

Article

# Analysis of rebased mid-year population estimates following Census 2021, England and Wales: 2012 to 2021

Analysis of the rebased mid-year population estimates from 2012 to 2021 and the components of change that affected the rebasing on a subnational level.



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# 1 . Main points

- Population estimates for most local authorities (LAs) changed by up to positive or negative 4.99% in 2021, as a result of the rebasing of our mid-year population estimates for the period mid-2012 to mid-2021, following the results from Census 2021.
- Large cities with university campuses were more likely to have high unattributable population change (UPC), which is defined as change to our population estimates that could not be explained by our components of change.
- Out of 331 LAs, males aged under 35 years had the largest share of the UPC for 214 LAs (64.7%), and females had the largest share of the UPC for 260 LAs (78.5%).
- City of London, Camden, and Westminster had the highest percentage difference between the rolled-forward mid-year population estimates and the rebased population estimates for 2021.
- Camden, Liverpool, and Birmingham had some of the highest percentages of the absolute total UPC for LAs in England and Wales.

## 2 . Overview of rebasing mid-year population estimates

In November 2023, our [Rebasing of the mid-year population estimates following Census 2021 in England and Wales bulletin](#) outlined the components of change that affected the reconciliation of our population estimates from 2012 to 2021. The report also described the unattributable population change (UPC) that remained.

UPC is the remaining population change that can be seen between the census-based estimates and the rolled-forward mid-year population estimates, which cannot be explained by any of the components of change. UPC has affected local authorities (LAs), ages, and sexes differently, and represents uncertainty affecting the components of change for these LAs.

This analysis explores the impact of the rebasing on a subnational level, focusing on how LA population estimates have changed, and the distribution of UPC by age and sex. The report also details the components of change that affected the rebased population estimates of specific LAs through exploratory case studies.

For more information and for definitions of the terms used here, please see [Section 9: Glossary](#).

## 3 . Local authorities with the highest positive or negative unattributable population change

The unattributable population change (UPC) total between 2012 and 2021 amounted to negative 40,400 (negative 297,000 males and positive 256,600 females). This means that the rolled-forward mid-year estimates for 2021 were 40,400 greater than the Census 2021 based mid-year population estimates, before we added UPC. More information on how the UPC was calculated and distributed across the decade is available in our [Rebasing the mid-year population estimates following Census 2021 bulletin](#).

Of the 331 local authorities (LAs) in England and Wales, 322 (97.3%) had between net positive or negative 1.99% of the absolute total UPC for males over the 2012 to 2021 period. For females, 326 LAs (98.5%) had between net positive or negative 1.99% of the absolute total UPC.

### Figure 1: Unattributable population change was highest in London boroughs and large cities

Distribution of unattributable population change by local authority and sex in England and Wales by 2021

Notes:

1. UPC refers to unattributable population change.
2. Where the percentage is positive, UPC increased the population estimate. Where the percentage is negative, UPC decreased the estimate.
3. Percentages were calculated using the absolute total UPC for each sex as the denominator, as such totals will not sum to 100%.
4. For example, a value of negative 2.9% means that that local authority had 2.9% of the total absolute UPC for males or females, and for this local authority the UPC was negative. A value of 2.9% for a different local authority would be the same size UPC but in the opposite direction.

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Figure 1 shows that, generally, large cities and London boroughs had the largest share of UPC between 2012 and 2021, defined as the highest percentage of the absolute total UPC for England and Wales over the 2012 to 2021 period.

For males, Camden had the largest share of UPC at 3.2% (which was negative for Camden). For females, Birmingham had the largest share of UPC at 2.9% (which was positive for Birmingham).

## **4 . Age groups with the highest positive or negative unattributable population change**

Of the 331 local authorities (LAs), males aged under the age of 35 years had the largest share of the unattributable population change (UPC) for 214 LAs (64.7%), and females had the largest share of the UPC for 260 LAs (78.5%).

### **Figure 2: People aged under 35 years often had the largest share of unattributable population change**

**Largest unattributable population change share by age band for each local authority in England and Wales by 2021**

#### **Notes:**

1. UPC refers to unattributable population change.
2. Local authorities with less than 0.01% of the absolute total UPC are not included.

