

Methodology used to produce the 2018-based subnational population projections for England

Information on the methods used to produce the 2018-based subnational population projections.

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1 . Introduction

This article documents the methodology and data used in producing the [2018-based principal and variant subnational population projections for England](#), published on 24 March 2020. It also discusses the impact that the methodology or data used may have had on the resulting projections. There have been changes to the methodology used for the subnational population projections over time and, in this release, we outline the further methodological improvements including changes to source data. The changes to date are summarised in [Annex A](#).

The 2018-based subnational population projections for England provide an indication of the possible size and structure of the future population, based on the continuation of recent demographic trends, and are produced on a consistent basis across all local authorities in England. Population projections for English regions, counties, clinical commissioning groups (CCGs) and NHS England regions are produced from the local authority projections.

Although we normally publish subnational projections every two years, we are currently proposing not to produce 2020-based projections, which would theoretically be published in autumn 2021 for the national projections and spring 2022 for the subnational projections. This is because the first results from Census 2021 are also expected in spring 2022. We therefore propose that the next round of projections will be based on 2021, enabling them to use the updated base population that the results from Census 2021 will offer. This approach would also apply to our household projections.

The projections make assumptions about future fertility, mortality and migration levels based on trends in recent estimates, over a five-year reference period. The projections are not forecasts and generally take no account of policy or development aims that have not yet had an impact on observed trends.

We also produce household projections, and the subnational population projections are used as an input into producing these figures. The projections are also used by the Department of Health and Social Care (DHSC) for healthcare planning, by central and local government for modelling and longer-term planning, and by various other groups for planning and research.

For the 2018-based subnational population projections, we changed our approach and timing compared with previous editions. We took the decision not to consult on the draft data, but instead we published two months earlier than previous occasions. We also published the variant subnational projections at the same time.

2 . Overview of methodology

The subnational population projections use the internationally accepted cohort component method. These 2018-based projections take the [mid-2018 population estimates](#) as their starting point. For most calculations, data for the preceding five years are used, so trends are based on data from the years ending mid-2014 to mid-2018. The projections based on these trends are constrained to the totals used in the principal [2018-based national population projections](#) for England.

The projections model splits population between the armed forces population, prison population and civilian population, and it treats them differently. The population of armed forces (including dependants of foreign armed forces) and the prison population are treated as “static populations” such that they retain the same size and age–sex structure throughout the projection period, subject to the allowance for the planned return of armed forces and their dependants from Germany to the UK by mid-2020.

The projections for each year are calculated by first removing these static populations to produce a civilian population. The civilian population from the previous year is then aged on, local fertility and mortality rates are applied to calculate projected numbers of births and deaths, and the population is adjusted for internal migration (movement between areas within England), cross-border migration (movements between England and the other countries of the UK) and international migration (movements between England and countries outside of the UK). Finally, the static population is added back in to reach the projection next year. For example, for the first year of the projections, the mid-2018 to mid-2019 change is applied to the mid-2018 base to produce the mid-2019 population projection.

Each component (except internal migration) is constrained to its respective total in the principal 2018-based national population projection for England. Similarly, once the static population has been added back, the projected population is constrained to the total in the principal 2018-based England national population projection for that year. This process is repeated for each year of the projection period. The following list of stages illustrates the projection process:

- stage one: begin with the resident population of base year
- stage two: remove the static population (home armed forces, dependants of foreign armed forces and prisoners)
- stage three: determine the age of the civilian population
- stage four: adjust for projected births and deaths (add births and subtract deaths)
- stage five: adjust the figure for projected migration (internal, cross-border and international)
- stage six: add the static population that was removed earlier in the process
- stage seven: scale the figure to national population projections
- stage eight: repeat for each year of projection

The population at the end of each cycle becomes the base population of the next cycle. The process in each stage is discussed in more detail in later sections of this article.

Projections for clinical commissioning groups (CCGs) are not produced directly. Instead, they are based on the projections created for local authorities.

In many cases, CCG areas share boundaries with local authorities or aggregations of local authorities, in which case projections for these areas are calculated by replicating or aggregating the appropriate local authority projections.

