Office for National Statistics

Article

# Reconciliation of mid-year population estimates with Census 2021 at local authority level

Exploration of the differences between the official 2021 Census-based mid-year estimates and the 2021 rolled-forward mid-year estimates at local authority level.

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Release date:
2 March 2023

Next release:
To be announced

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# 1 . Main points

- 89.12% of local authorities had a difference in their population of less than positive or negative 4.99% between the official mid-2021 population estimates for England and Wales, based on Census 2021 data, and the rolled-forward estimates from mid-2020.
- At the local authority level, the rolled-forward mid-year estimates were more likely to overestimate males than females compared with the census-based mid-year estimates.
- Excluding City of London, Camden showed the largest percentage difference (24.97%) between the rolled-forward and 2021 Census-based mid-year estimates for all local authorities in England and Wales.
- Patterns of difference at the local level can be complex, and further research is needed to understand the impact of rebasing at lower geographic levels, as well as how various components have fed into the differences explored in this article.

Differences between population estimates based on Census 2021 data and annual mid-year population estimates are expected. The high response rate for Census 2021 combined with improved methods of estimating international migration, should ensure that this difference is kept to a minimum in the future.

# 2 . Overview

This article sits alongside the England and Wales level reconciliation report published on 28 February 2023. It seeks to explore the differences between the official Census 2021-based mid-year estimates (based on Census 2021 and accounting for births, deaths and migration in the period to mid-year 2021) and the 2021 rolled-forward (based on the 2011 Census with a decade of mid-years estimates with births, deaths and migration incorporated) mid-year estimates at a lower geographical level. See Section 3: Population estimates used in this report for a more detailed description of the two estimates.

This article also provides part of the suite of evidence that can be referred to as part of the consultation on the future population and social statistics system in mid-2023.

The Office for National Statistics (ONS) produces annual estimates of the resident population as at 30 June each year. These mid-year population estimates (MYEs) tell us how many people live in England and Wales as a whole and in each local area, and include information on age-sex structure.

This article examines the differences between the estimates but does not seek to attribute those differences to any specific cause. Initial information on what has contributed to the differences at the England and Wales level can be found in the main reconciliation report, and information on sub-national causes, such as internal migration flows, will follow in the sub-national rebasing planned for May 2023.

# 3 . Population estimates used in this report

Throughout this article we will be referring to two main mid-year estimates (MYE) of population.

Census-based MYEs are the official mid-2021 population estimates, these are based on the 2021 Census for England and Wales. The usual resident population as at Census Day (21 March 2021), by single year of age, is aged on to 30 June 2021 and then births, deaths and migration are accounted for.

Censuses provide the most accurate estimate of the population and therefore the reliability of MYEs is very high immediately following a census. Quality information on Census 2021 can be found in our Quality and methodology information (QMI) for Census 2021.

The 2021 rolled-forward MYEs use the population estimate from the previous reference date (2020 in this instance) as the starting point for estimating the population at the current reference date. The previous population estimate is aged on and data on births, deaths and migration are used to reflect population change during the reference period.

The census has evolved throughout the decades, providing an insight every 10 years into who we are and how we live. While the census and MYEs based on the census provide the best picture of society at a moment in time, how we produce population and social statistics is changing.

We are using a variety of data sources to provide more frequent, relevant and timely statistics. This will allow us to understand population change in local areas this year and beyond.