#### **Download the data**

Figure 2 shows that males aged 25 to 34 years had the largest share of the UPC for 107 LAs (34.3%) of the 312 LAs included. Females in the same age group had the largest share of the UPC for 105 LAs of the 298 LAs included (35.2%).

Older age groups were more likely to have the largest share of UPC in LAs with an older age profile. Females aged 75 years and over had the largest UPC share for 13 LAs (4.4%), compared with only 2 LAs (0.6%) for males of the same age. Conwy was the only LA where both males and females aged 75 years and over had the largest share of the UPC, likely because of the older age profile and the small amount of UPC overall.

## 5 . The impact of the rebasing on the population estimates

### Figure 3: Population estimates changed by up to positive or negative 4.99% for most local authorities after rebasing

Population estimate percentage differences pre- and post-rebasing in England and Wales in 2021

**Notes:**

1. Where the percentage is negative, the population estimate was decreased following rebasing. Where the percentage is positive, the estimate was increased.

**Download the data**

Figure 3 shows that, of the 331 local authorities (LAs), 202 (61.0%) had a difference of between positive and negative 1.99% between its mid-year and its rebased population estimate in 2021, and 296 LAs (89.4%) had a difference of between positive and negative 4.99%.

City of London had the largest change in its 2021 population estimate following the rebasing (24.9%), followed by Camden, and Westminster (24.8% and 24.0%, respectively).

Following the rebasing, the population estimate in 2021 increased for 141 LAs (42.6%) and decreased for 190 LAs (57.4%). The male population estimate increased for 116 LAs (35.0%) and decreased for 215 LAs (65.0%). The female population increased for 162 LAs (48.9%) and decreased for 169 LAs (51.1%).

## 6 . Case studies

Table 1: Location of universities and impact of migration often affect unattributable population change  
Local authorities included in exploratory case studies, with reason for inclusion

Lower Tier Local Authority (LTLA) name	Rolled-forward mid-year population estimate in 2021	Rebased population estimate in 2021	Why have we included this case study?
<b>Coventry</b>	382,015	344,151	Accommodation for the University of Warwick is located across the geographical boundary between Coventry and Warwick, leading to uncertainty on the location of university students.  The components of change were accurate in rebasing the mid-year population estimates because of the central location of accommodation for University of Surrey students as well as a low percentage of international students.  The revisions to the impact of migration were insufficient in explaining the rebased population estimates, which may be because of the young age profile of the population and the high percentage residing in rented accommodation.
	146,472	148,693	
<b>Warwick</b>	152,009	144,013	
<b>Guildford</b>			
<b>Camden</b>	280,403	210,968	
	270,864	205,759	
<b>Westminster</b>			

Source: Mid-year estimates from the Office for National Statistics

Notes

1. UPC refers to unattributable population change.

Table 1 summarises five case studies with potential reasoning for the unattributable population change (UPC) for local authorities (LAs) with population estimates of interest.

Each case study will have a table presenting the components of change, the impact of rebasing the population estimate for 2021, the net impact of UPC, and the net impacts of the revisions to internal and international migration between 2012 and 2021.

## Coventry and Warwick

Table 2: Population estimate for Coventry changed by almost 40,000 people for 2021 after rebasing Coventry and Warwick population estimate change and net impacts of components of change by 2021

<b>Coventry</b>	<b>Total</b>	<b>Males</b>	<b>Females</b>
<b>Impact of rebasing the population estimate</b>	-37,864	-23,423	-14,441
<b>Impact of UPC</b>	-24,564	-16,395	-8,169
<b>Impact of revisions to internal migration</b>	-3,381	-1,553	-1,828
<b>Impact of revisions to international migration</b>	-9,846	-5,466	-4,380
<b>Warwick</b>			
<b>Impact of rebasing the population estimate</b>	2,221	699	1,522
<b>Impact of UPC</b>	1,969	-402	2,371
<b>Impact of revisions to internal migration</b>	843	656	187
<b>Impact of revisions to international migration</b>	-593	434	-1,027

Source: Mid-year estimates from the Office for National Statistics

### Notes

1. UPC refers to unattributable population change.
2. The impacts of UPC and revisions to migration will not sum to the impact of rebasing the population estimates because of the exclusion of births, deaths, and special changes.

