

Household projections in England QMI

Quality and methodology information report for household projections in England.

Contact:


Release date:
20 September 2018

Next release:
To be announced

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1 . Methodology background

National Statistic	
Survey name	Household Projections in England
Frequency	Every two years
How compiled	Census and SNPP data
Geographic coverage	England by local authority and region
Last revised	20 September 2018

2 . About this Quality and Methodology Information report

This quality and methodology report contains information on the quality characteristics of the data (including the five European Statistical System dimensions of quality) as well as the methods used to create it.

The information in this report will help you to:

- understand the strengths and limitations of the data
- learn about existing uses and user of the data
- reduce the risk of misusing data
- help you to decide suitable uses for the data
- understand the methods used to create the data

3 . Important points about the data

- Projections relate to the usually resident population and do not include people who come to or leave the country for less than 12 months.
- They are not forecasts and do not attempt to predict the impact of future political and economic changes, or local development policies.
- Since household projections are produced in the same way for all local authorities, they can be used as a common framework for informing local-level policy and planning; they should be seen as a starting point for calculating future housing needs.
- Users should be aware that projections become increasingly uncertain, as they go forward into the future, particularly for smaller geographical areas and detailed age and sex breakdowns.
- Trends in household projections are a result of trends in household formation between the census years, 2001 and 2011 and population change indicated by the subnational population projections.

4 . Quality summary

Overview

This is the first publication by Office for National Statistics (ONS) of household projections; previously, they were published by the Ministry of Housing, Communities and Local Government (MHCLG). Household projections show the number of households¹ there would be in England in the future if a set of assumptions about the size and structure of the population and that population's patterns of household formation were realised in practice.

Uses and users

Household projections have a number of uses, both direct and indirect, informing policy decisions at a national and local level.

Uses of the data include:

- the method proposed for the calculation of local housing need figures in the revised National Planning Policy Framework (NPPF)
- assessing potential need and demand for housing and associated services
- planning future service provision such as household waste and recycling, school places, adult and child social services and health and social care
- macroeconomic forecasting, central government policy simulation and planning

Strengths and limitations

Strengths

- These data provide users with valuable insight into the changing patterns of household formation in England.
- Household projections provide data produced using the same methods for all local authorities in England, so that data for one local authority are comparable with data for other local authorities, within a set of projections.
- The transfer of production of household projections to ONS further improves the consistency between the household projections and the subnational population projections (SNPPs) and allows us to make some efficiencies in their production.

Limitations

As with any set of projections, the household projections are subject to error if any of the components used to produce them – usual resident population, household population, or household representative rate – contain error. One of the main reasons why a component of the household projections might be subject to error is because the assumptions made in their production do not play out in practice.

The assumptions used in household projections are based on past demographic trends. However, demographic behaviour is inherently uncertain, so projections become increasingly uncertain the further they are carried forward. This is particularly the case for smaller geographical areas and detailed age, sex and household-type breakdowns. There are many reasons why past trends and other assumptions made in the household projections may not be realised in practice. Some of the main factors that can change these assumptions include:

- changes in population, migration, fertility and life expectancy
- changes in international and internal migration
- changes in the availability, affordability and desirability of communal establishment accommodation, compared with living in a private household (which can vary by area and life stage)
- changes in relationship and family formation and breakdown, for example, having children later in life, separation, divorce and remarriage
- changes in the availability and affordability of suitable housing (for example, housing of the right size and type in the right location that is affordable to those wanting to live in it)

Household projections are also limited by what data are available to inform detailed breakdowns of household population and households by age and sex of household reference person (HRP) at the local authority level. For example, the age distribution of the local authority prison population by sex is modelled using assumptions based on the prison population of England and Wales as a whole. In the future, we intend to carry out further research about how other data sources (particularly administrative data sources) might be used to improve household projections for England.

Recent improvements

As well as using new population projections, several changes to the methodology have resulted in revised projections. These changes are outlined in the [methodology used to produce household projections for England](#). The impact of these can be seen in [this article comparing past household projections with household estimates](#).