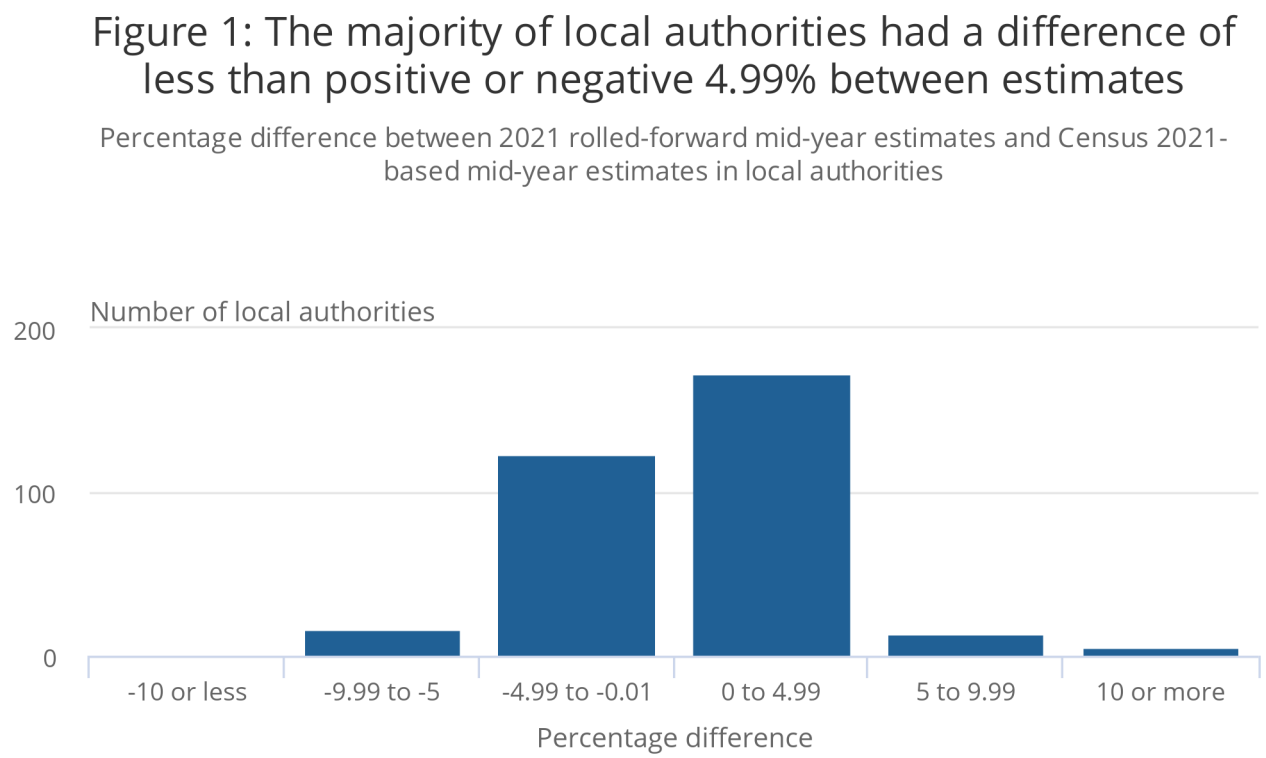
# 4 . Differences at the local authority level

Of the 331 local authorities (LAs), 295 (89.12%) had a difference of less than positive or negative 4.99% between the rolled-forward mid-year estimates (MYE) and census-based MYE, and 231 (69.79%) had a difference of less than positive or negative 2.49% between the rolled-forward MYE and census-based MYE. LAs with a difference of greater than positive or negative 4.99% between the rolled-forward and census-based estimates were predominantly concentrated in London and cities with a relatively high student population.

Rolled-forward MYE were higher in 191 LAs and lower in 140 LAs compared with the 2021 Census-based MYE.

**Figure 1: The majority of local authorities had a difference of less than positive or negative 4.99% between estimates**

**Percentage difference between 2021 rolled-forward mid-year estimates and Census 2021-based mid-year estimates in local authorities**