Where areas do not share boundaries, CCG projections are derived from proportions based on CCG or local authority-level splits using Lower-layer Super Output Area- (LSOA-) level estimates by age and sex for the base year.

The derived proportions are multiplied by the projected local authority figures. The respective CCG parts are then aggregated to the CCG level.

3 . Base population, static population and ageing on

The [mid-2018 population estimates](#) form the base population for the subnational population projections. The estimates refer to the population at their usual place of residence. This includes all those temporarily away from home (for six months or less) and excludes visitors. Armed forces stationed outside England are not included, but those stationed inside England are included. Asylum seekers and visitor switchers (people who enter a country intending to visit but stay 12 months or more to become usual residents) now residing in England are included. Students are taken to be resident at their term-time address.

The resident population is divided into two types for the purposes of projection: first, civilian population and second, armed forces (home, foreign and foreign armed forces' dependants) and prisoners (first treated as special population in the 2018-based projections).

The civilian population refers to the usually resident population excluding home armed forces, foreign armed forces and their dependants, and prisoners.

An adjustment is made for the US armed forces' dependants aged under one year to prevent double counting of births. Treating the dependants of US armed forces as a static population counters the inaccurate ageing on of women of childbearing age and reduces the imbalance in the sex ratio in local authorities with a large US armed forces presence.

Data on UK armed forces are supplied by Defence Statistics at the Ministry of Defence, and data on foreign armed forces originate mainly from US Air Force statistics. They will include numbers of home and foreign armed forces usually resident in an area. Resident armed forces populations, including foreign armed forces and their dependants and the prison population, are removed from the usually resident population to create the civilian population at the start of processing for each projection year.

The civilian population is then aged on one year to become the appropriate age in the following year of the projection. For example, 17-year-olds in Birmingham in one year will become the basis for the 18-year-olds in Birmingham for the next year. The population is then adjusted for births, deaths and migration. Then, in the final stage, the resident armed forces, foreign armed forces and their dependants, and prisoners are added back in.

4 . Births

Projected numbers of births are calculated by applying local authority age-specific fertility rates (ASFRs) to the population to derive a number of births, by age of mother. Male and female births are assigned by multiplying the births by an England-level sex ratio derived from five years' worth of local authority data. These births figures for local authorities are constrained to add up to the number of births projected in the 2018-based national population projections for England for each year of the projection.

Data used

Births data come from registered births collected by the General Register Office (GRO) by local authority, age of mother and sex of child. The [mid-2018 population estimates](#) are used to calculate fertility rates. The subnational projections assume a range of childbearing ages from 15 to 44 years; this means that, when calculating fertility rates, the small number of births to women aged under 15 years or over 44 years are classed as having occurred at age 15 years or age 44 years respectively.

Detailed methodology

Local authority-level ASFRs are calculated using the most recent five years' worth of trend data. For the 2018-based projections, these were the years ending mid-2014 to mid-2018.

There are four steps to the methodology:

- stage one: the projection model calculates initial local authority-level ASFRs by dividing the observed number of births by the total number of women of childbearing age for each of the five years in the historical data; this process is repeated for data aggregated at England level to obtain national-level ASFRs
- stage two: an initial fertility differential is calculated by dividing the sum of local ASFRs across the five-year historical period by the sum of their corresponding national ASFRs over the same period for each childbearing age
- stage three: the initial local authority-level differential is multiplied by the national-level ASFRs for the first year of the projection to calculate the final local authority-level ASFRs for that year
- stage four: this process is then repeated for the remaining years of the projection using a rolling five-year average approach where the differentials are calculated using data from the five years prior to the projection year (for example, the final local authority-level ASFRs for the year ending mid-2019 are calculated by multiplying the national fertility rates for the year ending mid-2019 by the differential derived from the years ending mid-2014 to mid-2018)

The projected number of births is calculated for each year by multiplying the final local authority-level ASFRs by the number of women of the corresponding age. Projected births are split by sex of child using a national-level sex ratio calculated by dividing the sum of all male births by the total number of births in England over the five-year period covering the years ending mid-2014 to mid-2018. Male births are assigned by multiplying this ratio by the total number of births in the local authority; the remaining births are allocated as female.

