Methodology used to produce the 2016-based subnational population projections for England

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1 . Introduction

This report documents the methodology and data used in producing the [2016-based subnational population projections for England](#), published on 24 May 2018. 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, there have been further methodological improvements including changes to source data. The changes to date are summarised in Annex A.

The 2016-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.

We normally publish subnational projections every two years. 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 are now responsible for producing 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 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 2016-based projections we held a user engagement exercise to inform users of the methodological improvements and changes to source data. Users were asked to provide feedback on the new methods and what they need from the projections and related outputs. The feedback was generally positive and there were no further changes to the projections methodology.

The report also documents the methods and data used to create the [variant subnational population projections for England](#), published on 9 April 2019.

2 . Overview of methodology

The subnational population projections use the internationally accepted cohort component method. These 2016-based projections take the [revised mid-2016 population estimates](#) as their starting point. Data for the preceding five years are used, so trends are based on data from the years ending mid-2012 to mid-2016. The projections based on these trends are constrained to the totals used in the principal [2016-based national population projection](#) for England.

The projections model splits population between the armed forces and civilian population and treats them differently. The population of armed forces (including dependants of foreign armed forces) is treated as a "static population" 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 over the years ending mid-2017 to mid-2020.

The projections for each year are calculated by first removing this static population 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-2016 to mid-2017 change is applied to the mid-2016 base to produce the mid-2017 population projection.

Each component (except internal migration) is constrained to its respective total in the principal 2016-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 2016-based England national population projection for that year. This process is repeated for each year of the projection period. The following diagram illustrates the projection process (Figure 1).

Figure 1: Projection process
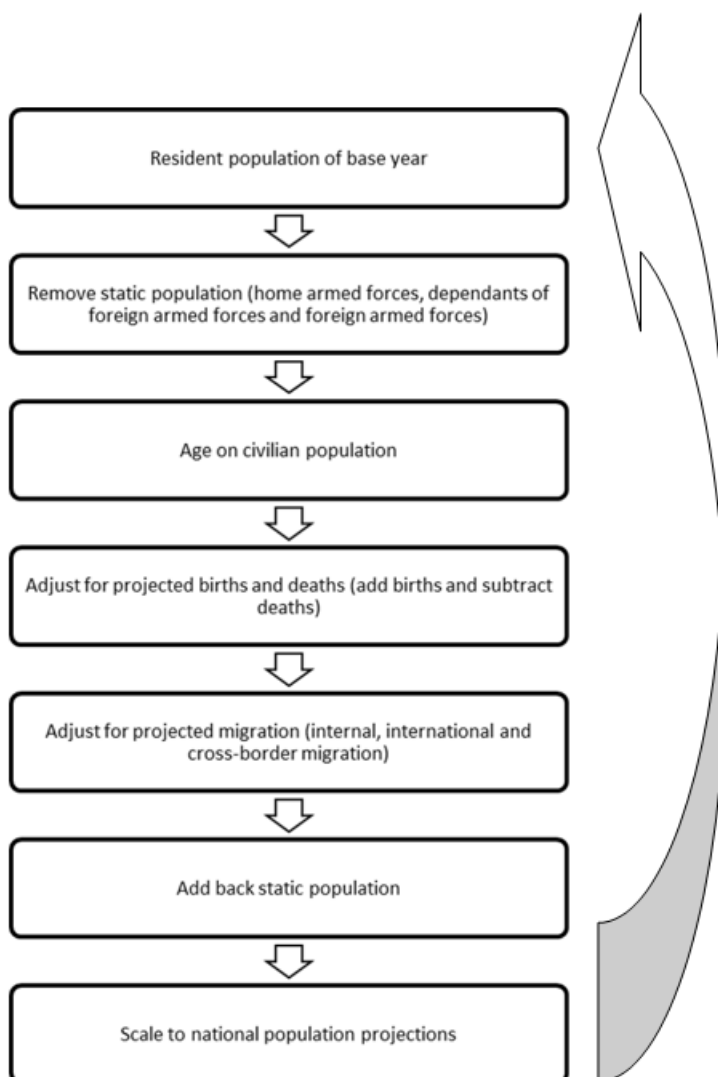
Source: Office for National Statistics

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 report.