Notes about Quality summary

1. The household projections are based on the census [definition of a household](#), which in 2011 was: “one person living alone, or a group of people (not necessarily related) living at the same address who share cooking facilities and share a living room or sitting room or dining area.” This includes sheltered accommodation units in an establishment where 50% or more have their own kitchens (irrespective of whether there are other communal facilities) and all people living in caravans on any type of site that is their usual residence. This will include anyone who has no other usual residence elsewhere in the UK. A household must contain at least one person whose place of usual residence is at the address. A group of short-term residents living together is not classified as a household, and neither is a group of people at an address where only visitors are staying.

5 . Quality characteristics of the household projections data

This report provides a range of information that describes the quality of the data and identifies the issues that should be noted when using the output.

We have developed [Guidelines for measuring statistical quality](#) based upon the five European Statistical System (ESS) quality dimensions. This report addresses the quality dimensions and important quality characteristics, which are:

- relevance
- accuracy and reliability
- output quality
- coherence and comparability
- concepts and definitions
- geography
- accessibility and clarity
- timeliness and punctuality
- why you can trust our data

More information is provided about these quality dimensions in the following sections.

Relevance

A robust and objective methodology is employed to create household projections that are relevant for all types of users. The projections take no account of local development aims, policies on growth, capacity to accommodate population change, or economic factors that could impact the population in the future. As with the national and subnational population projections, they also do not try to predict any potential demographic consequences of future political or economic changes, including the UK's pending withdrawal from the European Union.

Household projections are currently produced up to 25 years ahead from the base year. This provides a sufficiently long time series to enable analysis and planning, but avoids going too far into the future when values become increasingly uncertain. They can be combined with household projections from previous base years to create a time series from 1971.

The advantage of using household projections for planning is that the time element is built in. For example, if an area is increasing or decreasing in population over time, then this will be accounted for. However, there is a limitation in that the household projections are demographic and trend-based, taking no account of the growth policies of an area. In addition, they do not predict changing demographic patterns over time – they simply provide an indication of household levels arising if the underlying assumptions are realised.

Local authorities use household projections as a starting point for local level planning and monitoring. Since the household projections do not consider local growth policies, local authorities are advised not to use household projections alone when producing their plans. The household projections are used in the calculation of local rates and measures, which provide indicators for future requirements of local services.

Part of the usual production of household projections involves consulting with users on the content published in the release, and on the methods used to produce the projections. This process helps us to better understand user requirements. We [consulted users](#) on proposed changes to the household projections in 2017. We also established a household projections collaborative group to provide advice and feedback on our research. The production of the 2016-based household projections was unusual as a number of changes were made to the methodology and source data (detailed in this [report](#)), following the transfer of household projections from the Ministry of Housing, Communities and Local Government (MHCLG) to Office for National Statistics (ONS). At the same time, a new production system was introduced.

The Population Statistics Division within ONS routinely considers what user needs are not being met by their published statistics. This is done using evidence from user engagement activities and contact with users. This process enables the division to understand unmet user needs and, if appropriate, consider the inclusion of new outputs in the divisional workplan.

Accuracy and reliability

(The degree of closeness between an estimate and the true value.)

The household projections use the latest available subnational population projections and are inevitably dependent on the accuracy of these data.

Subnational population projections are demographic, trend-based projections indicating likely size and age structure of the future population if the underlying trends and assumptions about future levels of components of change are realised. Subnational population projections are based on levels of births, deaths and migration observed over a five-year reference period leading up to the base year. However, projections are not forecasts and, because of the inherent uncertainty of demographic behaviour, any set of projections will inevitably differ from actual future outcomes to a greater or lesser extent.

As such, the household projections should be used as a starting point and supplemented with other information for planning purposes.

For further information on the accuracy of the subnational population estimates, refer to the [Quality and Methodology Information \(QMI\) article for subnational population projections](#). Household projections take no account of the following factors, which could lead to differences between the projections and actual change in the numbers of households:

- local development aims
- policies on growth
- capacity of a given area to accommodate population change
- changes in the stock of dwellings and communal establishments (for example, new builds, demolitions and changes of use)
- political or economic factors that could impact the population in the future
- future changes to the housing market, such as house prices or changes to the private or social renting sectors
- changes in marital status, income, economic activity or any other demographic factors of the population
- any international factors that may affect the UK population

Output quality

- For users to gain an understanding of the level of accuracy and coherence of the household projections, a [paper comparing current and past household projections](#) with household estimates and other sources is published.
- To illustrate the impact of revisions to the input data (subnational population projections (SNPPs) and mid-year population estimates (MYEs)) and changes in the methodology, sensitivity analysis is included in Section 8 of the [Methodology used to produce the 2016-based household projections for England](#) report.
- To illustrate the possible impact of alternative assumptions about future fertility, mortality and migration for England, variant analysis is included in Section 8 of the [Methodology used to produce the 2016-based household projections for England](#) report.