The total number of births is then constrained to the projected total of births in the principal national population projection for England by dividing the national population projection births data by the aggregated local authority births data for each combination of age of mother against sex of child. This gives scaling factors for each age or sex combination, which are then applied to the local authority data for each year of the projection.

We made the following adjustments in the 2018-based subnational projections to improve the projections of births in local areas:

- fertility rates were capped to be no greater than five times the national fertility rate
- for the Isles of Scilly, fertility rates were replaced by the assumed fertility rates used in the national population projections for England; this is because fertility rates for this area are highly volatile owing to its small population size
- where fertility rates were zero for an individual age or sex for an area, these were replaced by the projected national rate for that age or sex; this adjustment affected small local authorities

5 . Deaths

Projected number of deaths are calculated in a similar way to births. They are calculated by applying local authority age- or sex-specific mortality rates (ASMRs) to derive numbers of deaths, by age and sex. The deaths figures for local authorities are then constrained to add up to the number of deaths projected in the 2018-based [national population projections](#) for England for each year of the projection. The deaths figures are subtracted from the aged-on population.

Data used

Data are collected from information supplied through the death registration process via the Local Registration Service, on behalf of the General Register Office (GRO), by local authority, age and sex. The [mid-2018 population estimates](#) are used to calculate mortality rates.

Detailed methodology

Local authority-level ASMRs are calculated using the most recent five years' worth of trend data. For the 2018-based projections, these were years ending mid-2014 to mid-2018.

There are four steps to the methodology:

- stage one: the projection model calculates initial local authority-level ASMRs by dividing the observed number of deaths by the civilian population for each of the five years in the historical data; this process is repeated for data aggregated at England level to obtain national-level ASMRs
- stage two: an initial mortality differential is calculated by dividing the sum of local ASMRs across the five-year historical period by the sum of their corresponding national ASMRs over the same period for each year
- stage three: the initial local authority-level differential is multiplied by the national-level ASMRs for the first year of the projection to calculate the final local authority-level ASMRs for that year
- stage four: this process is then repeated for the remaining years of the projection using a rolling five-year average approach where the differentials are calculated using data from the five years prior to the projection year (for example, the final local authority-level ASMRs for 2018 are calculated by multiplying the national mortality rates for the year ending mid-2018 by the differential derived from the years ending mid-2014 to mid-2018)

The projected number of deaths is calculated for each year by multiplying the final local authority-level ASMRs by the civilian population.

The total number of deaths is then constrained to the projected total of deaths in the principal national population projection for England by dividing the national population projection deaths data by the aggregated local authority deaths data for each year. This gives scaling factors for each age or sex combination, which are then applied to the local authority data.

The following adjustments were made in the 2018-based subnational projections to improve the projections of deaths in local areas:

- mortality rates were capped to be no greater than five times the national mortality rate
- for the Isles of Scilly and the City of London, mortality rates were replaced by the assumed mortality rates used in the national population projections for England; this is because mortality rates for these areas are highly volatile owing to their small population size
- where mortality rates were zero for an individual age or sex for an area, these were replaced by the projected national rate for that age or sex; the adjustment was mostly applied to people of younger ages where there tend to be fewer deaths

6 . Migration

Adjusting for the expected number of people entering and leaving a local authority by age and sex is done separately for internal, cross-border and international migration using different methodologies.

Internal migration

An internal migrant is defined as someone who changes their local authority of residence between one year and the next. In the subnational population projections, internal migration is defined as migration between areas within England only. For some other uses, internal migration is defined as including migrant flows between England, Wales, Scotland and Northern Ireland, but in the subnational projections these are referred to as cross-border flows.

The internal migration estimates that we produce provide an origin–destination matrix that provides information on moves from each local authority in England to every other local authority in England, by sex and single year of age. To project internal migration moves, two-year trend data are used to derive the average proportion of the population, for each sex and age, that has left each local authority and where they have moved to. By applying these proportions to the population figures, estimates of internal migration flows between areas are calculated. By adding up the estimated number of outflows of internal migrants from every other authority into an authority, the inflows into that authority are calculated.