**Source: Office for National Statistics - Mid-year estimates**

**Notes:**

1. Positive value means the rolled-forward estimate is higher, negative value means the rolled-forward value is lower.

2. Differences are expressed as percentage difference from the rolled-forward 2021 value.

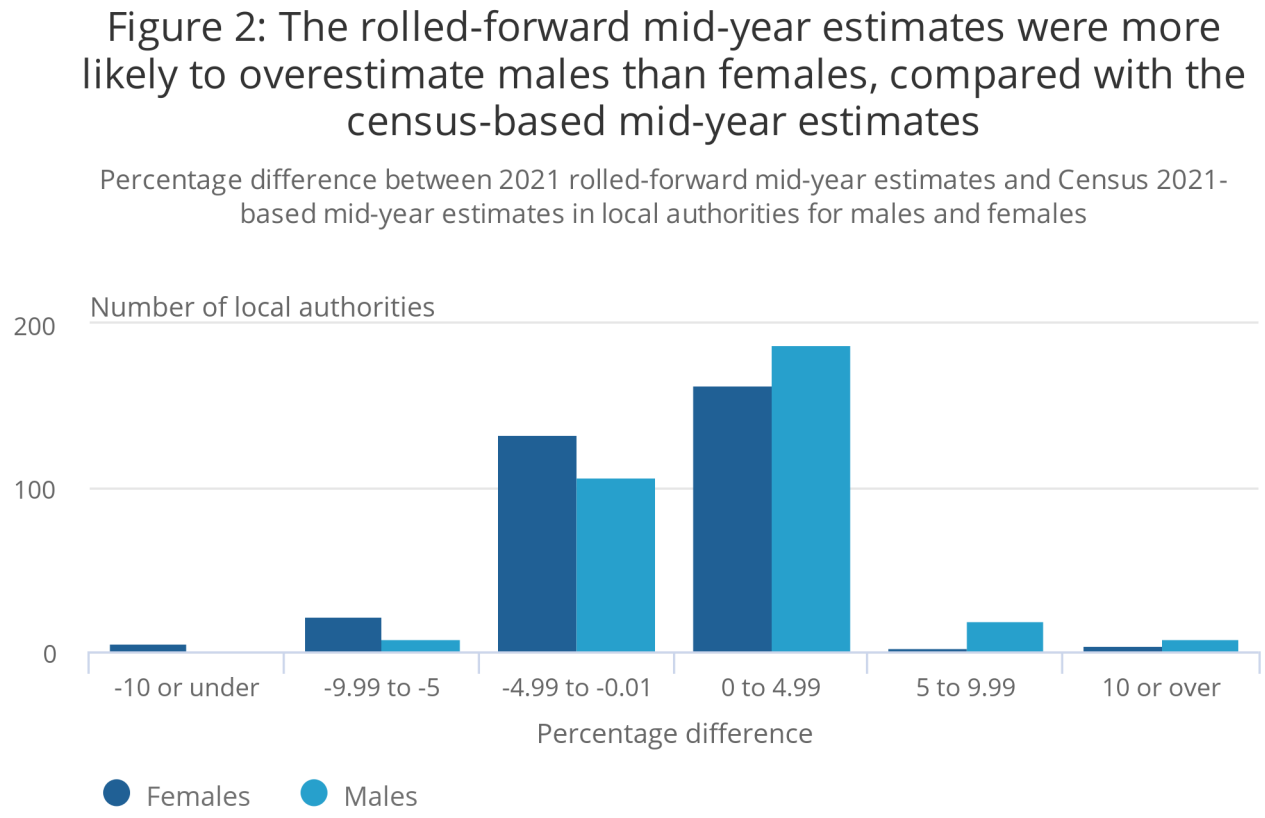
Differences at the LA level are likely to be driven by a combination of factors, including internal migration, which does not play a role at the England and Wales level (barring a small amount of cross-border migration to and from Scotland and Northern Ireland). These LA estimates and comparisons are presented to aid user understanding, but more detail on the impact of internal migration and other causes of disparity between the estimates will be found in the sub-national rebasing report planned for publication in May 2023.

# 5 . Differences at the local authority level by age, sex and geography

The rolled-forward estimates were between 0 to 4.99% higher in 188 local authorities (LAs) for males, and 163 LAs for females compared with the census-based estimates. The rolled-forward estimates were between negative 4.99% to negative 0.01% lower in 107 LAs for males and 133 LAs for females compared with the census-based estimates.