Coherence and comparability

(Coherence is the degree to which data that are derived from different sources or methods, but refer to the same topic, are similar. Comparability is the degree to which data can be compared over time and domain, for example, geographic level.)

Coherence

Household projections, household estimates and other sources of household and planning data are produced differently for different purposes; figures from different sources and methods should not be expected to match exactly.

Household projections may be generated by other organisations. However, these often use a different methodology from that used for the ONS household projections and, therefore, produce different results.

Important methodological differences include:

- different assumptions about the household population projections, for example, other organisations may have more detailed knowledge of the population that resides in communal establishments
- different assumptions about the future migration to and from a local authority
- different assumptions about future patterns of household formation

Comparability

There are several important differences between the household representative rates (HRRs) used in the 2016-based household projections and previous sets of household projections, produced by MHCLG. Firstly, the demographic groups used for calculating HRRs in the 2016-based household projections are based on geography, age group and sex and do not include marital status, which the previous projections did. Secondly, we use a different definition of HRP, which is discussed in the concepts and definitions section in this report.

There are two important consequences of this HRP definitional change. Firstly, it allows full information from the 2011 Census to be used in the methodology for calculating HRRs. Previous sets of household projections had only been able to use partial information from the 2011 Census, because complex adjustments¹ were required to enable 2011 Census data to align to the eldest male definition of HRP. By using the current definition, these adjustments to 2011 Census data are no longer required.

Secondly, the change of HRP definition means it is no longer possible to use the 1971, 1981 and 1991 Census data used in the previous methodology in the production of household projections. Household data from these Censuses used the eldest male definition of HRP, therefore to include data from them in the methodology would require making complex adjustments of a similar nature to the adjustments made to 2011 Census data in the previous methodology. Our investigations have found that existing tables from the 1991 Census are not available in the required age-sex breakdowns to produce HRRs and we have confirmed that it is no longer possible to commission bespoke tables from these censuses. We would, therefore, have limited information on which to base such adjustments.

The household projections are comparable with the previous projections produced by MHCLG, in that using the same input data (2014-based population projections), we are able to produce results illustrating the effects of methodological changes, as shown in the [methodology article](#) used to produce the household projections for England.

Concepts and definitions

(Concepts and definitions describe the legislation governing the output and a description of the classifications used in the output.)

The [overview of population and migration statistics](#) explains the concepts and definitions used in population projections.

Conceptual framework

A [conceptual framework](#) for population and migration statistics (including the population estimates) is available.

Average household size

The average household size is the average number of people within a household (including children). It is calculated by dividing the household population by the number of households for a given geography and/or age group.

Communal establishment (CE) population

The communal establishment population (also known as the institutional population) includes all people not living in private households. CEs provide managed residential accommodation, for example, nursing homes, student halls of residence, military barracks and prisons. The full definition of a CE can be found in the [2011 Census glossary](#).

Dependent child

Any person aged 0 to 15 years living in a household, or a person aged 16 to 18 years in full-time education and living in a family with their parent(s) or grandparent(s). It does not include any people aged 16 to 18 years who have a spouse, partner or child living in the household.

Household

The household projections are based on the census definition of a household, which in 2011 was: “one person living alone, or a group of people (not necessarily related) living at the same address who share cooking facilities and share a living room or sitting room or dining area.” This includes sheltered accommodation units in an establishment where 50% or more have their own kitchens (irrespective of whether there are other communal facilities) and all people living in caravans on any type of site that is their usual residence. This will include anyone who has no other usual residence elsewhere in the UK. A household must contain at least one person whose place of usual residence is at the address. A group of short-term residents living together is not classified as a household, and neither is a group of people at an address where only visitors are staying.

