

Mid-year admin-based population estimates for England and Wales quality and methods guide

How we produced the statistics, their strengths and limitations and further quality information.

Contact:
Admin-based Population
Estimates team
pop.info@ons.gov.uk
+44 1329 444661

Release date:
30 July 2025

Next release:
To be announced

Table of contents

1. [Overview](#)
2. [What the statistics cover](#)
3. [Where the data come from and how we produce the statistics](#)
4. [Quality of the statistics](#)
5. [How we are developing the statistics](#)
6. [Users and uses of the data](#)
7. [Definitions](#)
8. [Acknowledgements](#)
9. [Related links](#)
10. [Provide feedback](#)
11. [Cite this guide](#)

1 . Overview

We produce mid-year admin-based population estimates (ABPEs), and the components of population change by single year of age and sex for countries, regions and local authorities in England and Wales. We produce these estimates using the dynamic population model (DPM), which supports the use of a wide and increasing range of data sources over time and captures the dynamics of population change. The DPM builds on the cohort component method, explained in [Section 7: Definitions](#), which we have used to produce our population estimates for many years.

The DPM uses statistical modelling to balance initial estimates of population stocks and population flows each year starting with 2011, which was a census year. Information about the uncertainty of these initial estimates is used to determine the most likely true estimates of the population and population flows. Credible intervals, explained in [Section 7: Definitions](#), give the range in which these true estimates are likely to be contained.

The methods and data sources used to produce the ABPEs are continually reviewed and enhanced where appropriate. This guide reflects current methods and provides a good level of detail for a broad range of users. Links to further information are provided for those who require more detail. We welcome your feedback on our first published version of this guide to help inform future updates and ensure we best meet user needs.

These are [official statistics in development](#).

2 . What the statistics cover

Geographic coverage

Admin-based population estimates (ABPEs) and associated components of population change are produced for countries, regions and local authorities in England and Wales by single year of age and sex. ABPEs are summed to give higher-level estimates for combined groups, such as total population within a local authority, region, country or age group. Each ABPE release uses the latest geography boundaries available at the time of production, more information is available in [Section 5: How we are developing the statistics](#), under the subheading, How comparable the statistics are.

We compile and publish population estimates for the UK, using official mid-year estimates:

- for England and Wales, produced by us at the Office for National Statistics (ONS)
- for Scotland, produced by the [National Records of Scotland \(NRS\)](#)
- for Northern Ireland, produced by the [Northern Ireland Statistics and Research Agency \(NISRA\)](#)

Estimates for the UK will be compiled using ABPEs when they become the official population estimate for England and Wales.

The NRS and NISRA are also investigating alternative methods and data sources for producing population estimates. The NRS has published research on [Administrative data based population, household and ethnicity estimates](#), and NISRA has also published [Research into using administrative data for population estimates](#). We are all sharing information to support each other's work, in line with the [Concordat on Statistics](#) and its supplementary [statement of agreement](#). By taking similar approaches, we will be able to maximise the coherence of UK estimates.

The dynamic population model (DPM) and the traditional cohort component method cannot be used to produce population estimates below local authority level or for other geographies, for example national parks. This is because we do not have all the necessary data sources available for these geographies. Instead, we use a ratio change method to generate population estimates for super output areas from local authority estimates. This method is explained in more detail in Section 5 of our [Population estimates by output areas, electoral, health and other geographies quality and methodology information](#). This method can continue to be used with the ABPEs.

We are investigating options for improving methods for small area population estimates, as explained in our [Small area population estimates in the transformed population estimation system methodology article](#). One potential approach is to make use of geospatial methods and data sources. Our working paper, [Geospatial methods for small area population estimates: proof of concept](#), was reviewed by the Methodological Assurance Review Panel (MARP) in August 2024.

Time period

All estimates of the population relate to mid-year (30 June). Population flow estimates cover the 12-month period to mid-year.

Usual resident population

Our estimates are consistent with the UN definition of usual residence outlined on page 40 in the [Principles and Recommendations for Population and Housing Censuses \(PDF, 2.36MB\)](#). This definition includes people who reside, or intend to reside, in the country for at least 12 months, whatever their nationality. Visitors and short-term migrants who enter or leave the UK for less than 12 months are not included.

For some groups, the concept of usual residence is more difficult to define. Specific rules are used for these groups:

- higher education students and schoolchildren living away from home are considered usually resident at their term-time address
- members of the armed forces are considered usually resident at the address where they spend most of their time
- prisoners are usually resident in the prison estate if they have a sentence of twelve months or more

Population estimates include UK Armed Forces (UKAF) who are overseas on operations and temporary assignments if their last permanent station was in England and Wales. UKAF on overseas postings and any accompanying partners and children are not included.

The usually resident population does not always coincide with the number of people found in an area at a particular point in time. Temporary residents who live in an area for less than 12 months, for example, draw on the same local services and amenities as usual residents. We are considering population estimates using alternative definitions and user requirements for these, starting with temporary international migrants; early estimates for these were published in our [Population and migration estimates - exploring alternative definitions: May 2023 article](#).

Guidance on using different types of ABPEs

We produce ABPEs at several points in time using the best data available.

Provisional ABPEs

We are exploring how we can provide provisional ABPEs that give an early indication of the size of the population in England and Wales. We plan to publish provisional ABPEs around six months after the mid-year reference period.

Provisional ABPEs are early estimates for the latest year. These make use of data that have become available since the previous ABPE release and include assumptions and adjustments to the data that are likely to be revised. Caution is advised when using provisional estimates for policy and funding decisions.

First-updated ABPEs

First-updated ABPEs are improved estimates. These include additional data that have become available alongside refined assumptions and adjustments. These are produced around 12 months after the reference period.

Second-updated ABPEs

Second-updated ABPEs are our best estimates, where more adjustments and assumptions are replaced with data. They are produced around two years after the reference period. Second-updated estimates should be used for any work that requires greater stability in the data.

Our [Publication schedule for admin-based population and migration statistics article](#) explains our proposed approach to revisions and the availability of data in our admin-based population and migration statistical system.

3 . Where the data come from and how we produce the statistics

Where the data come from

We use a range of data sources to produce our admin-based population estimates (ABPEs). The majority of these are administrative data that have already been provided to government, for example, when people access public services, rather than data collected specifically for creating population estimates. We have been using administrative data for many years to produce population estimates, for example, by including data from birth, death and NHS patient registers. Methods used to produce the ABPEs support the use of an increasing range of data sources over time.

Information about the data sources used is provided in our [Quality overview of data sources used in mid-2024 admin-based population estimates for England and Wales](#), including:

- why they have been selected
- how the data are collected
- their quality
- their bias
- their strengths
- their limitations

All input data are quality assured using a wide range of standard checks and expert assessment. More information on the quality assurance conducted throughout all stages of production and analysis is detailed in [Section 4: Quality of the statistics](#), under the subheading How we quality assure the data and statistics.

How we produce the statistics

Overview

The admin-based population estimates (ABPEs) are produced using the dynamic population model (DPM). The DPM uses a Bayesian demographic accounts framework, to create coherent demographic estimates from multiple imperfect datasets. Statistical modelling allows for differing levels of bias and precision, associated with input data and takes account of underlying demographic trends. Bayesian demographic accounts, bias and precision are explained in [Section 7: Definitions](#).

Within this Bayesian demographic accounts framework, we:

- have greater flexibility to use multiple sources for population stock and flow estimates
- can accommodate missingness in input data
- can add new datasets as they become available

In summary, the DPM generates the ABPEs in three steps, a more detailed explanation of each step is provided later in this section.