**Figure 2: The rolled-forward mid-year estimates were more likely to overestimate males than females, compared with the census-based mid-year estimates**

**Percentage difference between 2021 rolled-forward mid-year estimates and Census 2021-based mid-year estimates in local authorities for males and females**




**Source: Office for National Statistics - Mid-year estimates**

**Notes:**

1. Positive value means the rolled-forward estimate is higher, negative value means the rolled-forward value is lower.

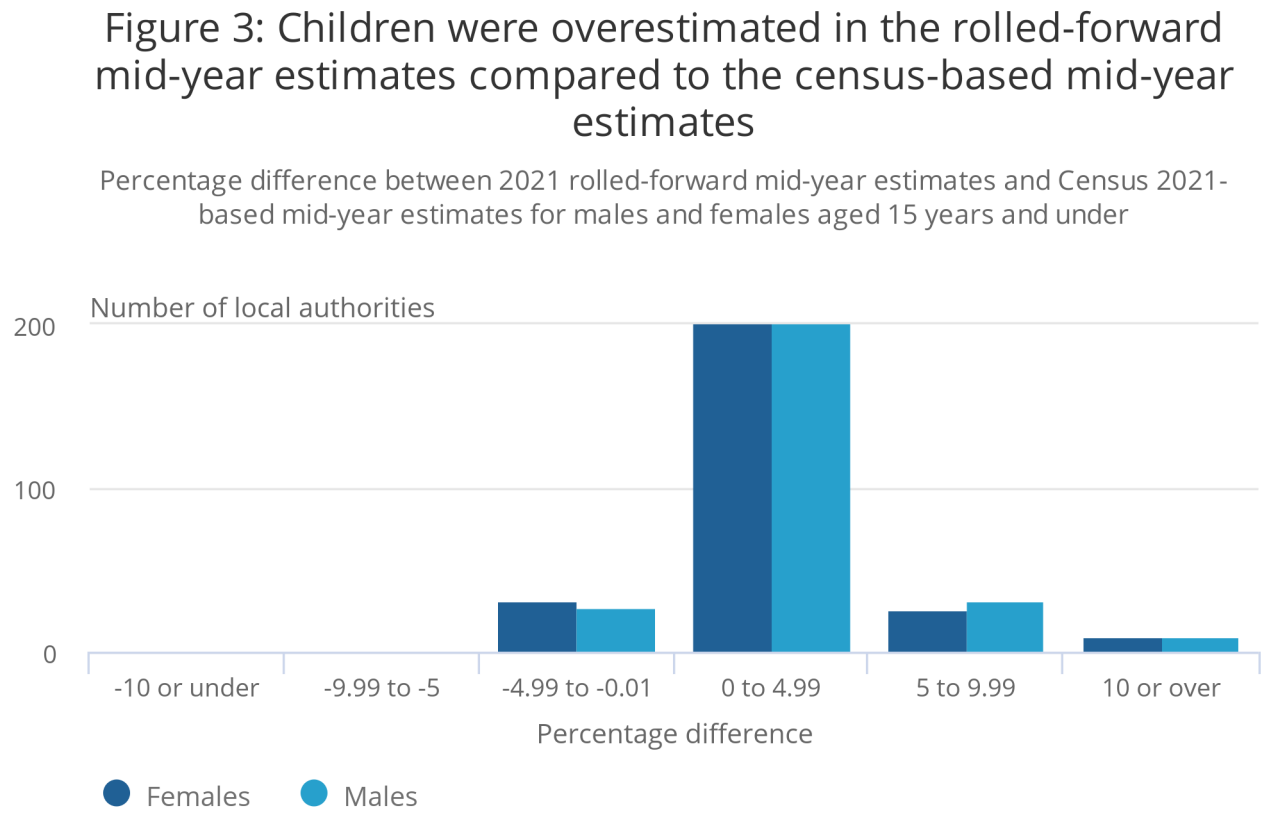
2. Differences are expressed as percentage difference from the rolled-forward 2021 value.

Figure 2 shows that at LA level, males were more likely to be overestimated than females were in the rolled-forward mid-year estimate (MYE), compared with the census-based MYE. This aligns with the findings in England and Wales as a whole.

The same distributional analysis was conducted for males and females aged 15 years and under, a group where there was a significant overestimate in the rolled-forward MYE at the England and Wales level. Figure 3 shows that the LA data follows a similar trend, with 91.24% of LAs for males and 90.33% of LAs for females showing overestimates in the rolled-forward estimates for the 15 years and under population. There was a concentration of LAs located in the North West (such as Pendle, Bolton and Burnley), which showed the opposite trend, with underestimates for those aged 15 years and under in the rolled-forward estimates.