Household headship rate

In past sets of household projections, the household headship rate was the proportion of individuals in a specific group considered the head of household, defined by geography, age group, sex and household type. The formula differed from the household representative rate formula as it used the variable of household type, rather than relationship status.

Household population

The household population is the difference between the total usual resident population and the usual resident population living in communal establishments.

Household reference person (HRP)

The HRP is a person chosen for statistical reasons by virtue of economic activity, age and/or sex as the representative of a household. The 2016-based household projections define the HRP as the eldest economically active person in the household, then the eldest inactive person if there was no economically active person. Past sets of Stage 1 household projections defined the HRP as the eldest male within the household, then the eldest female if there was no male. The full explanation of the current HRP definition can be found on [page 23 of the 2011 Census Glossary](#).

Household representative rate (HRR)

The HRR is the proportion of people in a particular demographic group (for the 2016-based household projections this is based on geography, age group and sex) who were the HRP. The value of the HRR will be between zero and one.

Household type

Household types classify each household by the number of adults and dependent children living within it and the nature of those relationships.

Institutional population

The institutional population is another name for the communal establishment population, used more frequently in past sets of household projections.

Quinary age group

The five-year age groups used in the 2016-based household projections are:

- 16- to 19-year-olds
- 20- to 24-year-olds
- 25- to 29-year-olds
- 30- to 34-year-olds
- 35- to 39-year-olds
- 40- to 44-year-olds
- 45- to 49-year-olds
- 50- to 54-year-olds
- 55- to 59-year-olds
- 60- to 64-year-olds
- 65- to 69-year-olds
- 70- to 74-year-olds
- 75- to 79-year-olds
- 80- to 84-year-olds
- 85- to 89-year-olds
- those aged 90 years and over

Stage 1

Stage 1 household projections provide projected numbers of households by the age group and sex of the household reference person, for England, regions and local authorities.

Stage 2

Stage 2 household projections provide projected numbers of households by household type, for England, regions and local authorities.

Usually resident

The usual resident population includes people who reside, or intend to reside, in the country for at least 12 months, whatever their nationality.

Geography

Household estimates are produced by Office for National Statistics (ONS) for England, by local authority and region.

Accessibility and clarity

(Accessibility is the ease with which users are able to access the data, also reflecting the format in which the data are available and the availability of supporting information. Clarity refers to the quality and sufficiency of the release details, illustrations and accompanying advice.)

Household projections are available online and can be downloaded free of charge in Microsoft Excel and CSV format. Graphs, textual background information and supporting documents are provided as part of each release.

Any additional enquires regarding household projections can be made via email to pop.info@ons.gov.uk or by telephone on +44 (0)1329 444661. Additional data requests can be met where this is possible. Metadata describing the limitations of additional data are provided with individual requests. These requests are also published on the ONS website.

Our recommended format for accessible content is a combination of HTML webpages for narrative, charts and graphs, with data being provided in usable formats such as CSV and Excel. We also offer users the option to download the narrative in PDF format. In some instances, other software may be used, or may be available on request. For further information please refer to the contact details at the beginning of this report.

For information regarding conditions of access to data, please refer to the following:

- [Terms and conditions \(for data on the website\)](#)
- [Freedom of information](#)
- [Accessibility](#)

Timeliness and punctuality

(Timeliness refers to the lapse of time between publication and the period to which the data refer. Punctuality refers to the gap between planned and actual publication dates.)

Household projections follow the publication of subnational population projections (SNPPs), typically published in May, around two years after the base year. This timeframe occurs because the subnational population projections are based on input data that are not available until late in the year after the base year. The time between then and May is needed for the production and quality assurance of the projections.

Household projections are typically published a few months after the SNPPs. In the future, we would like to publish the household projections and SNPPs at a similar time. This has not been possible for the 2016-based household projections due to the methodological changes being applied following the transfer of the household projections from the Ministry of Housing, Communities and Local Government (MHCLG) to ONS.

This timetable ensures that the projections are available to two important customers, MHCLG and the Department of Health and Social Care (DHSC), for their use in resource allocation and planning.

