mid-2009 and mid-2010 were published in May and September 2011 respectively. The latest estimates were published roughly three months after the mid-year population estimates were released. The estimates for mid-2001 to mid-2010 were revised in April 2014 following the 2011 Census (see [revision policy](#)), alongside new estimates for mid-2011 and mid-2012.

Population estimates for Super Output Areas have been released as part of the mid-year population estimates for mid-2013 and mid-2014. These have now become the building blocks to create population estimates for all areas within Northern Ireland. New population estimates for Small Areas for those years were released in November 2015, alongside revised figures for mi-2012.

¹ <http://www.statisticsauthority.gov.uk/assessment/assessment/assessment-reports/assessment-report-311---population-estimates-and-projections-for-scotland.pdf>

² Small area population estimates for 2003 were created by external consultants, based on the Ratio Change methodology. See Appendix 2 of <http://www.nisra.gov.uk/deprivation/archive/NIMDM2005FullReport.pdf>

The assessment by the UK Statistics Authority of statistics of population statistics in Northern Ireland³, published in 2015, has indicated that small area population estimates in Northern Ireland will keep National Statistic status subject to NISRA meeting the requirement set in the assessment report.

10. Future developments

The findings of the 2011 Census have led to revised small area population estimates in each UK country. There are now annual releases for each country.

11. Users' guidance

This document has set out the differences and similarities between the small area population estimates produced by ONS, NRS and NISRA for England & Wales, Scotland, and Northern Ireland respectively.

The population size of small areas varies across the United Kingdom. Datazones in Scotland are on average smaller in population than LSOAs in England & Wales, which are in turn smaller on average than SOAs in Northern Ireland. This is important as the smaller the area in population terms, the more likely the people living the area share similar social characteristics and thus the more likely there is to be extreme values in the spatial distribution of people's characteristics.

12. Further documentation

More detailed information on small area population estimates are available from ONS, NRS and NISRA. This section provides some useful links.

For England & Wales, see:

<http://www.ons.gov.uk/ons/guide-method/method-quality/specific/population-and-migration/pop-ests/index.html>

and

<http://www.ons.gov.uk/ons/guide-method/method-quality/quality/quality-information/population/index.html>

³ <http://www.statisticsauthority.gov.uk/assessment/assessment-reports/assessment-report-312---population-estimates-and-projections-for-northern-ireland.pdf>

For Scotland, see:

<http://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/2011-based-special-area-population-estimates/small-area-population-estimates>

and

<http://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/special-area-population-estimates/small-area-population-estimates/background-and-methodology>

For Northern Ireland, see:

http://www.nisra.gov.uk/archive/demography/population/small_area/Small%20Areas%20Population%20Estimates%202010%20-%20Statistical%20Report.pdf

and

http://www.nisra.gov.uk/archive/demography/population/small_area/SAPEdocFinal.pdf

NISRA

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