Step 1: Create initial estimates

A variety of data sources are used to create initial estimates of the usual resident population as close to each mid-year point as possible and changes in the population over time between mid-year points.

Changes in the size of the population result from population flows:

- births
- deaths
- international migration, where people move between the UK and the rest of the world
- internal migration including cross-border flows, where people move between local authorities in England and Wales, or between England and Wales combined, and other countries within the UK

Initial population stock and flow estimates are created for all local authorities by single year of age and sex. These estimates do not have to represent a balanced demographic account explained in [Section 7: Definitions](#).

We also create initial estimates of some parameters required for the statistical models in Step 2:

- coverage ratios - these are used to adjust the initial population stocks because of coverage errors in some of the data sources
- demographic rates - these are used to describe underlying trends

Step 2: Estimate balanced demographic accounts

Using the initial estimates of the population stocks, flows and demographic rates, we estimate statistical models:

- data models account for the precision and potential bias of the initial, unbalanced estimates of population stocks and flows; they ensure that more reliable data are given more weight in the estimation process
- system models represent underlying trends in the rates for births, deaths, and migration; they help ensure that estimates from the balanced set of accounts are plausible in terms of demographic rates

We also conduct sensitivity analyses, which are explained further in [Section 4: Quality of the statistics](#), under the subheading, Sensitivity analyses with changing estimation parameters. This helps us understand how sensitive the resulting ABPEs and components of population change are to changes in the parameters, estimated in Step 1, which represent uncertainty, coverage ratios and demographic rates.

Using the initial estimates from Step 1 and statistical models, balanced demographic accounts are estimated independently for each annual birth cohort by sex for each local authority. The annual birth cohort is all people born within a given year, which ends 30 June.

The DPM generates a sample of potential population and migration counts for each mid-year reference point. The sample counts reflect the many possible ways to balance the initial estimates and represents a set of plausible values, given the uncertainty of the initial estimates.

The ABPEs and estimates of population change resulting from migration are the average (mean) value from the sample distribution. The DPM models combined migration flows. Modelled migration estimates at this stage give combined inflows and combined outflows for each local authority in England and Wales.

The numbers of births and deaths come from administrative registers and are considered reliable. They are therefore treated as exact counts throughout the estimation process and remain unchanged in our published estimates.

The uncertainty around the ABPEs is shown by a 95% credible interval, explained in [Section 7: Definitions](#), which is generated from the sample distribution.

To form a unified balanced demographic account for England and Wales as a whole, the ABPEs for each single year of age and sex are combined for all local authorities.

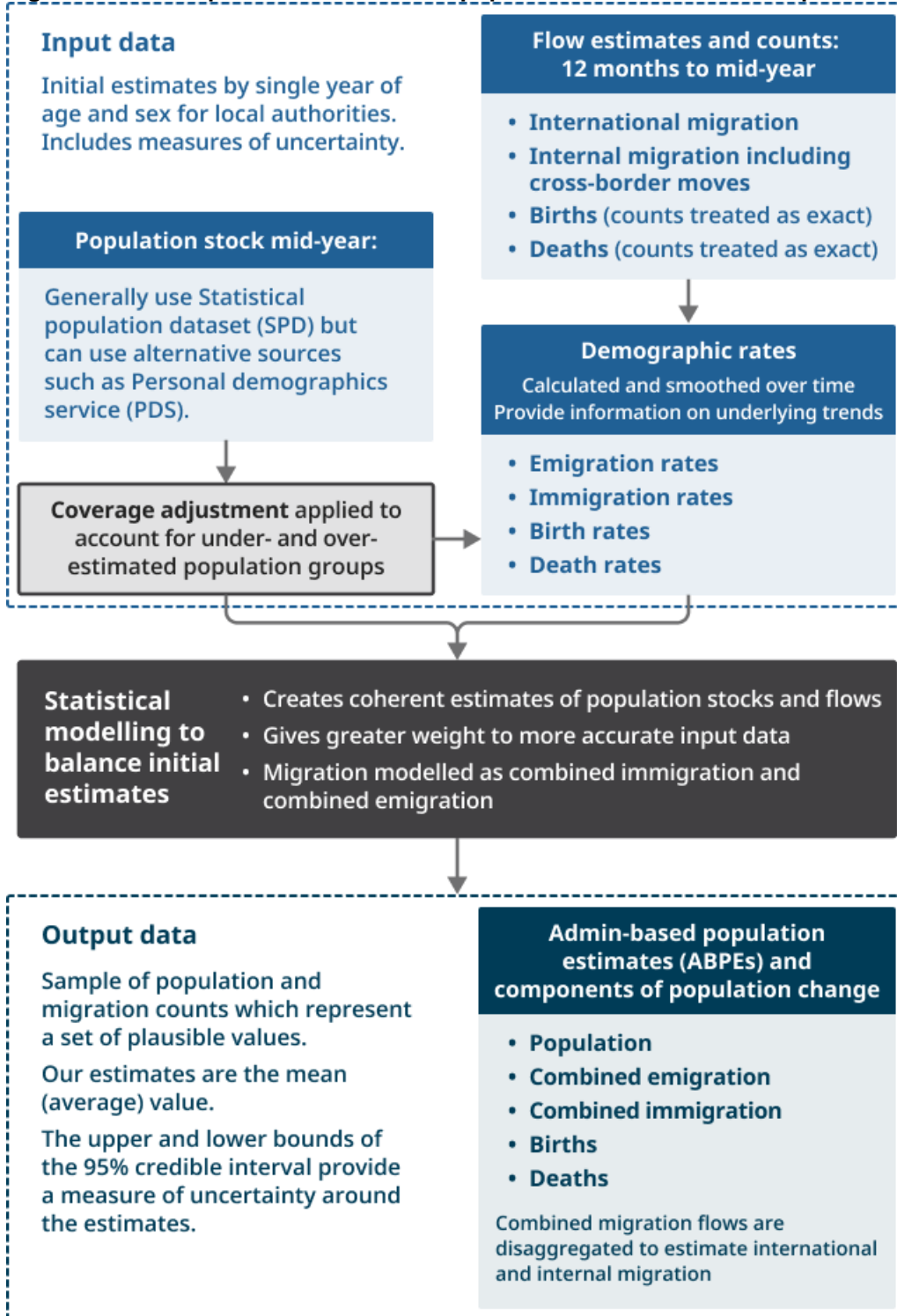
Step 3: Estimate international and internal migration flows

To better understand changes in the size of local authority populations, estimates of combined immigration and combined emigration are disaggregated to show people moving:

- between the UK and the rest of the world
- between local authorities in England and Wales
- between England and Wales combined and other countries within the UK

We explain the method used later in this section.

Figure 1: How we produce admin-based population estimates and components of population change



Source: Admin-based population estimates (ABPEs) from the Office for National Statistics

The DPM has been developed in [a free software environment for statistical computing, known as "R"](#). As part of our commitment to continuous improvement and transparency, we have published the R code that we use for [estimating a demographic account](#) and [disaggregating combined migration flows](#) to estimate international and internal flows. Further code and updates to existing code will be made available on [the Office for National Statistics Digital GitHub](#).

Modelling framework

Using a Bayesian demographic accounts framework, explained in [Section 7: Definitions](#), allows us to update prior information about the population, with evidence from additional data sources which become available measuring population change, to generate posterior estimates.