**Figure 3: Children were overestimated in the rolled-forward mid-year estimates compared to the census-based mid-year estimates**

**Percentage difference between 2021 rolled-forward mid-year estimates and Census 2021-based mid-year estimates for males and females aged 15 years and under**




**Source: Office for National Statistics – Mid-year estimates**

**Notes:**

1. Positive value means the rolled-forward estimate is higher, negative value means the rolled-forward value is lower.

2. Differences are expressed as percentage difference from the rolled-forward 2021 value.

Figure 4 shows the geographic distribution of the percentage differences split by sex. This highlights the overestimate of males (as indicated by a larger presence of orange) and underestimate of females (as indicated by a larger presence of purple), which is particularly evident in London.

There are a cluster of LAs between the East Midlands and the South East where the rolled-forward MYEs are lower than the census-based estimates for both males and females.

Local authorities in Wales generally experienced slight overestimate in the rolled-forward mid-year estimates compared with the census-based estimates. Gwynedd was the Welsh LA with the largest total percentage difference between the estimates at 6.23% while Wrexham had the smallest total percentage difference between estimates at negative 0.19%.

Rotherham and Winchester were the LAs with the smallest percentage difference between rolled-forward and census-based estimates in England and Wales for males (negative 0.01%) and females (0.00%).

Camden and City of London showed the largest percentage difference between estimates in England and Wales for males (Camden: 30.91%) and females (City of London: 26.15%), respectively. Further information on the differences between individual LAs is presented in Section 6: Local authorities with the largest differences.

The differences between estimates are likely to have arisen because of a combination of factors, including internal migration flows between LAs. The impact of this alongside other factors such as international migration flows will be explored in our sub-national rebasing report, planned for publication in May 2023.

### Figure 4: Explore the differences in your area

**Percentage difference in population estimates for mid-2021, comparison of census-based estimates and rolled-forward estimates in local authorities**

**Source: Office for National Statistics – Mid-year estimates**

**Download the data**

.xlsx

# 6 . Local authorities with the largest differences

As highlighted in Section 4: Differences at the local authority level, the 2021 rolled-forward estimates were within positive or negative 4.99% of the 2021 Census-based estimates in 89.12% of local authorities (LAs). There is value in exploring those areas that fell outside the positive or negative 5% difference mark, and they are listed in Table 1.

Areas with the largest differences between estimates can generally be attributed to one of three groups:

- LAs in London
- LAs with a large student population
- LAs with a special population (presence of military personnel, for example)

Differences in these areas are likely to be partially attributed to high population churn. It is worth noting that similar areas do not show a unifying pattern, with LAs in London presenting large positive (Camden) and negative (Ealing) differences.

Case studies are presented in Section 7: Local authority case studies to explore the population structures and possible causes of differences between estimates within these groups. Other likely causes of these differences are under investigation as part of the rebasing project and our May publication will look to explore how rebasing the population estimates for 2012 to 2020 has affected these areas.

Table 1: Local authorities with a percentage difference of larger than positive or negative 5% between the 2021 rolled-forward and 2021 Census-based mid-year estimates
Mid-year population estimates, England and Wales, 2021

| Local authority name | Percentage difference between estimates |
|---|---|
| **Leicester** | -5.22 |
| **Crawley** | -5.49 |
| **Oxford** | -5.56 |
| **Brent** | -5.62 |
| **Milton Keynes** | -5.64 |
| **Luton** | -5.69 |
| **Merton** | -5.82 |
| **Burnley** | -6.09 |
| **Slough** | -6.53 |
| **Peterborough** | -6.53 |
| **Watford** | -6.83 |
| **Harlow** | -6.91 |
| **Rushmoor** | -7.10 |
| **Hounslow** | -7.67 |
| **Ealing** | -9.39 |
| **Reading** | -9.57 |
| **Cambridge** | -15.66 |
| **City of London** | 25.46 |
| **Camden** | 24.97 |
| **Westminster** | 24.28 |
| **Islington** | 12.47 |
| **Coventry** | 10.13 |
| **Isles of Scilly** | 9.88 |
| **Kensington and Chelsea** | 8.31 |
| **Tower Hamlets** | 7.58 |
| **Hackney** | 7.04 |
| **Canterbury** | 6.59 |
| **Sheffield** | 6.50 |
| **Gwynedd** | 6.23 |
| **Nottingham** | 6.13 |
| **Richmondshire** | 5.96 |
| **Kingston upon Thames** | 5.47 |
| **York** | 5.42 |
| **Brighton and Hove** | 5.33 |
| **Guildford** | 5.32 |