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.

However, for the 2016-based projections there is a complication. As noted, the projections are based on the revised mid-2016 population estimates published in March 2018. However, revised mid-2016 LSOA and CCG estimates were not available at the time the projections were published, meaning the apportionment process is based on the (unrevised) mid-2016 Lower layer Super Output Area mid-year population estimates published in October 2017. This means that for some CCGs the mid-2016 values differ from the latest mid-2016 Clinical Commissioning Group mid-year population estimates, published in October 2018.

3 . Base population, static population and ageing on

The revised back series of population estimates covering the years mid-2012 to mid-2016, published on 22 March 2018, provides the starting point for the subnational population projections.

The revised mid-2016 population 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:

- civilian population

- armed forces (home, foreign and foreign armed forces dependants)

The civilian population refers to the usually resident population excluding home armed forces, foreign armed forces and foreign armed forces dependants. In previous projections foreign armed forces dependants were included in the civilian population.

For the 2016-based subnational population projections, dependants of US armed forces are treated as a static population. An adjustment is made for the US armed forces dependants aged under one 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, 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 foreign armed forces dependants 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, and in the final stage the resident armed forces, foreign armed forces and foreign armed forces dependants 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 2016-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 by local authority, age of mother and sex of child. The revised mid-2012 to mid-2016 population estimates are used to calculate fertility rates. The subnational projections assume a range of childbearing ages from 15 to 44; this means that, when calculating fertility rates, the small number of births to women aged under 15 or over 44 are classed as having occurred at age 15 or age 44 respectively.

Detailed methodology

Local authority-level ASFRs are calculated using the most recent five years' worth of trend data. For the 2016-based projections, these were the years ending mid-2012 to mid-2016.

1. 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.

2. 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.

3. 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.

4. 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 year ending mid-2018 are calculated by multiplying the national fertility rates for year ending mid-2018 by the differential derived from the years ending mid-2013 to mid-2017.

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-2012 to mid-2016. 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 (NPP) for England by dividing the NPP birth data by the aggregated local authority birth 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.

The following adjustments were made in the 2016-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 due 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 2016-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 revised mid-2012 to mid-2016 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 2016-based projections, these were years ending mid-2012 to mid-2016.

1. 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.

2. 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.

3. 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.

4. 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 year ending mid-2018 by the differential derived from the years ending mid-2013 to mid-2017.

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 (NPP) for England by dividing the NPP death data by the aggregated local authority death 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 2016-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 due 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 and Wales, Scotland and Northern Ireland, but in the subnational projections these are referred to as cross-border flows.

Internal migration estimates that we produce provide an origin-destination matrix which 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, five-year trend data are used to derive the average proportion of the population, for each age and sex, 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

Migration is recognised as the most difficult component of population change to estimate as there is no compulsory system within the UK to record movements of the population. At present we use a combination of three administrative data sources as a proxy for internal migration within England and Wales: The National Health Service Central Register (NHSCR), the Patient Register Data Service (PRDS) and Higher Education Statistics Agency (HESA) data. We use these data sources to calculate the internal migration component of the mid-year population estimates, which forms the basis upon which projected internal migration is calculated.

It should be noted, however, that the Central Health Register Inquiry System (CHRIS) was closed in February 2016 so, as a result, no complete NHSCR data are available beyond 2015. We subsequently determined that it was more optimal, for the internal migration estimates for year ending mid-2016, to re-apply the NHSCR data for the year ending (YE) mid-2015 rather than relying on partial 2016 data.

The internal migration estimates for the years ending mid-2012 to mid-2016 were used to calculate the trends in the 2016-based subnational population projections. The estimates are available in the revised mid-2012 to mid-2016 population estimates back series. However, the internal migration values did not change in the population estimates revisions.