A more technical summary of the estimation method is available in [Evaluating the DPM estimation method \(Template Model Builder \(TMB\)\) using a simulation study \(PDF, 1.132KB\)](#). This working paper was reviewed by the Methodological Assurance Review Panel (MARF) in August 2024 and is available from the UK Statistics Authority website.

Creating initial estimates of population stocks

Our Statistical Population Datasets (SPDs) generally provide the population stock. However, this information can also come from other sources, including the [NHS Personal Demographics Service \(PDS\)](#) or the census. The specific data sources used can vary based on availability; the PDS often becomes available before other data sources. Information on the data used to compile each population stock used within each ABPE release is outlined in the data sources worksheets in our [published datasets](#).

Population stock estimates for mid-2011 onwards are derived independently for each year, and are split by:

- age, in years
- sex
- local authority of usual residence

SPDs are linked administrative data to which a set of inclusion rules are applied. These look for signs of activity, so that we can approximate the usually resident population. SPDs are created by combining a variety of data sources, including:

- income datasets
- health datasets
- education datasets covering schools, further education and higher education
- prisoners' data
- death registrations

We are working to better understand sources of bias in the SPD. More information is available in [Section 5: How we are developing the statistics](#).

Creating initial estimates for coverage ratios

Coverage adjustment is applied to address gaps or overcount in our estimated population stocks. Coverage ratios are currently estimated for each single year of age and sex within each local authority as follows:

- for the census year 2011, we compare both the NHS Patient Register (PR) and the proxy SPD with mid-2011 population estimates
- for the census year 2021, we compare both the proxy PR and the SPD with mid-2021 population estimates
- for 2012 to 2020, we linearly interpolate between smoothed coverage ratios for 2011 and 2021
- for 2022 onwards, we use one set of smoothed coverage ratios calculated by comparing the SPD in 2021 with mid-2021 population estimates; these same ratios are then used for each subsequent year

There is no SPD for 2011 and no PR available for 2021, so we created proxy versions.

The PR was discontinued after 2020. The proxy 2021 PR was created using the PDS with a series of filter rules to reduce the population to just those registered with a GP surgery, to match the inclusion rules of the PR.

Our SPDs developed for the ABPEs have only been produced for 2016 onwards. To create the proxy SPD for 2011, we calculated the ratio between the PR and SPD in the years we have both, 2016 to 2021. We then fitted a linear model through these ratios over time for each local authority, age and sex group. We extrapolated these linear models to estimate a ratio for 2011, which was then applied to the PR for 2011.

Coverage ratios are then smoothed across ages for each local authority and sex using generalised additive models (GAM). This helps to reduce error from fluctuations and to capture the true underlying relationship. GAMs are explained in more detail in [Section 7: Definitions](#).

The data from a census in 2031 would provide a high-quality point of comparison to understand the quality of our initial population stocks. Our long-term aim is to create coverage ratios using administrative data, but this requires improvements in the quality of the data and a more stable supply of data.

Creating initial estimates of population flows

The specific data sources used to produce initial estimates of population flows for 2012 onwards can vary for each set of ABPEs, based on availability. Information on the data used in each release is outlined in the data sources worksheet of the [ABPE dataset](#).

Initial estimates of the population stocks and flows are not required to represent a balanced demographic account.

Initial estimates: births

Birth counts are obtained from the Civil Registration System of England and Wales. The DPM requires live births for each year ending 30 June, split by:

- mother's age, in years
- birth cohort
- mother's local authority of usual residence
- sex of the child

Births registered to mothers who are usually resident outside of England and Wales are included. Births to mothers who are usually resident in England and Wales that take place outside England and Wales are not generally included. We assume that the number of births for the two groups are similar in number and, on average, balance each other out. We impute the local authorities of residence for these births using the distribution of births within England and Wales to usually resident mothers each year.

Our [Birth statistics in England and Wales QMI](#) provides more information on the quality, strength and limitations of birth registration data.

Initial estimates: deaths

Death counts are obtained from the Civil Registration System of England and Wales. The DPM requires counts of deaths occurring in each year ending 30 June, split by:

- age, in years
- sex
- birth cohort
- local authority of usual residence

Deaths, occurring in England and Wales, of people who usually reside elsewhere are included. Deaths of usual residents, which occur outside England and Wales, are usually registered in the country where the death occurs, and so are not generally included. We assume that the number of deaths for the two groups are similar in number and, on average, balance each other out. Local authorities of residence for these deaths are imputed using the distribution of deaths within England and Wales each year.

A new extract of deaths data is used for each ABPE release. This ensures late death registrations, not in previous extracts, are included. Registration delays are explained in more detail in our [Impact of registration delays on mortality statistics in England and Wales: 2022 article](#).

Our [Mortality statistics in England and Wales QMI](#) provides more information on the quality, strength and limitations of death registration data.

Initial estimates: internal migration including cross-border flows

We create an origin-destination matrix of internal migration including cross-border flows estimated to have occurred in each year ending 30 June, split by:

- age, in years, at time of event
- sex
- local authority

We use two different methods to produce these estimates. The method used depends on the availability of higher education data from [Higher Education Statistics Agency \(HESA\)](#) and cross-border flows data from National Records of Scotland (NRS), and Northern Ireland Statistics and Research Agency (NISRA).

When HESA data are available, usually in our summer publication, we use official estimates of internal migration, which are produced using:

- [NHS Personal Demographics Service \(PDS\)](#) data to identify transitions
- HESA data to better capture student moves to university
- Higher Education Leavers Methodology (HELM) to better capture people leaving higher education

Transitions are where a person changes their local authority of residence between one mid-year reference point and the next as an internal migrant; additional within-year moves are not covered. Initial estimates of transitions are scaled up to better account for all the moves made during the year including by those entering and exiting the population during the year.

HELM involves:

- identifying where PDS records are out date for people who have left higher education
- records that previously linked to HESA, but no longer link, have an updated area of residence imputed to better reflect the destination of higher education leavers; moves of higher education leavers from three years previous, who took more than a year to update their health registration, provide the estimated distribution of destinations for current leavers (three years is considered to give the best balance of recent and older data, reflecting recent patterns and maximise the proportion of updated registrations)
- random imputation avoids systematic bias in destinations

The method recognises that some higher education leavers remain in their local authority of study.

Cross-border flows are identified using PDS data. Totals are agreed with NRS and NISRA. These data are usually available for updated ABPEs, but not provisional ABPEs.

Estimates for 2017 onwards are based on PDS stock files, HESA data, and PDS weekly updates, unless otherwise stated. Scaling factors derived from PDS stocks and PDS updates are applied to the transitions to give moves.

Before 2016, estimates are based on the NHS Central Register (NHSCR) and NHS Patient Register (PR). The NHSCR was discontinued in February 2016, consequently, for mid-2016, estimates were derived by combining the 2016 PR and 2015 NHSCR. Linear regression was applied to the scaling factors for 2012 to 2016 to ensure the scaling factors were consistent across the decade.

When provisional ABPEs are produced in our winter publications, HESA data and cross-border flows from NRS and NISRA are not yet available. Instead, estimates of internal migration between local authorities in England and Wales are produced using PDS data only. These are then scaled using the ratio between official internal migration estimates and PDS-based moves for the previous year by LA, age and sex for inflows and outflows. For example, if official estimates for 2023 capture 10% more males aged 19 years moving into a given local authority, compared with PDS estimates, we scale up by 10% the number of moves into the area for this same group in the 2024 PDS estimates.