Data used

Internal migration is moves made between local authorities within England. The 2018-based subnational population projections used a revised methodology for internal migration to be more robust and in line with the mid-2018 population estimates. This methodological change relates to how we account for the movements of the highly mobile population leaving higher education. The Office for National Statistics (ONS) introduced the higher education leavers methodology (HELM) to better address this. It builds on methodology introduced to the population estimates in 2012 by moving those who have finished higher education but have not updated the information we use such as NHS Patient Register information.

Prior to the 2018-based population projections, internal migration used five-year averages based on the NHS Patient Registration Data System (NHS PRDS), NHS Personal Demographics Service (NHS PDS), NHS Central Register (NHS CR) and Higher Education Statistics Agency (HESA) data. Following the discontinuation of the NHS CR in February 2016, the 2018-based population projections' internal migration data use two-year averages based on NHS PDS and HESA data.

The decision to use two-year averages for internal migration in the 2018-based population projections was because analysis conducted by the ONS showed the new methods used for the years ending mid-2017 and mid-2018 were more accurate and robust at picking up moves. There is a chance that using only two years of data will create unusual averages for local authorities experiencing abnormal migration patterns over this short period. However, we decided that although there may be risks associated with this change, the general increase in accuracy outweighs any impacts on individual local authorities.

The 2018-based principal projection, high migration variant and low migration variant used two-year averages for internal migration because data for the new methodology only started in the year ending mid-2017. Future projections will still use five-year averages for internal migration when a larger back series is available. The 10-year migration variant uses the new methodology for the years ending mid-2017 and mid-2018 and the previous methodologies for the years ending mid-2009 to mid-2016. We also published an additional variant, the alternative internal migration variant, which uses the new methodology for the years ending mid-2017 and mid-2018 with the previous methodology for the years ending mid-2014 to mid-2016. The alternative internal migration variant has been published for comparison with the principal projection.

NHSCR data for the year ending mid-2015 were re-used in the internal migration estimates for the year ending mid-2016. This was to avoid using partial data for mid-2016 because of the closure of the Central Health Register Inquiry System (CHRIS) in February 2016. For the years ending mid-2017 and mid-2018, data that were previously provided by the NHS PRDS and NHS CR have been received from the NHS PDS.

As explained earlier, the internal migration estimates for the years ending mid-2017 to mid-2018 were used to calculate the trends in the 2018-based subnational population projections. The estimates are available in the [mid-2018 population estimates](#) back series.

A full report on the impacts and implications of this new methodology can be found in the [methodology article for the 2018 mid-year population estimates](#).

Detailed methodology

The proportion of people moving from one local authority is calculated by dividing the number of people moving out of the area by the number of people living there. This is calculated separately for males and females by single year of age for each of the trend years individually and then a two-year average is calculated to produce rates of out-migration by age and sex.

In some local authorities with small numbers of moves and/or populations, this can lead to atypical rates, which produce unrealistic results in the projected population. To overcome this, adjustments are sometimes made to smooth the data. These can take the form of upper limits (or caps) on migration rates or the replacement of rates with appropriate alternatives. The following adjustments were applied in the 2018-based projections: the assumed proportion of people of any individual age and sex group moving out of an area was capped at a maximum rate of 0.75, while for Oadby and Wigston, the internal out-migration probabilities for males were replaced by those for females for ages 19 to 25 years; this was to overcome a known issue in the population estimates regarding a first year University of Leicester student hall of residence situated in Oadby and Wigston.

The out-migration rates are applied to the aged-on civilian population (after adjusting for births and deaths) in each authority to estimate the number of internal out-migrants for the projected year.

To distribute the projected out-migrants to a destination local authority, we use the origin–destination matrix. The probability of a person moving from local authority A to local authority B, given that they are moving from local authority A, is calculated by dividing the number of people moving from local authority A to local authority B by the total number moving out of local authority A using two years of trend data.

The total inflow for each local authority is calculated by adding the outflows from every other local authority into this particular local authority.