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 five-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 2016-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

- 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, the origin-destination matrix is used. 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 A to B by the total number moving out of A using five years' 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 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 due to 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.

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 within 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.

Note that the internal migration data in the 2016-based projections pre-date the improved Higher Education Leavers Methodology introduced in the mid-2017 population estimates. More information is available in the latest Methodology guide for mid-2017 UK population estimates (England and Wales): June 2018 .

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 rest 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 and the Northern Ireland Statistics Research Agency. Further information is available in the internal migration estimates Methodology Guide for Mid-2017 UK Population Estimates (England and Wales), June 2018 .

Detailed methodology

To calculate cross-border moves, an average of five years' cross-border estimates data from years ending mid-2012 to mid-2016 is used to give an average number of moves, by age and sex, between each local authority in England and each of the other countries of the UK (Wales, Scotland and Northern Ireland). The approach of calculating separate cross-border flows for each country is new for the 2016-based subnational projections; previously flows to and from each country were combined into a single cross-border figure for each age and sex group for each local authority.

Since the 2014-based projections, 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. To reflect this, cross-border flows in the 2016-based subnational projections are constrained to the flows in the respective national population projections for each year. Previously the subnational projection flows were constrained to the national projection flows for six years for inflows and four years for outflows and then held constant.

International migration

The national projections international migration assumptions are made in terms of in and out flows of international migrants into 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 2016-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-2012 to mid-2016.

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 which uses the IPS and other data sources to create a more robust estimate of emigration at 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 projections. Details about this methodology and the resulting improvements are published in the Population statistics research update: February 2018.

The 2016-based subnational 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.

While the methodology used to project immigration remains unchanged for the 2016-based subnational projections, some of the source data used to project immigration were revised. Estimates of immigration for local authorities in the population estimates are created by distributing migration estimates directly from the national to local authority level using administrative data sources. Supply of more up-to-date administrative data and a change in processing environment meant that the immigration estimates changed for years ending mid-2015 and mid-2016. In general the impact was minimal but in some local authorities it changed the mid-2016 population by a few thousand. Further information is available in the documentation published in March 2018 to support the release of the revised back series of population estimates.

Detailed methodology

For immigration (international inflows) an average of five years' historic trend data from year ending mid-2012 to year ending mid-2016 has 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.

The method used for calculating emigration (international outflows) in the 2016-based subnational population projections has changed. Previously, the methodology for projecting emigration used a model that applied a complex weighting system to the emigration estimates for the last six years and used the New Migration Geographies, which are no longer used in the emigration estimates. The new methodology removes the New Migration Geographies from the process and projects emigration based on a simple five-year average of trend data. Within this process the assumption is that this average remains constant for the whole projection period. However, as with the other components, this outflow is constrained to the national population projections, by age and sex for each year. This means that, dependent on the national projected emigration, the local authority-level figures may be scaled up or down.

Some impacts of constraining to the national population projections

As already mentioned, constraining to the 2016-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. Five years' data are used to create the local trends in the subnational projections; however, the national 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 UK armed forces stationed in Germany are expected to move back to bases across the UK by 2020.

In the 2014-based subnational population projections, returning armed forces and their dependants were distributed to local authorities based on the distribution of international immigration to local areas, except for Wiltshire where we had clear evidence on the likely net effect of the return on the UK armed forces population in the area.

The 2016-based subnational population projections have used data from 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 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 2016-based subnational population projections the returned UK armed forces distribution will better match the expected reality. The UK armed forces will become part of the static population in each area, while their dependants will be 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 dependants are used to estimate outflows of asylum seekers leaving the UK after 12 months or more.

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 totals in the national population projections for two years.

For the 2016-based projections, a five-year average of asylum seeker data is calculated using the most recent five years' worth of data available, years ending mid-2012 to mid-2016. 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. This use of five years' worth of trend data is consistent with the methodology for other components and smooths out the potential impact of a single atypical year of asylum seeker data.