| | |
|---|---|
| **Exeter** | 5.02 |

Source: Office for National Statistics - Mid-year estimates

It is also possible to look closer at the difference between the two 2021 mid-year estimates (MYEs), broken down by single year of age at LA level. This shows that 29 LAs had a difference of more than positive or negative 5% in 50% or more of their single year of age estimates (treating 90 years and over as a single year) (Table 2).

Table 2: Local authorities with a difference of more than positive or negative 5% in 50% or more of single year ages between rolled-forward and 2021 Census-based mid-year estimates
Mid-year population estimates, local authority Level, England and Wales, 2021

| Local authority name | Percentage of ages over positive or negative 5% difference |
|---|---|
| **Camden** | 98.90 |
| **Westminster** | 97.80 |
| **City of London** | 93.41 |
| **Tower Hamlets** | 90.11 |
| **Isles of Scilly** | 82.42 |
| **Kensington and Chelsea** | 81.32 |
| **Brent** | 78.02 |
| **Hackney** | 73.63 |
| **Ealing** | 71.43 |
| **Islington** | 67.03 |
| **Oxford** | 67.03 |
| **Newham** | 65.93 |
| **Richmondshire** | 64.84 |
| **Cambridge** | 62.64 |
| **Lambeth** | 61.54 |
| **Southwark** | 61.54 |
| **Hammersmith and Fulham** | 60.44 |
| **Hounslow** | 59.34 |
| **Leicester** | 59.34 |
| **Harlow** | 58.24 |
| **Bristol** | 56.04 |
| **Luton** | 56.04 |
| **Burnley** | 54.95 |
| **Reading** | 54.95 |
| **Peterborough** | 53.85 |
| **Lincoln** | 52.75 |
| **Watford** | 51.65 |
| **Rushmoor** | 50.55 |
| **Waltham Forest** | 50.55 |

Source: Office for National Statistics - Mid-year estimates

Detailed analysis of the individual ages for all areas where underestimation and overestimation occurred in the 2021 rolled-forward MYE are outside the scope of this article. The pattern in most LAs is a complex mix of both underestimation and overestimation, and users are encouraged to explore the data themselves using the official mid-2021 population estimates published in December 2022 to understand the patterns occurring in their area.

# 7 . Local authority case studies

Case studies of Medway, Cambridge, Coventry, Ceredigion, Camden and Richmondshire are presented to assist users in interpreting the data. These are used to show local authorities (LAs) with differing population structures and characteristics.

## Medway, an area where net migration has not significantly changed the population structure

The age structure of Medway is similar between the 2021 rolled-forward estimates and 2021 Census-based estimates, where the total estimated populations are 278,619 and 279,827 respectively, representing a difference of negative 1,208 (negative 0.43%) overall.

### Figure 5: The differences in Medway are similar to that of England and Wales as a whole

**Source: Office for National Statistics – Mid-year estimates**

**Download the data**

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The population structure of Medway shows a similar picture to the findings at the England and Wales level, with an overestimation of children and young men, and an underestimation of young women in the rolled-forward mid-year estimate (MYE). The performance of the mid-year estimates in Medway is typical of many LAs. The discrepancies between the MYEs rolled forward from 2011 and the 2021 Census-based estimates tend to be larger in areas of high population churn such as areas with significant student populations or large urban areas.

## Cambridge, an area with a significant student population

Cambridge is an area with a large student population, with a peak in the population aged between 18 and 22 years, which gradually decreases as students finish their studies.

### Figure 6: The population of Cambridge was underestimated in the rolled-forward estimates

**Source: Office for National Statistics – Mid-year estimates**

**Download the data**

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The total population estimates for Cambridge from the rolled-forward estimates and the census-based estimates are 125,119 and 144,714 respectively, a difference of -19,595 (negative 15.66%).