The net internal migration adjustment for each local authority, by age and sex, is calculated by subtracting outflows from inflows. The total net internal migration adjustment across all local authorities in England must sum to zero, as these are movements within the country, not between countries.

Impacts of methodology and data used

The internal migration assumptions are set in terms of the probability of moving out of an area. For the majority of areas and most ages, the calculated probabilities are realistic even though there are delays in some people registering with a General Practitioner (GP) after moving. However, for some age groups in some areas, there are reasons why they may not be similar.

Areas with large numbers of students incur issues in estimating internal out-migration. This is partly because of the known issue of students, especially males, delaying re-registering with a GP when they move out of an area at the end of their studies. Care should be taken in using or interpreting age distributions in the early 20s for local authorities with substantial student populations. The impact of this will be an overestimation of the migration rates at some ages and an underestimation at other ages. The new methodology introduced in the 2018-based subnational projections aims to lessen the impact of overestimation and underestimation, but caution is still advised.

A specific adjustment is made in the mid-year population estimates to allow for internal migration to and from a large university campus, which is allocated, based on its postcode, to Coventry but has halls of residence on both sides of the border between Coventry and Warwick. The subnational projections reflect this adjustment in the base population for the projection. However, the adjustment is not replicated in the projections themselves. The impact of this process is complex but is liable to have a minor impact over time on the size and age structure of Coventry and Warwick's projected populations.

Cross-border migration

Cross-border migration is the moves made by people between England and the rest of the UK.

Data used

Cross-border migration between England and the constituent countries of the UK is captured in a similar way to internal migration flows. Flows between England and Wales are produced using the same data sources as for internal migration.

Information on moves into, and out of, Scotland and Northern Ireland in the population estimates are collected and treated differently from moves within England and Wales, by using data from National Records of Scotland (NRS) and the Northern Ireland Statistics and Research Agency (NISRA). Further information is available in the [internal migration estimates section of the methodology guide for the mid-2018 UK population estimates for England and Wales](#).

Detailed methodology

To calculate cross-border moves, an average of five years' cross-border estimates data from the years ending mid-2014 to mid-2018 are used to give an average number of moves, by age and sex, between each local authority in England and each of the other constituent countries of the UK (Wales, Scotland and Northern Ireland).

Cross-border migration assumptions at the national level have been set as rates rather than as a fixed number of migrants. This means that cross-border migration varies throughout the course of the projection and is not held constant beyond a particular point in time. The flows in the 2018-based subnational projections are constrained to the flows in the respective national population projections for each year.

International migration

The national population projections' international migration assumptions are made in terms of inflows and outflows of international migrants into and out of England. This includes adjustments for visitor and migrant switchers, armed forces returning from Germany and their dependants, asylum seekers, and people from Syria granted humanitarian protection.

These streams are also used in the subnational population projections with the inflows (immigration), outflows (emigration), armed forces returning from Germany and their dependants, asylum seekers, and people from Syria granted humanitarian protection modelled separately.

The data sources and methods are described for each stream in the following sections.

The outflows from each stream are subtracted from their respective inflows to calculate the net flow for each stream by local authority, age and sex.

Data used

The main source of information on international migration is the International Passenger Survey (IPS). This is a voluntary sample survey of passengers travelling through airports, seaports and the Channel Tunnel. It provides information on the number of people intending to stay in, or leave, the UK for 12 months or more. Adjustments are made to account for people who enter or leave the country initially for a short stay but subsequently decide to remain for a year or more ("visitor switchers") and people who originally intend to be migrants but, in reality, stay in the UK or abroad for less than a year ("migrant switchers").

The 2018-based subnational population projections use the published international migration component of population change as used in the published population estimates. They use a five-year average of international migration estimates, covering the years ending mid-2014 to mid-2018.

Local authority estimates for immigration are created by distributing migration estimates directly from the national to local authority-level using administrative data sources. Details about this methodology were first published with the [indicative mid-year population estimates](#) in November 2011.

Estimates of emigration for local authorities are created by using a statistical model that uses the IPS and other data sources to create a more robust estimate of emigration at the local authority level. The statistical model has been improved, and these improvements have been implemented in the revised population estimates. These revised population estimates provide the trend data for emigration used in the population projections. Details about this methodology and the resulting improvements are available in the [Population statistics research update: February 2018](#).