9 . People granted humanitarian protection

The 2016-based subnational population projections included, for the first-time, people from Syria granted humanitarian protection under the Vulnerable Persons Resettlement Scheme (VPRS). Those granted humanitarian protection are different from asylum seekers in that there is no main applicant or dependants, so humanitarian protection is granted individually. The national population projections contain around 10,000 people expected to be granted humanitarian protection in England between mid-2016 and mid-2020, so including them in the subnational population projections provides consistency with the national flows.

As this is a new flow that has only existed since 2015, the distribution to local authorities is based on the proportion, according to Home Office data, that were received in each local authority over the two years between mid-2015 and mid-2017.

10 . Other component

The main (principal) subnational population projections and each of the variants contain a 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 2016-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 2016-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. 2016-based national population projections data and supporting documentation are available.

The births, deaths and migration components of the projection are constrained to the corresponding England data (in the national population projections) for each projection year. However, the subnational 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 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 other countries of the UK are produced by Welsh Government, National Records of Scotland, and the Northern Ireland Statistics and Research Agency. More information is available in Subnational population projections across the UK: a comparison of data sources and methods.

13 . Variant subnational population projections

Three variant subnational population projections were published on 9 April 2019 for high international migration, low international migration and 10-year migration. The three variants were produced using broadly the same methods as the 2016-based subnational population projections main release, published in May 2018, 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 2016-based high migration variant national population projection for England. This has a higher long-term net migration total of 215,000 per year from year ending mid-2023 onwards, compared with 152,000 in the principal projection.

The higher net migration reflects higher immigration and lower emigration. From year ending mid-2023 onwards, this reflects a long-term annual increase of 7% in immigration and an 11% decrease in emigration for England as a whole. While these differences are also typical at local authority level, because of the complexity of the constraining process there is some variation. 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, internal and cross-border migrants.

As with the main (principal) subnational population projection, in the high international migration variant the disaggregation to local authority level is based on a five-year average (years ending mid-2012 to mid-2016) 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 2016-based low migration variant national population projection for England. This has a lower long-term net migration total of 90,000 per year from year ending mid-2023 onwards, compared with 152,000 in the principal projection.

The lower net migration reflects lower immigration and higher emigration. From year ending mid-2023 onwards, this reflects a long-term annual decrease of 7% in immigration and an 11% increase in emigration for England as a whole. While these differences are also typical at local authority level, because of the complexity of the constraining process there is some variation. 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, internal and cross-border migrants.

As with the main (principal) subnational population projection, in the low international migration variant the disaggregation to local authority level is based on a five-year average (years ending mid-2012 to mid-2016) 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) projection except that it uses a 10-year average (years ending mid-2007 to mid-2016) of internal migration, international migration, 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 2016-based national population projection for England. However, because it uses 10 years' worth of migration input data rather than five, the distribution of migration at local authority level is different.

14 . Annex A: Changes to subnational population projections methodology

Methodology changed

International migration, change first implemented 2010-based

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 are projected along with other international migration flows

International migration, change first implemented 2010-based

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 2012-based

Visitor switchers are no longer modelled separately 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 2012-based

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 (was 0.80 in 2010-based projections).

Cross-border migration, change first implemented 2014-based

National population projections cross-border migration assumptions are set as rates rather than numbers of migrants. Although subnational migration methodology is not directly changed, figures are constrained to national flows calculated on the new basis.

Emigration, change first implemented 2016-based

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 Migration Geographies 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 2016-based

Dependants of US 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 2016-based

The 2016-based subnational population projections use data from 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 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 2016-based

Cross-border migration is now calculated at individual country level using five years' worth of trend data. This means that, for example, cross-border flows between England and Scotland in the subnational projections are calculated, which are then constrained to the cross-border flows between England and Scotland in the national projections. Cross-border flows are constrained to the national projections for the entire projected period, for both inflows and outflows.

People granted humanitarian protection, change first implemented 2016-based

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 2016-based

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.