In special circumstances, interim sets of population and household projections may be produced, using modified methods and the most recent data available. An example of this is the interim 2011-based subnational population projections and household projections, which were produced shortly after the 2011 Census results. This set of projections was published to satisfy a strong user requirement for projections that took on board the results of the 2011 Census, sooner than the normal publication timetable.

For more details on related releases, the [release calendar](#) provides 12 months' advance notice of release dates. In the unlikely event of a change to the pre-announced release schedule, public attention will be drawn to the change and the reasons for the change explained at the same time, as set out in the [Code of Practice for Statistics](#).

Notes about Quality characteristic of the household projections data

1. These adjustments are described on pages 4 to 5 and 13 to 16 of [Household Projections 2014-based: Methodological Report \(PDF, 781.7KB\)](#).

6 . Methods used to produce the household projections

Main data sources

This section provides a list of all the input data sources used in the production of the 2016-based household projections for England, for users wishing to carry out their own analysis or modelling.

To produce the household population, the following data sources are used:

- mid-2001 to mid-2017 population estimates by age and sex, [detailed time series](#)
- [2016-based subnational population projections](#) by age and sex
- 2001 Census data on [communal establishment \(CE\)](#) and [total usual resident](#) populations by age and sex
- 2011 Census data on [CE](#) and [total usual resident](#) populations by age and sex
- prison population data from [offender management statistics quarterly](#)

To produce base household representative rates (HRRs), the following data sources are used:

- 2001 Census data – household reference persons (HRPs) by age and sex; these data were obtained from 2001 Census commissioned table C1092_01 and this table is [listed as a 2001 Census commissioned table](#) and can be obtained free of charge from [Census Customer Services](#)
- 2001 Census data – [household](#) populations by age and sex
- 2011 Census data – [HRPs by age and sex](#)
- 2011 Census data – household populations by age and sex (the 2011 household population was derived by subtracting the [CE](#) population from the [total usual resident population](#))

Use of other data sources in the projection of HRRs

The 2014-based household projections used Labour Force Survey (LFS) data in the projection of HRRs, to adjust the 2011 Census data point to reflect the new HRP definition, to combine the two fitted trends used to project forward the five Census points of data, and to make further adjustments at the England level for 2002 to 2011 data.

We have decided not to incorporate the LFS or any other data sources into the projection of the HRRs for the 2016-based household projections, primarily, to reduce the complexity of the method. As we are no longer using the eldest male definition of HRP, we no longer need to use the LFS to adjust the 2011 Census data to refer to this definition. As we are using only two census points and a different projection model, we no longer need to use the LFS to combine the two fitted trends in the previous model. The assumption about projecting HRRs for 2011 to 2021 has been informed by analysis of HRRs from LFS data, although neither the LFS nor any other data sources have been incorporated into the model itself.

In the future, we intend to carry out further research about how other data sources (particularly administrative data sources) might be used to provide more recent trends for projecting HRRs.

How we process the household projections data

The methodology used to produce the projections is detailed in the [methodology article](#). A summary of that methodology is provided in this section.

As with [previous household projections](#), the methodology is split into two stages. Stage 1 produces projected total numbers of households by quinary age group and sex of the household reference person (HRP) ¹ over the projection period for England, regions and local authorities. The total number of households in each geographical area form the basis of the control totals for Stage 2 of the projection methodology, which gives the detailed household-type breakdown. We will update this report when the Stage 2 projections are published, so that it includes full details about both stages of the methodology.

Stage 1 begins by taking the latest sets of mid-year population estimates (MYEs) and subnational population projections (SNPPs), by quinary age group and sex, and applying an adjustment to remove those living in communal establishments (CEs) using census data. This adjustment uses the same assumptions as the existing methodology. It is also supplemented by administrative data about the prison population. This part of the method produces a projected household population by quinary age group and sex for the years 2001 to 2041.

Like the 2014-based methodology, the 2016-based household projections use household representative rates (HRR), multiplied by the projected household population, to produce projected numbers of households. The HRR is the proportion of people in a particular demographic group (based on geography, age group and sex) who were the HRP. The value of the HRR will be between zero and one. HRRs for 2001 and 2011 are calculated using census data. These HRRs are then projected forward to produce HRRs for the other years of the projection period and applied to the projected household population to produce a projected number of households for 2001 to 2021. From 2022 to 2041, HRRs are held constant at 2021 rates.