Scaling accounts for movements of young adults to and from higher education, which is not well captured by health data alone. The ratio between official internal migration estimates and PDS estimates for a given year will not entirely reflect the following year but provides a good proxy in the absence of more robust data.

Estimates of cross-border flows are also produced using PDS data only, then scaled using the ratio between official cross-border flows and PDS-based cross-border moves from the previous year.

Special populations adjustment

Movements of serving members of armed forces, their partners and children, and prisoners are not typically captured in the data sources used to estimate internal migration.

A special populations adjustment is applied to internal migration estimates to cover the movements of these groups. These adjustments represent changes in the size and location of these special populations between the previous and current mid-year reference points.

The special population change adjustment only provides net moves giving the difference between in-migration and out-migration for a local authority. A net positive change is added to the initial estimates of internal in-migration, while a net negative change is added to internal-out migration.

Armed forces and their partners and children

Population estimates include:

- UK Armed Forces (UKAF) and their partners and children who are overseas on operations and temporary assignments if their last permanent station was in England and Wales
- foreign armed forces and their partners and children when they are usually resident in England and Wales

UKAF on overseas postings and any accompanying partners and children are not included.

Aggregated UKAF data from the Ministry of Defence (MoD) provides counts of military personnel by:

- age
- sex
- local authority of their military base

Census data are used to adjust the local authority of base to the local authority in which they are resident.

We estimate changes to the size and location of the UKAF population by comparing data for current year with the previous year. This provides estimates of movers, joiners and leavers during the year. Those joining and leaving the armed forces are distributed to or from the civilian population using census data on the distribution of veterans from the 2021 census.

The number of partners and children accompanying UKAF overseas is estimated using the ratio of partners and children per UKAF member from British Forces Germany (BFG) data on dependants accompanying UKAF stationed in Germany. Age and sex distributions from the BFG data are used to inform the age and sex profile of UKAF dependents. Local authority of residence is imputed for each net flow using a distribution derived from census for members of UKAF living with a partner.

All foreign armed forces personnel and their partners and children usually resident in England and Wales are exempt from immigration control. We receive data on all US military personnel and their partners and children based in England and Wales by:

- sex
- age
- local authority of military base

Before 2023, we only received data on US Air Force personnel. We supplemented this with data on the total number of US military personnel stationed in the UK. Foreign armed forces not from the US, who meet the usual residence definition, are considered very small in number and no data are available for these.

Estimated changes in the foreign armed forces population by local authority of residence, sex and age are derived by subtracting estimates for the previous year from the current year. Census data are used to adjust the local authority to reflect their usual residence, rather than their base. In instances where base-to-residence information is not available, personnel are assumed to live in the local authority of the base. This is a valid assumption, as most US armed forces live on base.

Children of foreign armed forces who are aged under one year and born in England and Wales are counted in the births data, so need to be removed from the special population adjustment. It is assumed that moves of these children, aged under 1 year, into and out of England and Wales, are broadly similar and cancel out.

Prisoners

For population estimates, a person is regarded as usually resident in a prison if they have been sentenced to serve 12 months or more. The Ministry of Justice (MoJ) provides data on the number of people resident in prisons in England and Wales by:

- prison name, which we use to assign local authority
- sex
- age

The estimated change in the prisoner population by local authority, sex, and age is derived by subtracting estimates for the previous year from the current year.

Changes in the estimated size of the prisoner population, from one year to the next, need to be reflected in the general population of England and Wales. Information on the previous, or next local authority of usual residence is not available for people joining or leaving the prison population. We use the local authority distribution of the total population in the previous year to proportionally distribute the inflows and outflows of prisoners to and from the general population of England and Wales.

Foreign national offenders who are deported following completion of their sentence and ex-prisoners who move to Scotland or Northern Ireland are not accounted for by this method. Owing to difficulties in accurately estimating these moves, we assume that the flow of ex-prisoners returning to England and Wales from elsewhere balances out these flows.

Initial estimates: international migration

We use the United Nations (UN) recommended definition of a long-term international migrant. This is a person who moves to a country other than that of their usual residence for a period of at least a year (12 months), so that the country of destination effectively becomes their new country of usual residence.

Our [Long-term international migration \(LTIM\) estimates](#) provide initial estimates for immigration and emigration occurring each year ending 30 June. Further information on the data sources and methods used for LTIM estimates is available in our [Provisional long-term international migration estimates: technical user guide](#).

We then disaggregate the LTIM estimates by age, sex and local authority using several data sources:

- Home Office Borders and Immigration Data (HOBID)
- Registration and Population Interaction Database (RAPID) from the Department for Work and Pensions
- [Higher Education Statistics Agency \(HESA\)](#)
- [NHS Personal Demographics Service \(PDS\)](#)
- Census 2021

For EU nationals, estimates of immigration are disaggregated using PDS for people aged under 18 years and RAPID adjusted for undercoverage using HESA data for students not in employment. This adjustment is tailored for each local authority to account for areas that do not have a higher education institution.

Emigration estimates for EU nationals are disaggregated in a similar way, except for people aged under 16 years. For this group, we create national child-to-adult emigration ratios by dividing national estimates of child emigrants by age and sex by the total number of adult emigrants by sex. We then multiply these ratios by the total number of adult emigrants by sex and local authority. This generates estimates of child emigration by:

- age
- sex
- local authority

For non-EU nationals, UK-level estimates of immigration and emigration are produced solely from HOBID, which includes age and sex. The same method for EU nationals is applied to provide geographical distributions for non-EU nationals. However, the age and sex distribution from RAPID, HESA, and PDS are then reconstrained to the age and sex totals from HOBID to ensure consistency between the two estimates.

For British nationals, we use Census 2021 distributions of local authority migration. The age and sex distribution uses a mix of International Passenger Survey (IPS) data and Census 2021.

We may update our approach as we continue to refine methods to provide the most accurate picture of international migration.

Initial estimates: combined immigration and combined emigration

The DPM models migration as combined inflows and combined outflows for each local authority in England and Wales. Initial estimates of inflows and outflows relating to international migration, and internal migration including cross-border flows are summed to provide initial estimates of combined immigration and combined emigration.

We create estimates of migration data at both age at mid-year and age at time of migration using [NHS Personal Demographics Service \(PDS\)](#) internal migration data. The ratio between these two estimates is then used to adjust our combined migration data to represent age at time of migration. This adjustment helps represent student migration more accurately at local authority level where most students move to university aged 18 years but are usually aged 19 years by mid-year. Age at time of migration is not available for international and cross-border migration. Instead, we assume that the relationship between age at time of internal migration within England and Wales, and year of birth also applies to international migration and cross-border flows.

Estimating system models that summarise underlying demographic trends

In Step 2 of the dynamic population model (DPM), we perform cohort estimation where we use system models to describe patterns in underlying demographic rates. In these system models, population flows covering births, deaths, in-migration and out-migration are assumed to follow a Poisson distribution. The mean of the Poisson distribution is the flow rate multiplied by the population associated with the rate. The flow rate is assumed to follow a Gamma distribution with a mean underlying rate and dispersion (a measure of uncertainty).

We obtain initial parameters for the mean underlying rates and dispersions for these Step 2 system models in Step 1 by fitting Bayesian hierarchical models for births, deaths, in-migration and out-migration. We use the R statistical computing package called "bage", which is explained in more detail on the [Comprehensive R Archive Network](#).