Coventry is a metropolitan district bordering Warwick, located in the West Midlands in England, with two university campuses (Coventry University and University of Warwick).

After rebasing our population estimates from 2012 to 2021, Table 2 shows that the Coventry population estimate in 2021 was reduced by 23,423 males and 14,441 females, from 382,015 to 344,151 people (a decrease of 9.9%).

Warwick has a smaller population than Coventry. Following the rebasing, the Warwick population estimate in 2021 was increased by 699 males and 1,522 females, from 146,472 to 148,693 people (an increase of 1.5%).

The UPC for Coventry was high at a net reduction of 24,564 people across 2012 to 2021, made up of 16,395 males and 8,169 females, which may be because of uncertainty surrounding the location of people of undergraduate student age in the administrative data that feed into our population estimates of Coventry and Warwick.

### Figure 4: People aged 25 to 30 years saw the largest reduction in their population estimate in Coventry in 2021

Population estimate change of Coventry and Warwick in 2021 by age and sex following rebasing

[Download the data](#)

In Coventry, the population estimate of people of university and graduate age (19 to 30 years) was reduced from 96,770 to 67,775, a decrease of 30.0%.

In Warwick, the population estimate of people the same age was reduced from 28,978 to 25,237 people, a decrease of 12.9%, however, Figure 4 shows that the reduction was mostly concentrated to people aged 20 to 24 years, and people aged around 30 years. This could be related to an adjustment that was made during processing of the 2011 Census. More detail can be found in our [frequently asked questions on the 2011 Census unrounded population and household estimates for England and Wales \(PDF, 23.4KB\)](#).

## **Figure 5: High net migration and unattributable population change was mostly concentrated in people aged 19 to 40 years in Coventry**

**Cumulative net migration and unattributable population change impact by 2021 in Coventry and Warwick by age and sex**

### **Notes:**

1. UPC refers to unattributable population change.

**Download the data**

## **Impact of migration**

Following the rebasing, Figure 5 shows that the population estimate of people aged 19 to 30 years in Coventry decreased by 15,717 people because of migration. This is likely because of the impact of changing internal and international migration estimates from 2012 to 2021, and the decrease is made up of 8,458 males and 7,259 females.

The impact of changing the migration estimates in Warwick was lower, at a net emigration of just 1,937 people aged 19 to 30 years, made up of 491 males and 1,446 females.

## **Impact of unattributable population change (UPC)**

Figure 5 also shows that UPC decreased the population estimate of people aged 19 to 30 years in Coventry by 13,154 people, compared with a reduction of 1,729 people in Warwick of the same age. This means that uncertainty of the change to the Coventry population estimate was mostly concentrated to young adults and students.

The UPC for people aged 25 years was also high in Coventry, at a decrease of 2,390 people, which may indicate graduates not updating their administrative records (for example, GP registrations) following graduation.

Higher UPC in Coventry than Warwick may reflect a weakness in the administrative data used to rebase the population estimates, as well as potential misalignment with the 2011 Census population base. In our migration data used for rebasing, there was no distinction between the postcodes of University of Warwick accommodation in Coventry, and those in Warwick. Comparatively higher migration flows than Warwick may also increase uncertainty of the population of Coventry. Therefore, our components of change may not accurately capture moves of students between Coventry and Warwick from the 2011 Census population base, leading to an overestimation of the population of students in Coventry.