The 2018-based subnational population projections trend data for international migrants are already adjusted for visitor and migrant switchers, so they are being modelled as part of the international migration flows.

Detailed methodology

For immigration (international inflows), an average of five years' historical trend data from the year ending mid-2014 to the year ending mid-2018 have been used to give a five-year average of trend data of international migrants into local authorities in England. The assumption is that this average remains constant for the whole projection period; however, as with the other components, this inflow is constrained to the national population projections, by age and sex for each year. This means that, dependent on the national projected immigration, the local authority-level figures may be scaled up or down.

Some impacts of constraining to the national population projections

Constraining to the 2018-based national population projections' migration assumptions will entail scaling of the local trends calculated. Therefore, there may be a step change between recent trends locally and the assumptions used in the subnational population projections. In most cases, five years of data are used to create the local trends in the subnational population projections; however, the national population projections use a much longer time series in setting the national long-term assumptions. Therefore, it is not unusual for the assumptions made for international migration to be at a different level to a simple average of the latest local data.

7 . Armed forces returning from Germany

The majority of the UK armed forces stationed in Germany are expected to move back to bases across the UK by 2020.

The 2018-based subnational population projections use data from the Ministry of Defence and British Forces Germany to allocate returning UK armed forces and their dependants to the local areas where their units are due to be based in the year they are due to return. For those returning between mid-2019 and mid-2020, no specific base has been assigned; instead, the armed forces and their dependants have been distributed across a range of local authorities using base-to-residence matrices created from the 2011 Census.

This means that in the 2018-based subnational population projections, the returned UK armed forces distribution will better match the expected reality. The UK armed forces become part of the static population in each area, while their dependants are included in the civilian population and therefore aged on with the civilian fertility, mortality and migration rates applied in subsequent years.

8 . Asylum seekers

Data on asylum seekers and their dependants are provided by the Home Office and the National Asylum Support Service. Applications for asylum (excluding an estimate of those removed from the UK within one year) provide the basis for projected inflows of asylum seekers. Data on removals, refusals, withdrawals and appeals for principal applicants and their dependants are used to estimate outflows of asylum seekers leaving the UK after 12 months or more.

For the 2018-based population projections, a five-year average of asylum seeker data is calculated using the most recent five years' worth of data available, for the years ending mid-2014 to mid-2018. The local authority average flows are constrained to the national population projections for the entire projection period before being added onto the population for each year of the projection.

9 . People granted humanitarian protection

The subnational population projections include people from Syria granted humanitarian protection under the Vulnerable Persons Resettlement Scheme (VPRS). It is expected that around 5,000 people will be granted humanitarian protection in England between mid-2019 and mid-2020. Those arriving between mid-2018 and mid-2019 are distributed to the local authorities where they actually arrived. Those arriving after mid-2019 have been distributed by using Home Office data on numbers of VPRS migrants received by each local authority during the period between September 2015 and June 2018.

10 . “Other” component

The main (principal) subnational population projections and each of the variants contain a version of [Table 5: Subnational population projections with components of change \(births, deaths and migration\) for regions and local authorities in England](#). In each instance of the table, there is a category "Other". The category "Other" includes people granted humanitarian protection from Syria as well as armed forces returning from Germany and their dependants. In the 2018-based national population projections, these groups were counted in the "international inflows" component. Because the "Other" component is separate in the subnational population projections, the specific international inflows component is smaller than in the national population projections.

11 . Final constraining stage

At the England level, the subnational population projections are consistent with the 2018-based national population projections for England. The underlying assumptions used in the national projections were agreed in liaison with the devolved administrations following consultation with leading stakeholders and after seeking expert advice. [National population projections for 2018 data and supporting documentation](#) are available.

The births, deaths and migration components of the population projection are constrained to the corresponding England data (in the national population projections) for each projection year. However, the subnational population projections' components of change do not always fully explain the change in the national population between one year and the next. This is because of a difference in the processing order and the way mortality and fertility rates are applied in the national population projections and the subnational population projections.