Figure 6 shows a significant underestimate of the population in the rolled-forward estimates between the ages of 25 to 55 years for both males and females.

There is likely no single reason that explains the discrepancy between the estimates. Possible explanations include issues with effectively capturing young adults in the current MYEs methodology, incorrect estimation of post-graduate student migration or significant levels of internal or international migration unaccounted for. We aim to identify and address these discrepancies as part of our rebasing of the MYEs exercise.

## Coventry, another area with a significant student population

Coventry is another local authority with a large student population. Figure 7 shows a significant overestimate in the rolled-forward estimates from age 18 to 38 years for males and females, contrasting with the general underestimate in the rolled-forward estimates seen in Cambridge.

### Figure 7: The population of Coventry was overestimated in the rolled-forward estimates

**Source: Office for National Statistics – Mid-year estimates**

**Download the data**

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Coventry and Cambridge are both local authorities with large student populations that both experienced significant population growth over the decade. Growth was overestimated in Coventry and underestimated in Cambridge, despite a common set of data and methods being used. In other areas, such as Ceredigion, we are aware that internal migration left some graduates in the population, and it is likely this same mechanism is also at play in Coventry and Cambridge. This will be investigated further, alongside other sources of error, in the rebasing exercise.

## Ceredigion, a Welsh local authority with significant student population

Figure 8 shows the disparity between rolled-forward and census-based estimates for Ceredigion, an area with a total difference between estimates of 1,836 (2.53%). Overestimation in the rolled-forward estimates can be seen in younger ages for both males and females, following the general trend for England and Wales. There is a peak in the rolled-forward estimates for males aged 24 to 31 years, and females aged 27 to 31 years. This contrasts with a significant underestimate in the rolled-forward estimates for males and females aged between 32 and 37 years.

Ceredigion's population comprises a large number of students. Students are highly mobile and need to be counted into an area at the beginning of study and outwards at the end. The overestimate of males and females in their mid-to-late-20s and underestimate of males and females in their mid-30s is related to the difficulty moving graduates following the end of their studies.

Following the 2011 Census there were a large number of former students present on the administrative data (GP patient record) used to estimate internal migration. After 2011, these former students will have updated their details, and this will have created moves out of Ceredigion. However, these individuals will have been correctly identified by the 2011 Census as no longer being resident in Ceredigion. Therefore, the population aged 32 to 37 years in Ceredigion, and many other student areas, will tend to be underestimated.

### Figure 8: There were also notable discrepancies in the population of Ceredigion

**Source: Office for National Statistics – Mid-year estimates**

**Download the data**

.xlsx

## Camden, an area with high levels of international migration

Camden has historically been an area that experiences high levels of international migration. Figure 9 shows a significant overestimation of population in the rolled-forward estimates compared with the census-based estimates across all ages, with the largest differences generally in the male population.

The rolled-forward estimates' total population for Camden at mid-2021 was 280,403, while the census-based estimates showed a total of 210,390, a difference of 70,013 (24.97%). Only three local authorities in England and Wales (Westminster, Camden and City of London) had a percentage difference between the rolled-forward and census-based estimates of 20% or more. These three areas neighbour each other and all have very high levels of internal and international migration.

### Figure 9: The population of Camden was significantly overestimated in the rolled-forward estimates

**Source: Office for National Statistics – Mid-year estimates**

**Download the data**

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Over the course of the decade, the rolled-forward mid-year estimates suggested population growth of 27% (60,300) while the census-based estimate shows a decrease of negative 4.4% (negative 9,700). The mid-year estimates also estimated population growth in each year between 2011 and 2021.

Among other factors, an underestimation of out-migration and an overestimation of in-migration may explain the differences seen in Camden because of its historically high levels of international migration. The reasons behind these differences will be explored in more detail in the rebasing exercise.

## Richmondshire, an area with a notable special population

Richmondshire has a large presence of military personnel, making it a valuable case study for investigating areas with special populations. The rolled-forward estimates were 3,190 (5.96%) higher in Richmondshire compared with the census-based estimates.