## Guildford

Table 3: Population estimate for Guildford changed by almost 8,000 people for 2021 after rebasing Guildford population estimate change and net impacts of components of change by 2021

<b>Guildford</b>	<b>Total</b>	<b>Males</b>	<b>Females</b>
<b>Impact of rebasing the population estimate</b>	-7,996	-5,357	-2,639
<b>Impact of UPC</b>	-2,316	-2,179	-137
<b>Impact of revisions to internal migration</b>	262	263	-1
<b>Impact of revisions to international migration</b>	-5,774	-3,336	-2,438

Source: Mid-year estimates from the Office for National Statistics

### Notes

1. UPC refers to unattributable population change.
2. The impacts of UPC and revisions to migration will not sum to the impact of rebasing the population estimates because of the exclusion of births, deaths, and special changes.

Guildford is a town in the South East of England, home to the University of Surrey. Table 3 shows rebasing our population estimates from 2012 to 2021 reduced the Guildford population estimate by 5,357 males and 2,639 females from 152,009 to 144,013 people (a decrease of 5.3%).

The UPC for Guildford was low for both males and females, at a net reduction of 2,179 males and 137 females across 2012 to 2021, meaning our components of change were accurate in explaining the change in the population estimate.

### Figure 6: Unattributable population change was low for both males and females in Guildford by 2021

Distribution of unattributable population change in Guildford by 2021 by age and sex

#### Notes:

1. UPC refers to unattributable population change.

[Download the data](#)



Figure 6 shows that most of the total UPC for Guildford affected people aged 20 to 30 years (32.8% and 7.4% of the total UPC to males and females, respectively).

This is characteristic of graduate movement where there may be a lag to the updating of administrative records between university and employment, however, the UPC is much lower than other LAs with similarly large university campuses (for example, Coventry), meaning our revised components of change were accurate in explaining the change in the population estimates between the 2011 Census and Census 2021.

Low UPC may also be because of the central location of the University of Surrey, rather than being located across a boundary between multiple LAs. Therefore, students may be more likely to live and stay in Guildford for their duration of study, resulting in less uncertainty of student location.

According to the Higher Education Statistics Agency (HESA) data, the University of Surrey also had fewer international enrolments than other universities (25.1% of enrolments in the 2021 to 2022 academic year, compared with 38.4% for the University of Warwick), meaning student mobility may be easier to capture in Guildford, because movements of domestic students are typically easier to capture than for international students.

## Camden and Westminster

Table 4: Population estimate for Camden changed by almost 70,000 people for 2021 after rebasing Camden and Westminster population estimate change and net impacts of components of change by 2021

<b>Camden</b>	<b>Total</b>	<b>Males</b>	<b>Females</b>
<b>Impact of rebasing the population estimate</b>	-69,435	-44,423	-25,012
<b>Impact of UPC</b>	-40,163	-22,284	-17,879
<b>Impact of revisions to internal migration</b>	266	221	45
<b>Impact of revisions to international migration</b>	-29,455	-22,313	-7,142
<b>Westminster</b>			
<b>Impact of rebasing the population estimate</b>	-65,105	-43,300	-21,805
<b>Impact of UPC</b>	-15,734	-15,104	-630
<b>Impact of revisions to internal migration</b>	-10,879	-5,284	-5,595
<b>Impact of revisions to international migration</b>	-38,295	-22,740	-15,555

Source: Mid-year estimates from the Office for National Statistics

### Notes

1. UPC refers to unattributable population change.
2. The impacts of UPC and revisions to migration will not sum to the impact of rebasing the population estimates because of the exclusion of births, deaths, and special changes.

Camden is a London Borough. Table 4 shows that rebasing our population estimates from 2012 to 2021 reduced the Camden population estimate by 44,423 males and 25,012 females, from 280,403 to 210,968 people (a decrease of 24.8%).

Camden borders the city of Westminster. Table 4 shows that rebasing reduced the Westminster population estimate by 43,300 males and 21,805 females, from 270,864 to 205,759 people (a decrease of 24.0%).

The UPC for Camden was high for both males and females, at a net reduction of 22,284 males and 17,879 females across 2012 to 2021. The UPC for Westminster was lower despite the similar population estimate change, at a net reduction of 15,104 males and 630 females across 2012 to 2021.