Hierarchical modelling produces more reliable estimates and helps to represent the true underlying trends in each local authority, as it:

- reduces random fluctuations between years
- helps capture broader trends in the demographic rates, such as overall levels in a local authority, national age-profiles and trends over time

For example, an area with a university tends to have relatively high rates of in-migration at the ages people tend to go to university, and high rates of out-migration when students graduate.

In the Step 1 hierarchical models, we calculate demographic rates using initial estimates of population flows and coverage-adjusted population stocks to form appropriate population denominators. For immigration, there is no suitable population denominator, so instead we use a fixed value of 1.

We use age, sex, time and local authority to explain systematic patterns in the rates; for births, sex is not included. In some instances, additional dummy variables are needed to account for deviations from usual patterns. For example, we use a dummy variable in immigration and emigration for Neath Port Talbot to inform the model about a sudden change in student migration resulting from new student accommodation.

To avoid estimating unrealistic rates in age-sex groups when the estimated population is zero, we set a minimum value for the population denominator:

- for births and emigration, we use a value of 0.5
- for deaths we use the initial estimate of deaths multiplied by 0.5

From these hierarchical models fitted in Step 1, we retain the estimated mean underlying rates and dispersions that are then used in Step 2, where rates are re-estimated drawing on information from all data sources to create a consistent balanced demographic account.

Our working paper, [Evaluating the DPM estimation method \(Template Model Builder \(TMB\)\) using a simulation study \(PDF, 1,132KB\)](#), and the [bage computing package](#) provide more detail on the system models. The paper was reviewed by the Methodological Assurance Review Panel (MARP) in August 2024 and is available from the UK Statistics Authority website.

Estimating data models that summarise the quality of data sources

Statistical models represent the assumed relationship between the reported values in the initial population stock and flow estimates and the true, unknown counts. These data models account for inaccuracies in the initial estimates because of uncertainty in the coverage level and other measurement errors. Allowing for one or more imperfect dataset gives us much more flexibility than requiring a single perfect dataset.

Data used to fit the statistical models are limited to mid-year estimates for the census years 2011 and 2021, which we assume to be accurate.

A hierarchical model generates improved estimates of uncertainty by pooling strength across age, sex, local authority, and time.

For each estimated population stock, in-migration and out-migration dataset, we define a statistical model describing the probability of observing the data given the true, unknown values. The models use a normal probability distribution where the parameters are the means, and the standard deviations associated with the coverage ratios; the standard deviation reflects the uncertainty around the coverage ratios. More information on the coverage ratios is available earlier in this section, under the subheading, [Creating initial estimates for coverage ratios](#).

We optimise the parameters used in the data models using a maximum likelihood estimation approach. This considers how likely each of the initial stocks and flows are and re-estimates the parameters to achieve a best possible fit.

Measures of uncertainty for the coverage adjusted population stock are estimated using the method developed for computing uncertainty intervals for the Statistical Population Dataset (SPD). This is based on parametric bootstrapping of the standardised model residuals explained in our article, [Indicative uncertainty intervals for the admin-based population estimates: July 2020](#). It is important to note that prior to 2023, SPDs were referred to as admin-based population estimates.

Measures of uncertainty for international migration are explained in our [International migration research, progress update](#) and for internal migration in our [Measures of statistical uncertainty in mid-year population estimates](#) article. We use these measures to produce the variances of the data models for inflows and outflows. Data models are not included for births and deaths since these data are considered reliable and exact.

Scaling parameters help adjust for potential bias in the estimates of the coverage ratios. These multipliers allow us to adjust coverage ratios and input count data uncertainty, making our models more robust.

A scale parameter controls the distribution from which the coverage adjustment is drawn. A scale parameter of 0 (zero) implies no adjustment, while 0.05 or 0.1 act to potentially scale the coverage ratios up or down by as much as 10% or 20%, respectively.

If there is evidence of a consistent bias, the distributions of these scaling parameters are changed. Sensitivity analyses are used to compare the impact of different scale parameter values on the resultant estimates and inform the chosen scale parameters.

Our working paper, [Evaluation of DPM estimation method \(TMB\) using a simulation study \(PDF, 1.132KB\)](#), provides more detail on the data models. This paper was reviewed by the Methodological Assurance Review Panel (MARP) in August 2024 and is available from the UK Statistics Authority website.

Estimating balanced demographic accounts over time for each birth cohort

To estimate a consistent balanced set of demographic accounts, we independently estimate each annual birth cohort by sex and local authority. We account for potential relationships across these estimation groups by using statistical models and estimating the balanced demographic account multiple times using multiple collections of input data; we explain this further, later in this section, under the subheading, [Estimating the balanced demographic account multiple times](#).

For each estimation group, we have multiple imperfect and potentially inconsistent data on population stocks and flows. For each estimation group, we use:

- data models that allow for potential bias and the precision of the initial estimates
- system models that describe patterns in our initial estimates of the underlying demographic rates and their precision

These are explained in more detail in previous sections.

Using a Bayesian modelling approach, we generate a sample distribution of potential population and migration counts for each estimation group. These are a set of plausible values given the uncertainty of the inputs. They have a balanced demographic account for each individual cohort, by sex, within each local authority. We explain Bayesian methods and balanced demographic account in [Section 7: Definitions](#).

The separate balanced demographic accounts for each estimation group are combined to provide the demographic account for the England and Wales population.

The Laplace approximation method, as detailed in [Information Theory, Inference, and Learning Algorithms \(PDF, 11.1 MB\)](#), is used to generate a fast approximation of the posterior distribution of the population stock, and the population inflows and outflows and all demographic rates.

The R package Template Model Builder (TMB) is used to implement the Laplace approximation method. More information is available in the [TMB: automatic differentiation and Laplace approximation report](#). We have published the R code that we use for [estimating a demographic account](#).

Laplace's method is well established and has been used in other areas including [spatial modelling](#), [estimating HIV epidemic indicators](#) and [estimating life expectancy by race](#).

A sample is drawn from the posterior distribution and the values are exponentiated, to reverse the logarithmic transformations. This provides a sample of values for the mid-year population estimate for the first year and the population inflows and outflows over the following year. For each element of the sample, the demographic accounting identity is then used to derive the population stocks for the next mid-year reference point.

Estimating the balanced demographic account multiple times

The cohort estimation step of the DPM is repeated multiple times. This enables the production of plausible estimates of uncertainty for the population stock and flows for population groups, such as local authority totals.

We generate multiple posterior distributions using multiple collections of input parameters. Each collection represents a draw from the distributions of mean rates and coverage ratios obtained from the hierarchical models. We generate 50 posterior distributions of the balanced demographic account for each annual birth cohort, by sex within each local authority.

From each of the 50 posterior distributions, we take 100 draws resulting in a total of 5,000 draws. From these, we infer the admin-based population estimates (ABPEs) and associated components of population change using the average (mean) and standard deviation from the samples. These estimates represent a balanced demographic account.

Our multiple draw approach is explained in more detail in our working paper, [Hierarchical models and aggregate uncertainty in the Dynamic Population Model \(PDF, 281KB\)](#). This paper was reviewed by the Methodological Assurance Review Panel (MARP) in February 2025 and is available from the UK Statistics Authority website.

Credible intervals and uncertainty of aggregate estimates

ABPEs are subject to uncertainty related to the measurement of population stocks at specific points in time and the components of population change over time. Credible intervals, explained in [Section 7: Definitions](#), give the range of plausible values and show the uncertainty around the estimates.