### Figure 10: The population of Richmondshire was a complex mix of both over and underestimation

**Source: Office for National Statistics – Mid-year estimates**

**Download the data**

.xlsx

Figure 10 shows an underestimation of the number of males aged between 19 and 27 years, and a significant overestimation of males aged between 29 and 41 years in the rolled-forward estimates compared with the census-based estimates. This overestimation of men aged in their 30s in the rolled-forward estimates suggests that a portion of the armed forces population resident in 2011 have not been moved out correctly over the decade. The way in which armed forces recruits and leavers are distributed will be further investigated as part of the rebasing exercise.

### Figure 11: Explore the population structure in your area

**Source: Office for National Statistics – Mid-year estimates**

**Download the data**

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# 8 . Glossary

## Census-based estimates

The method used in years in which a census take place. The MYEs are based on the census estimates rolled forward only by the time between the Census Day and 30 June.

## Components of change

Factors contributing to population change, including births and deaths (commonly referred to as natural change), and net migration. Migration includes movements of people between England and the various countries of the world (international migration) and between local authority areas within the UK (internal migration).

## Internal migration

Moves made between local authorities, regions or countries within the UK. Unlike international migration, there is no internationally agreed definition.

### Rolled-forward estimates

The practice of using the population estimate from the previous reference date as the starting point for estimating the population at the current reference date. The previous population estimate is aged on and data on births, deaths and migration are used to reflect population change during the reference period.

### Usually resident population

The standard United Nations definition is used, including only people who reside in a country for 12 months or more, making them usually resident in that country. As such, visitors and short-term migrants are excluded.

## 9 . Future developments

The next stage is the production and publication of a rebased mid-year population estimates (MYE) series for England and Wales. Our goal is to publish this in April 2023. This will include the new official estimates of population for England and Wales for the years 2011 to 2020, to accompany the published census-based figures. These estimates will incorporate new migration estimates using our latest developments, where appropriate and available. This will allow us to spread any migration-attributed error over time, as well as make adjustments to other population groups (such as older ages and children).

Our aim is to follow the national rebasing with a rebased subnational MYE series in late May 2023. This will distribute the revised national-level estimates down to local authorities (LAs) and will incorporate the improved migration estimates and other improvements from the national rebasing. It will also include subnational specific improvements such as the improved internal migration methods (HELM) described in our Population estimates for the UK, mid-2021: methods guide, for the whole decade. We plan to provide tools to allow users to explore the impact of the rebasing for their local area, to allow them to understand how the rebased estimates differ from previous estimates, and the groups that are most impacted.

Alongside this, we have ambitious plans to further develop our Dynamic Population Model (DPM). The DPM uses a range of innovative sources to measure population counts and components of population change in a timely and coherent manner. These are not yet official statistics, while we develop our methodology and assess the quality of our outputs. We have also published our first attempt at producing DPM estimates for all 331 local authorities in England and Wales. In the summer of 2023, we will be updating this with improved data sources to compare against the Office for National Statistics (ONS) MYE for 2022.

# 10 . Related links

Population estimates: quality information
Dataset | Released 21 December 2022
Quality information on the mid-year population estimates at local authority and region level for England and Wales, by age and sex.

Estimates of the population for the UK, England, Wales, Scotland and Northern Ireland
Dataset | Released 21 December 2022
National and subnational mid-year population estimates for the UK and its constituent countries by administrative area, age and sex (including components of population change, median age and population density).

Reconciliation of mid-year population estimates with Census 2021, England and Wales
Article | Released 28 February 2023
Analysis of differences between mid-year population estimates rolled forward from mid-2020 and official estimates rolled forward from Census 2021.

Rebasing and reconciliation of mid-year population estimates following Census 2021, England and Wales: 2022 Dataset | Released 21 December 2022 Quality information on the mid-year population estimates at local authority and region level for England and Wales, by age and sex.

Methods to produce provisional long-term international migration estimates Dataset | Released 21 December 2022 National and subnational mid-year population estimates for the UK and its constituent countries by administrative area, age and sex (including components of population change, median age and population density).

# 11 . Cite this article

Office for National Statistics (ONS), released 2 March 2023, ONS website, article, Reconciliation of mid-year population estimates with Census 2021 at local authority level