### Figure 7: Most ages were affected by the decrease to the Camden population estimate

Population estimate change of Camden and Westminster in 2021 by age and sex after rebasing

[Download the data](#)

Figure 7 shows that among males in Camden, the largest reduction in the population estimate was for males aged 33 years. This was a decrease of 41.7%, from 3,220 to 1,878 people. Among females, the largest reduction was for children aged nine years from 1,732 to 1,023 girls, a decrease of 40.9%. The only ages that were marginally increased following the rebasing were females aged 0 and 19 years (increases of 0.5% and 0.4%, respectively).

Like Camden, the population estimates for most ages in Westminster were also decreased for similar age groups. The largest reduction among males was for those aged 38 years, from 2,789 to 1,442 people, a decrease of 48.3%. For females, the largest reduction was for people aged nine years from 1,605 to 833 people, a decrease of 48.1%.

## **Figure 8: Emigration data is not capturing all population outflow from Camden and Westminster**

**Cumulative net migration and unattributable population change impact by 2021 in Camden and Westminster by age and sex**

### **Notes:**

1. UPC refers to unattributable population change.

**[Download the data](#)**

## **Impact of migration**

Figure 8 shows that for both Camden and Westminster, the impact of revisions to international migration largely reduced the male population estimate for those aged up to 35 years, and increased the size of the group aged 35 to 45 years. In Camden, the population estimate was reduced by 16,851 males aged up to 35 years, because of international migration, compared with 3,778 females. In Westminster, the population estimate was reduced by 17,240 males of the same age, compared with 9,509 females.

In Camden, the impact of changes to internal migration was highest for ages 24 to 30 years, where the population estimate was increased by 2,477 people (made up of 1,047 males and 1,430 females). In Westminster the greatest impact was for people aged 35 to 45 years, where the population estimate was reduced by 4,939 people (made up of 2,076 males and 2,863 females).

## Impact of unattributable population change

Figure 8 also shows that unattributable population change (UPC) was highest in Camden for males aged 35 to 45 years and females aged 25 to 30 years, at reductions of 8,189 and 4,033 people, respectively. In Westminster, UPC was also highest for males aged 35 to 45 years, reducing the population estimate by 10,403 people. However, among females, the UPC was highest for females aged between 30 and 35 years, increasing the population estimate by 2,436 people.

The directions of UPC align with the directions of migration, and the changes made to the population estimates. This suggests that our components of change are not adequately capturing the population shrinkage of male young adults in Camden and Westminster, or the population growth of females aged 30 to 35 years in Westminster.

This may be because of the young age profile of Camden and Westminster, where a majority live in rented accommodation (69.3% and 71.6%, respectively), who may be more mobile and more likely to move within the 2012 to 2021 period, without updating their administrative data records. Like Coventry and Warwick, there may also be misalignment between the Census 2011 population base and our administrative data sources used to rebase the population estimates.

Because of the proximity of Camden and Westminster, it may also be possible that the UPCs for these LAs are compensating for one another. Specifically, the UPC for people aged 29 to 32 years reached an additional 2,916 people in Westminster but dropped to a reduction of 4,479 people in Camden. This suggests that there may be additional movement between Camden and Westminster that was not captured in the revisions to migration flows.

## 7 . Explore your area

We have investigated the impacts of rebasing the population estimates and revisions to internal and international migration for each local authority (LA) in England and Wales, which users can explore in Figure 9.

Figure 9 shows that for LAs in England and Wales, generally, population estimates of children aged under 13 years, people aged between 20 and 49 years, and people aged over 90 years were most likely to have changed the most after rebasing.

### Figure 9: Explore the data by local authority

Population estimate change impact and net components of change impact by local authority, age and sex by 2021

#### Notes:

1. UPC refers to unattributable population change.

[Download the data](#)

## 8 . Rebasing mid-year population estimates following Census 2021, England and Wales: 2012 to 2021 data

[Estimates of the population for England and Wales](#)

Dataset | Released 23 November 2023

National and subnational mid-year population estimates for England and Wales by administrative area, age, and sex, 2012 to 2022.