Consequently, a final constraining step takes place to ensure that the subnational population projections add up to the national population projections by both age and sex. This is done as the last process in the cycle of producing the population projection for a year, which then forms the base population for the next year's calculation. This process is repeated to produce each year's subnational population projections.

12 . Methods used for subnational population projections for other parts of the UK

We produce subnational population projections for areas in England. Equivalent subnational projections for the constituent countries of the UK are produced by the Welsh Government, National Records of Scotland (NRS), and the Northern Ireland Statistics and Research Agency (NISRA). More information is available in [Subnational population projections across the UK: a comparison of data sources and methods](#).

13 . Variant subnational population projections

The four 2018-based variant subnational population projections are released alongside the 2018-based subnational principal projection. The four variants are produced using broadly the same methods as the 2018-based subnational population projections main release, with a few differences. The differences in methods between the main subnational population projections release (the principal) and the variant methods are outlined in this section.

High international migration

The high international migration variant is produced in the same way as the main (principal) subnational population projection except that the migration component totals are constrained to match those in the 2018-based high migration variant national population projection for England. This has a higher long-term net migration total of 290,000 per year from the year ending mid-2025 onwards, compared with 190,000 in the principal projection.

The higher net migration reflects higher immigration and lower emigration. From the year ending mid-2025 onwards, this reflects a long-term annual increase of 10.2% in immigration and a 16.4% decrease in emigration for England as a whole. While these differences are also typical at the local authority level, there is some variation because of the complexity of the constraining process. The fertility and mortality rates are unchanged from the principal projection. In each area, the higher number of migrants will affect the subsequent numbers of births, deaths, and internal and cross-border migrants.

As with the main (principal) subnational population projection, in the high international migration variant the disaggregation to the local authority level is based on a five-year average (for the years ending mid-2014 to mid-2018) of international migration data, including asylum seeker flows, split by age and sex.

Low international migration

The low international migration variant is produced in the same way as the main (principal) subnational population projection except that the migration component totals are constrained to match those in the 2018-based low migration variant national population projection for England. This has a lower long-term net migration total of 90,000 per year from the year ending mid-2025 onwards, compared with 190,000 in the principal projection.

The lower net migration reflects lower immigration and higher emigration. From the year ending mid-2025 onwards, this reflects a long-term annual decrease of 10.2% in immigration and a 16.4% increase in emigration for England as a whole. While these differences are also typical at local authority level, there is some variation because of the complexity of the constraining process. The fertility and mortality rates are unchanged from the principal projection. In each area, the lower number of migrants will affect the subsequent numbers of births, deaths, and internal and cross-border migrants.

As with the main (principal) subnational population projection, in the low international migration variant the disaggregation to the local authority level is based on a five-year average (for the years ending mid-2014 to mid-2018) of international migration data, including asylum seeker flows, split by age and sex.

10-year migration

The 10-year migration variant is produced in the same way as the main (principal) population projection except that it uses a 10-year average (for the years ending mid-2009 to mid-2018) for internal migration, international migration, and cross-border and asylum seeker flows split by age and sex. The 10-year migration variant is consistent with the principal subnational population projection in that all components are constrained to the principal 2018-based national population projection for England. However, because it uses 10 years' worth of international migration input data, rather than five years' worth, and 10 years of internal migration data rather than two years' worth, the distribution of migration at the local authority level is different.

Alternative internal migration

The alternative internal migration variant is produced as a comparison with the main (principal) population projection in regard to internal migration. The principal population projection uses a new method to produce trends based on two-year averages because of a limited back series of data with the new methodology. The alternative internal migration variant uses a mix of the old and new methodology to create a trend, based on five-year averages, using three years from the year ending mid-2014 to the year ending mid-2016 under the old methodology and the two years ending mid-2017 and mid-2018 using the new methodology. This variant is being published for transparency and to allow users to compare between the two methods.

14 . Annex A: Changes to the subnational population projections' methodology

International migration (change first implemented in the 2010-based projections)

Up to mid-2008, estimates of migration from the Republic of Ireland were made separately from International Passenger Survey (IPS) flows and were therefore treated separately in the subnational population projections methodology. They are now included in IPS flow data, so they are projected along with other international migration flows.