We currently provide 95% credible intervals for our population and migration estimates by:

- single year of age and sex within each local authority
- local authority totals
- regional totals
- country totals
- England and Wales total

Credible interval bounds cannot be summed to provide credible intervals for combined population groups such as age groups.

We calculate aggregate estimates of uncertainty at the local authority level, and other levels such as for England and Wales as a whole. To do this, we need to account for potential correlations between all pairs of ages and sexes within each local authority, and between local authorities, depending on the level of aggregation. This is achieved by running the DPM multiple times, using inputs drawn from probability distributions obtained from appropriate statistical models. The samples of potential population and migration counts from each run are aggregated by summing the samples by age, sex and local authority and then pooling the aggregate samples of all runs.

The 95% credible intervals for local authority totals are obtained using the 2.5 and 97.5 percentiles of the pooled local authority's aggregate samples. The same approach is used to obtain credible intervals for regions, countries and national totals.

Further information on estimating uncertainty for combined population groups is provided in our working paper [Hierarchical models and aggregate uncertainty in the Dynamic Population Model \(PDF, 281KB\)](#). This paper was reviewed by the Methodological Assurance Review Panel (MARP) in February 2025 and is available from the UK Statistics Authority website.

We are working to refine the hierarchical models of coverage ratios of population stocks and the specification of data models for the population estimates in census years to improve the quality of uncertainty measures at all levels of aggregation.

Disaggregating combined migration estimates

To better understand changes in the size of local authority populations, combined migration flows are disaggregated to provide estimates of international and internal migration. The disaggregated flows provide the origin and destination for people moving:

- between local authorities in England and Wales
- within the UK, between local authorities in England and Wales, and Scotland or Northern Ireland
- between local authorities in England and Wales and countries outside the UK

An iterative proportional fitting method is used to adjust the observed input data, which are not necessarily consistent with the estimated combined flows output by the DPM. This involves iteratively scaling the observed input data by proportionally adjusting it to be consistent with combined inflows, then combined outflows. This is repeated until it is considered consistent with the combined inflows and the combined outflows output from the DPM for each local authority by single year of age and sex and for each year ending 30 June.

To calculate the 95% credible intervals for the disaggregated flows, we conduct migration disaggregation on the pooled combined migration samples output from the DPM. This provides samples of disaggregated migration from which credible intervals are calculated using the 2.5 and 97.5 percentiles.

Published estimates

The DPM generates a sample of population and migration estimates. Our published ABPEs and estimates of migration are the average (mean) value from the sample distribution. Estimates are provided for countries, regions and local authorities for each mid-year reference point, by single year of age up to 90 years and over, and sex.

Our 95% credible intervals, explained in [Section 7: Definitions](#), are derived from the sample distribution and give the range of plausible values and show the uncertainty around the estimates.

Our published estimates for births and deaths remain unchanged from the initial estimates used in the DPM. These estimates are obtained from administrative registers and are considered reliable.

Our [Publication schedule for admin-based population and migration statistics article](#) explains our proposed approach to revisions and the availability of data in our admin-based population and migration statistical system.

Protecting confidentiality

Input data used to produce the ABPEs are aggregate data by local authority, age and sex. The data are from a variety of sources and are used in statistical models to generate the ABPEs. Estimates of small counts should not be taken to refer to particular individuals.

For more information on how we protect sensitive data, see our [Data strategy web page](#).

4 . Quality of the statistics

Statistical designation

These statistics are labelled [official statistics in development](#). We are refining the data sources and methods to improve the quality of the ABPEs.

Once we have completed the developments, we will review the statistics with the Statistics Head of Profession.

If the statistics meet trustworthiness, quality and value standards based on user feedback, we will remove the "official statistics in development" label to publish under the "official statistics" label.

If they do not meet trustworthiness, quality and value standards, we will further develop them and might stop producing them.

We are confident that ABPEs will be the most-effective method for measuring the population in the future. We are working to meet the acceptance criteria outlined in our [Assessment of criteria for moving to admin-based population estimates as official estimates of population, England and Wales: 2025 article](#) and to increase our confidence of the ABPEs being badged as accredited official statistics when the Office for Statistics Regulation (OSR) carries out its assessment.

We intend to re-assess the acceptance criteria in spring 2026, with the aim of the ABPEs becoming the official estimates of the population following this assessment.

How we quality assure the data and statistics

We conduct rigorous quality assurance throughout the production and publication process. This involves using a range of standard checks and expert evaluation by specialists.

Input data

We explain how we quality assure and assess the accuracy and bias of data supplied in our [Quality overview of data sources used in mid-2024 admin-based population estimates for England and Wales](#).

We communicate with suppliers, both within the ONS and in external organisations, to improve and confirm our understanding of the data, their quality assurance checks and the reliability of the data.

We quality assure the data comparing across different data sources to assess the plausibility of figures. Data suppliers are contacted when unusual patterns are found in data.

The data are also quality assured at several stages before they are used in the estimation process. Examples of this includes checking that coverage adjusted population estimates or smoothed rates meet expectations. We ensure values and demographic trends over time are plausible and any that seem abnormal are valid. Sex ratios are used to check plausibility.

Statistical methods

We regularly review and quality assure our methods with support from:

- a cross-government demographic methods expert group
- the independent [Methodological Assurance Review Panel \(MARP\)](#)
- the Bayesian statistician subgroup of MARP set up to provide advice on the methods developed for and used in the dynamic population model (DPM)

Our methodological work, has been presented to MARP and is available on the [Papers section of the UK Statistics Authority website](#). We anticipate publishing relevant papers that are presented at the subgroup of MARP, so that they are available to all users.

Processing and estimation

Regular quality assurance checks throughout processing and estimation ensure that the process is working as it should at each stage.

Sensitivity analyses with changing estimation parameters

Sensitivity analyses are conducted so we understand how the ABPEs and components of population change are affected by:

- the availability and quality of data sources
- the different hyperparameters in the statistical models, which summarise underlying demographic trends and the quality of the data sources

Sensitivity analyses are used to check that small changes in the input data lead to small changes in the resultant estimates and test the impact of extreme changes.

Our findings are used to inform the estimated parameters used to produce our best estimates.

Resultant estimates

We quality assure and analyse the resultant estimates. ABPEs and the components of population change output from the DPM are entered into a Power BI dashboard.

Using visualisations at national, regional, and local authority level, we explore changes over time and between population subgroups.

Further tasks include:

- comparing estimates with alternative sources to check plausibility and outliers
- scrutinising trends in other data sources that can be considered signal data
- examining how changes in components relate to one another and to the overall population change
- consulting demographic experts who scrutinise the estimates considering plausibility of changes over time and outliers; estimates are explored further where necessary
- building knowledge of wider changes in local authority characteristics, for example, changes in the number of communal establishments and houses, to understand how this might impact the estimates over time

Published content

We check content thoroughly before publication to ensure:

- there are no errors or inaccuracies
- clarity and accessibility
- we meet current and potential needs of users
- confidentiality requirements are met

We continue to conduct further analyses using additional data sources that become available, and feedback received from users.

Strengths and limitations

Strengths

Admin-based population estimates are produced using a wide range of data sources. They can be produced using multiple sources for population stock and flow estimates, we can accommodate missingness in some input data, and we can add new datasets as they become available.

The numbers of births and deaths come from administrative registers and are considered reliable, so are treated as exact counts throughout the whole estimation process.

Our methods make the best use of available data to produce the best possible statistics at a point in time. Provisional estimates can be produced with the expectation that they will be revised and then further updated as more data become available.