## 9 . Glossary

### Census-based estimates

The method used in years in which a census takes place. The mid-year estimates (MYEs) are based on the census estimates rolled forward only by the time between Census Day and 30 June 2021.

### Components of change

Components of change are the factors that contribute to population change. This includes births and deaths (referred to as natural change), and net migration. Migration includes movements of people between the UK and the various countries of the world (international migration), and between local authority areas within the UK (internal migration).

### Internal migration

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

### International migration

International migration describes the flow (or movement) of migrants to and from the UK. This report uses the United Nations (UN)-recommended definition of a long-term international migrant, as explained in their [Recommendations on Statistics of International Migration paper \(PDF, 5.0MB\)](#). A long-term international migrant is defined as "A person who moves to a country other than that of his or her usual residence for a period of at least a year (12 months), so that the country of destination effectively becomes his or her new country of usual residence".

### Rebasing

Rebasing is the process of amending the back series of population estimates, using the most up-to-date information we have, so that they align with the latest census results.

### Reconciliation

Reconciliation is the process of comparing population estimates derived from 2021 Census estimates, against those that would have been produced if we had just rolled forward estimates from 2020, without using the 2021 Census.

### 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.

### Unattributable population change

Unattributable population change (UPC) is the remaining population change that can be seen between the census-based and the rolled-forward population estimates, which cannot be explained by any of the components of change. This is a natural feature of rebasing the estimates and represents uncertainty affecting the components and the base population estimates. UPC is allocated across the decade to create a plausible distribution of change.

## 10 . Data sources and quality

Quality and methodology information on strengths, limitations, appropriate uses, and how the mid-year population estimates were created is available in our [Mid-Year population estimates Quality and Methodology Information \(QMI\) report](#).

For local authority population estimates in England and Wales, confidence intervals from Census 2021, which compare age-sex estimates in 2021, are available in our [Local authority comparisons tool \(XLS, 2.39MB\)](#). These confidence intervals reflect most of the uncertainty in the 2021 mid-year estimates.

## 11 . Future developments

As part of our ongoing work to improve the quality of our data and understanding our population estimates, we are carrying out research to assess the impacts of alternative methods for distributing UPC over time, and the age profile. We hope to update users on the outcome of this, and any implications, in due course.

We will also publish the latest admin-based population estimates (ABPEs) from our dynamic population model (DPM). These estimates will use the revised components from the rebasing to inform its modelling and provide additional insight into patterns of population change over time. The ABPEs will include comparisons with the mid-year population estimates at the local authority (LA) level, along with measures of uncertainty.

### Providing feedback and staying informed

We welcome your feedback on our population statistics and planned outputs.

If you would like more detail about the reconciliation and rebasing projects, or the transformation population statistics are undergoing, please contact us. We can also help you to understand which population estimates you should be using at different times. Email [pop.info@ons.gov.uk](mailto:pop.info@ons.gov.uk) for help and support.

To receive the latest updates and our Population Statistics newsletter, sign up to the Office for National Statistics migration and population statistics mailing list. More information on how we process stakeholders' personal data, is available in our Privacy Information for our stakeholders.

## 12 . Related links

### [Rebasing of mid-year population estimates following Census 2021, England and Wales](#)

Bulletin | Released 23 November 2023

Rebased mid-year estimates for 2012 to 2021 to align with Census 2021 results. Includes a revised back series of components of population change.

### [Rebasing and reconciliation of mid-year population estimates following Census 2021, England and Wales: 2022](#)

Article | Released 5 September 2022

An update for users of population statistics, explaining the process used to integrate Census 2021 data into population estimates (2012 to 2021).

### [Estimating UK international migration: 2012 to 2021](#)

Article | Released 23 November 2023

How migration has changed over the decade, the methods used to produce the updated series and the evidence used to demonstrate confidence that the new methods are robust.

### [Population statistics and sources guide](#)

Methodology | Last revised 17 November 2023

A comparison of the different types of population estimate that are published on the ONS website or planned for future publication. Includes information about whether these are official estimates of the population or used only for wider research, as well as the sources, coverage and main uses and comparability issues for the estimate.

## 13 . Cite this article

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