International migration (change first implemented in the 2010-based projections)

Projections are based on the migration estimates from the indicative mid-year population estimates, which used new methods to distribute in-migrants to local authorities. These were based on distributing migration estimates directly from the national to local authority level using administrative data sources.

International migration (change first implemented in the 2012-based projections)

Visitor switchers are no longer modelled separately. This is because data for visitor switchers are now included with the main international migration data and are therefore modelled with these flows.

Internal migration (change first implemented in the 2012-based projections)

The capping of the proportion of people of any individual age and sex group moving out of an area to another area within England was changed to 0.75 (from 0.80 in the 2010-based projections).

Cross-border migration (change first implemented in the 2014-based projections)

The national population projections' cross-border migration assumptions are set as rates rather than as numbers of migrants. Although subnational migration methodology is not directly changed, figures are constrained to national flows calculated on the new basis. Previously, the subnational population projection flows were constrained to the national population projection flows for six years for inflows and four years for outflows and then held constant.

Emigration (change first implemented in the 2016-based projections)

The statistical model for creating emigration estimates has been improved, and these improvements have been implemented in the revised population estimates and consequently in the trend data for emigration used in the projections. In addition, the methodology to project emigration removes the New Geographies of Migration from the process and uses a simple five-year average of trend data, rather than the complex model used previously.

Dependants of US foreign armed forces (change first implemented in the 2016-based projections)

Dependants of US foreign armed forces are now treated as a static population in the subnational population projections alongside other foreign armed forces. An adjustment has been made for the US armed forces dependants aged under one to prevent double counting of births.

Returning armed forces from Germany (change first implemented in the 2016-based projections)

The 2016-based subnational population projections use data from the Ministry of Defence and British Forces Germany to allocate returning UK armed forces and their dependants to the local areas where their units are due to be based. Those UK armed forces and their dependants due to return between mid-2019 to mid-2020 are distributed across a range of local authorities using base-to-residence matrices created from the 2011 Census.

Cross-border flows (change first implemented in the 2016-based projections)

Cross-border migration is now calculated at the individual country level using five years' worth of trend data; previously, flows to and from each country were combined into a single cross-border figure. This means, for example, that specific cross-border flows between England and Scotland are now calculated, which are then constrained to the cross-border flows between England and Scotland in the national projections.

People granted humanitarian protection (change first implemented in the 2016-based projections)

People from Syria granted humanitarian protection under the Vulnerable Persons Resettlement Scheme (VPRS) are included. They are distributed to local authorities using Home Office data on where VPRS arrivals were placed over the period between mid-2015 and mid-2017.

Asylum seekers (change first implemented in the 2016-based projections)

The 2014-based projections used the most recent year of data available for asylum seeker flows by sex and age at the local authority level, and the data were constrained to the total in the national population projections for two years. For the 2016-based projections, a five-year average of asylum seekers' data is used, and these flows are constrained to the totals in the national population projections for the entire projection period.

Internal migration methodology (special change for 2018-based projections)

The higher education leavers methodology (HELM) has been introduced to better address the movements of people leaving higher education each year. This builds on the method introduced in 2012 by moving people who leave higher education but do not update their NHS Patient Register information to local authority destinations based on the movements of past cohorts of similar higher education leavers.

The 2018-based principal population projection, high migration variant and low migration variant used two-year averages for internal migration because data using the latest internal migration estimates' new methodology was only available from the year ending mid-2017. Future projections will still use five-year averages for internal migration when a longer back series is available. The 10-year migration variant uses the new methodology for the years ending mid-2017 and mid-2018 and the previous methodologies for the years ending mid-2009 to mid-2016. We also published an additional variant, the alternative internal migration variant, which uses the new methodology for the years ending mid-2017 and mid-2018 with the previous methodology for the year ending mid-2014 to the year ending mid-2016. The alternative internal migration variant was published for comparison with the principal projection.

Treating prisoners as a static population

The 2018-based subnational population projections are the first time that prisoners are included as a special population.