ABPEs are subject to uncertainty related to the measurement of initial population stocks and flows over time. The 95% credible intervals show the uncertainty around our estimates.

ABPEs are produced using independent population stocks for each year. This reduces the increase in uncertainty that occurs as we move further away from a census year, compared with population estimates produced using the cohort component method. Our [Dynamic population model, improvements to data sources and methodology for local authorities, England and Wales: 2021 to 2022](#) shows how the level of uncertainty between 2011 and 2021 increased at a much slower rate for ABPEs.

We are working towards ABPEs being produced using [reproducible analytical pipelines \(RAPs\)](#) and incorporating unit testing in our statistical processing. These automated statistical and analytical processes will ensure that estimates are reproducible, auditable, delivered efficiently and are of high quality.

Limitations

ABPEs are [official statistics in development](#) while we refine our methods and the data sources used. They should not be used for policy or decision making.

ABPEs represent the usually resident population and so do not include daytime populations, such as day-trip visitors or short-term visitors.

Our current proxy coverage adjustment method for the initial population stocks uses census data, as explained in [Section 3: Where the data come from and how we produce the statistics](#), under the subheading, Creating initial estimates for coverage ratios. The data from a census in 2031 would provide a high-quality point of comparison to understand the quality of our initial population stocks. Our long-term aim is to create coverage ratios using admin data, but this requires improvements in the quality of the data and a more stable supply of data.

It is not possible to produce estimates for geographical breakdowns below local authority level using the Dynamic population model (DPM). We are exploring possible approaches for producing small area population estimates, [Section 2: What the statistics cover](#), provides more information.

Research into credible intervals showing the uncertainty around aggregate estimates for combined population groups is ongoing. In July 2025, our [Admin-based population estimates for local authorities in England and Wales dataset](#) provided estimates of uncertainty for the total population at national, country, region, county and local authority level.

We use our [Long-term international migration \(LTIM\) estimates](#) as the initial international migration estimates for the ABPEs. The estimates of international migration output by the DPM, as part of the ABPE components of change, differ from the LTIM estimates. We are working towards coherence in the admin-based population and migration system for England and Wales. More detail is available in [Section 5: How we are developing the statistics](#), under the subheading, How comparable the statistics are.

European Statistical System Quality Dimensions

The Office for National Statistics (ONS) has developed [Guidelines for measuring statistical quality](#) based on the five European Statistical System (ESS) Quality Dimensions. These are:

- relevance
- accuracy and reliability
- timeliness and punctuality
- comparability and coherence
- accessibility and clarity

We have integrated these considerations into the guide.

5 . How we are developing the statistics

We assessed the readiness of admin-based population estimates (ABPEs) to become the official estimates of the population, using the criteria explained in our [Criteria for moving to admin-based population estimates as official estimates of population article](#), published in January 2025. We are confident that ABPEs will be the best method for estimating the population in the future. However, more work is still needed to successfully meet the acceptance criteria, particularly around:

- meeting the most important needs of users
- data supply and quality
- coherence and comparability

Our [Assessment of criteria for moving to admin-based population estimates as official estimates of population for England and Wales: 2025 article](#) provides more detail on how we plan to develop the ABPEs over the next year.

More specifically, our working papers, reviewed by the Methodological Assurance Review Panel (MARP), and available on the UK Statistics authority website, explain our recent and future work:

- on [Hierarchical models and aggregate uncertainty in the Dynamic Population Model \(PDF, 281KB\)](#)
- on [Geospatial methods for Small Area Population Estimates: proof of concept \(PDF, 891KB\)](#)
- on [Coverage estimation for admin-based population size estimation \(PDF, 576KB\)](#)

We anticipate publishing relevant papers that are presented at the Bayesian statistician subgroup of MARP so that they are available to all users.

We are working to address potential sources of uncertainty and bias that are not currently accounted for by the DPM. This includes developing statistical methods, to create quality metrics that quantify potential errors in linked administrative data. We explain how we use linked administrative data to create initial population stocks in [Section 3: Where the data come from and how we produce the statistics](#), under the subheading Creating initial estimates of population stocks.

How comparable the statistics are

Comparability between ONS data sources

Our [Population estimates for England and Wales: mid-2024 statistical bulletin](#) includes an interactive population pyramid in Figure 7, which compares the admin-based population estimates (ABPEs) and the official mid-year population estimates by age and sex for all local authorities for mid-2022 to mid-2024.

In November 2024, we published our [Admin-based population estimates: local authority case studies, England and Wales, mid-2023 article](#) to help users understand what is causing more notable differences between the ABPEs and the official mid-year estimates (MYEs) and build confidence in our ABPEs. Differences between the ABPEs and the official mid-2023 population estimates are small for most areas.

Our [Long-term international migration estimates](#), which are classified as official statistics in development, are used to generate the ABPEs. The dynamic population model (DPM) balances input data on population stocks and flows taking account of underlying demographic trends and differing levels of coverage and uncertainty associated with the input data. As a result, estimates of international migration provided as part of the ABPE components of change will differ from the official estimates used as an input. The methods for deriving cross-border flows, international and internal migration for ABPEs are under development and therefore migration estimates for ABPEs are likely to be revised in future publications.

We are working towards coherence in the admin-based population and migration system for England and Wales. We are exploring the potential for international migration estimates for England and Wales to be produced by the DPM to ensure consistency with the ABPEs. As the DPM produces estimates for England and Wales only, we will also explore methods to continue producing coherent LTIM estimates for the whole of the UK.

Estimates of births and deaths used to calculate the ABPEs are based on live births and deaths that occur during the year to the mid-year reference point, irrespective of the date when they were registered. These can differ slightly to those used in other ONS births and deaths statistics if the period reported is calendar year rather than mid-year. Estimates can also differ if the figures represent the number of events registered rather than the number that occurred.

Comparability of the statistics over time

Comparability of areas

England and Wales are subdivided into local areas, which are subject to change. Each admin-based population estimate (ABPE) release uses the latest geography boundaries available at the time of production. For this reason, ABPEs produced at different points in time may not have comparable geographical boundaries. The geographical boundaries used in each release is clearly stated within the published datasets. The ONS [Open geography portal](#) provides information on local authority boundaries over time.

Comparability across ABPE releases

When the admin-based population estimates (ABPEs) become the official population estimates, we plan to revise the population estimates data time series back to 2022, using the ABPE back series. We have selected 2022 because the ABPEs are very similar to the official mid-year population estimates in 2021. This is because Census 2021 data are used to produce both estimates. This will ensure that users have a consistent time series after Census 2021.

A fully comparable time series of ABPEs for 2022 to 2024 was published in July 2025 and takes account of methodological improvements and new and updated data sources. These include new estimates for migration; this supersedes and is not comparable with previous ABPE series published in July 2024, covering 2011 to 2023.

A necessary feature of the dynamic population model (DPM), which generates the ABPEs, is that every time we incorporate new data, the timeseries of population estimates from 2011 changes. This is because the estimation process uses data on population stocks and flows from 2011 onwards to produce a balanced and coherent set of estimates that adhere to demographic accounting principles. When new data are added, even if they are just added for the latest time period, our best estimates for the earlier years change because they are influenced by this additional information.

Revisions to population statistics have wide-reaching implications for users and producers of other statistical outputs. We manage the frequency of revisions to the published back series to balance accuracy and timeliness of the estimates with the need for stability.

We publish ABPEs, one year after the end of the reference period. Following this, we plan to update the ABPEs two years after the reference period, as outlined in Section 4 of our [Publication schedule for admin-based population and migration statistics](#). After this, they will not be updated again unless there is a revision to the published back series to incorporate improved methods or new data sources, or a correction. This ensures a more timely and stable back series than mid-year estimates (MYEs), produced using the cohort component method. Following a census, MYEs over the ten-year period between censuses are rebased. This is explained in our [Rebasing of mid-year population estimates following Census 2021, England and Wales article](#).

We are exploring adjustment methods to ensure updated population estimates and components of population change represent a consistent timeseries and continue to represent a balanced demographic account. For example, in summer 2026, we plan to publish updated mid-2024 ABPEs for England and Wales. ABPEs for mid-2023 will remain unchanged. Our revision adjustments will ensure that estimates of the population and components of population change for mid-2024 remain consistent with the unchanged mid-2023 and the mid-2025 ABPEs.

Users may compare admin-based population estimates (ABPEs) for individual local authorities with other data sources, for example, administrative records or anecdotal evidence. Comparisons between data sources should be treated with caution, as there are often definitional differences in the data collected. For example, whether the data differentiate between long-term or short-term migration, or whether they account for individuals who have left the country or local authority. Also, other data sources may cover only a subset of the population or measure daytime populations rather than the usual resident population.

Our quality assurance of the ABPEs prior to publication includes comparing estimates with alternative sources to check plausibility and outliers.

6 . Users and uses of the data

When the ABPEs become the official population estimate, the number and types of users are likely to grow to include all current users of official mid-year population estimates including:

- Central and local government and the health sector
- International organisations such as United Nations
- ONS teams, for producing further statistics such as population projections, calculating demographic rates and weighting survey estimates
- Private sector including commercial companies, for market research
- Researchers, including academics, demographers and special interest groups

Our [Quarterly update on population and migration statistics article](#) series explains our progress and future plans.

We engage with users and seek feedback through a range of activities including:

- webinars, which include question and answer sessions
- conferences
- meeting and working groups such as the [Central Local Information Partnership \(CLIP\)](#), the UK Population Theme Advisory Board (chaired by the Office for National Statistics (ONS) and including representatives from academia, the Welsh Government, the NRS and NISRA), the [British Society for Population Studies \(BSPS\)](#), [Administrative Data Research UK \(ADR UK\)](#), and the [Royal Statistical Society \(RSS\)](#)
- a working group to consider the impact of changing population estimate methods on funding formulae, models or other processes
- focused meetings with selected local authorities that represent some important population features seen in some local areas; these local authorities are listed in Section 3 of our [January 2025 quarterly update](#)
- consultations; of most relevance to the ABPEs are our [Help shape our published content for population estimates consultation](#) and our [Consultation on the future of population and migration statistics in England and Wales](#)
- asking for feedback in all our publications

The valuable feedback, received through these activities, is used to guide our work. Some examples can be found in our [Admin-based population estimates: England and Wales engagement plan 2025 to 2026](#). We continue to explore new opportunities to collect user feedback to understand how to best meet user needs.

7 . Definitions

Balanced demographic account

Describes estimates of population stocks and flows over time where the change in population between two time periods equals the net population flows.

Bayesian methods

A statistical approach that updates prior beliefs about an event using new evidence, resulting in a revised belief, or posterior probability. Bayes' theorem is used to calculate the probability of a hypothesis given observed data, integrating both prior knowledge and new data.

Bayesian demographic accounts are a statistical framework for estimating the population and components of population change, incorporating prior knowledge and uncertainties using a Bayesian approach. All unknown quantities are treated as random variables to reflect uncertainties.

Bias in data

Data are collected in different ways for different purposes. There can be inconsistencies and gaps in the data caused by collecting, recording and processing the data. These inconsistencies can lead to a systematic under or overestimation in the data, relative to the true unobserved concept being measured. Bias (or accuracy) refers to this systematic under or over estimation.

Birth cohort

All people born within a given period of time, such as year ending 30 June.

Cohort component approach

A standard demographic approach that estimates the size of the population using the components of population change to update a population base.

An estimate of the population in the following year, given by the cohort component approach, is obtained by:

- ageing on by one year, the coverage-adjusted population stock referring to a specific mid-year reference point
- adding those who were born during the year
- removing those who died during the year
- adding those who moved into the local authority
- removing those who moved out of the local authority

Coverage errors

When a member of the population is not counted (undercoverage), is counted more than once (overcoverage) or is counted in the wrong location.

Credible intervals

The range in which the true value of the quantity being estimated is likely to be contained.

In Bayesian statistics, credible intervals are an important concept. We use 95% credible intervals by taking 2.5th and 97.5th percentiles from the distributions of population and migration counts, produced by our estimation process. These give the lower and upper bounds for the credible intervals, respectively. In this case, we can say that the probability that the true value lies in the credible interval is 95%.

Demographic rates

Measurements that describe changes within a population. Birth rates, death rates and migration rates are demographic rates that describe the number of events occurring relative to the population at risk of the event. For example, death rates show the number of people per thousand who die in a particular area during a particular period of time.

Population flows

Estimates of changes to the population over time because of births, deaths, international and internal migration. Internal migration includes cross-border flows where people move, in either direction, between England and Wales (combined), Scotland and Northern Ireland. Our annual population flows cover the 12-month period to mid-year (30 June).

Population stocks

Estimates of the population at specific points in time; we use population stocks relating to mid-year (30 June).

Generalised Additive Model

A Generalised Additive Model (GAM) allows the modelling and smoothing of data where the variables do not have a linear relationship. GAMs have been used within the DPM to model and smooth raw stock and flow data. This reduces the amount of random variation and attempts to represent the true underlying pattern. This approach is particularly useful when working with noisy data or rare events.

Precision

Refers to how close estimates are in repeated measurements. Estimates can be very precise but still have bias.

8 . Acknowledgements

The development of the DPM and ABPEs has been supported by the University of Southampton and Bayesian Demography Limited. Specifically, we would like to thank John Bryant, Peter Smith, Paul Smith, Jakub Bijak, Jason Hilton, Andrew Hind, Erengul Dodd and Joanne Ellison for their guidance and support.

9 . Related links

[Admin-based population estimates for local authorities in England and Wales](#)

Dataset | Released 30 July 2025

Admin-based population estimates for all local authorities in England and Wales from the dynamic population model.

[Understanding mid-year admin-based population estimates for local authorities in England and Wales](#)

Methodology | Released 30 July 2025

Important information about our mid-year admin-based population estimates (ABPEs) for England and Wales.

[Admin-based population estimates: local authority case studies, England and Wales, mid-2023](#)

Article | Released 22 November 2024

Case studies to analyse differences between the admin-based population estimates and the official mid-year population estimates.

[Assessment of criteria for moving to admin-based population estimates as official estimates of population, England and Wales: 2025](#)

Article | Released 19 May 2025

Assessment of readiness for admin-based population estimates to become the official estimates of population for England and Wales in summer 2025.

[Publication schedule for admin-based population and migration statistics](#)

Article | Released 26 February 2025

Our planned publication schedule, approach to revisions and the availability of data in our admin-based population and migration statistical system.

10 . Provide feedback

You can provide feedback on the methods used to produce these statistics and their quality by emailing pop.info@ons.gov.uk.

11 . Cite this guide

Office for National Statistics (ONS), released 30 July 2025, ONS website, quality and methods guide, [Mid-year admin-based population estimates for England and Wales quality and methods guide](#)