Household projections are produced separately for England, regions and local authorities. Projected numbers of households for the regions are then constrained to the England total, with figures for local authorities constrained to the relevant regional totals.

As well as projecting data for future years, household projections are also produced for past years, to provide a consistent time series². The 2014-based household projections used MYEs data for 1991 to 2014 and 2014-based SNPPs for the years 2015 to 2039³. However, MYEs for regions and local authorities for the years mid-2012 to mid-2016 have been revised since the publication of the 2014-based household projections. Therefore, the 2016-based household projections use MYEs data for 2001 to 2016, incorporating estimates from the revised MYE back series and 2016-based SNPPs for the years 2017 to 2041. The 2016-based household projections provide a shorter time series – 2001 to 2041, as opposed to 1991 to 2039 – because they are using a shorter time series of census data to produce HRRs ([see the methodology article](#)).

Links to the specific MYEs and SNPPs data used in the 2016-based household projections are provided in the [Main data sources section](#).

Quinary age band changes

MYEs and SNPPs by quinary age band and sex are used for England, regions and local authorities. The quinary age bands used in the 2016-based household projections differ slightly from those used in previous sets of projections. Nine respondents to the [consultation on proposed changes](#) to household projections said that the quinary age groups used in the 2014-based method were not appropriate for young adults, students and the elderly population, where they felt there was greater variation in how households were formed. Therefore, in the 2016-based household projections, the 15- to 19-year-old age group has been changed to 16- to 19-year-olds, to better reflect the age at which young adults can be household reference persons (HRPs). The 85 years and over age group has been expanded to two groups: those aged 85 to 89 years and those aged 90 years and over. This change acknowledges the ageing population and provides consistency with the age breakdowns used in the MYEs and SNPPs, which include breakdowns for those aged 85 to 89 years and those aged 90 years and over.

Communal establishment and household populations

Household projections are based on the household population rather than the total usual resident population. The difference between the two is the population living in communal establishments (CEs)⁴. CEs provide managed residential accommodation, for example, nursing homes, student halls of residence, military barracks and prisons.

Therefore, the first step in the methodology is to adjust the mid-year population estimates (MYEs) and subnational population projections (SNPPs) so that they only refer to usual residents living in private households. This adjustment is made by subtracting the population living in CEs from the MYEs and SNPPs. There are currently no sources that can provide consistent and reliable data about the size of the CE population by quinary age and sex for years between censuses. There are administrative data sources that provide information about parts of the CE population; for example, prison population data from the Ministry of Justice. In the future, we will be seeking to make greater use of administrative data in making assumptions about the size of the CE population.

As a result, the primary source used to make assumptions about the size of the CE population is census data. Estimates of the population living in CEs by quinary age group and sex were available from the 2001⁵ and 2011⁶ Censuses at England and local authority level. These estimates are different to those used to calculate the size of the CE population in the 2014-based household projections, as they do not include a marital status breakdown.

The assumption is made that the size of the CE population for the years 2001 to 2010 stays constant at 2001 levels by quinary age group and sex for those aged under 75 years and that the proportion of the CE population stays constant at the 2001 proportion by quinary age group and sex for those aged 75 years and over. The same assumptions are made for the years 2011 to 2041, but using 2011 Census data.

Prison population adjustments

In previous sets of household projections for England, one-off adjustments have been made to the prison population excluded from the household population for certain groups, using MYEs components of change, to better reflect the growth of the prison population (for example, for young males in the years 2002 to 2008 for the 2008-based household projections⁷). As a high proportion of change in the prison population is due to legislative change concerning custody, sentence lengths and prison openings and closures, rather than demographic patterns, it was considered impractical to build this into the model for projecting the prison population. However, we have been able to use data about the prison population from the Ministry of Justice to update the number of prisoners in the population for each year up until 2016.

Only prisoners serving sentences of six months or more are enumerated in the census and MYEs at the prison; those serving sentences of less than six months are enumerated at their household. Therefore, we needed to calculate data for the number of prisoners serving sentences of six months or more by age, sex and local authority in England, a detailed description of which is included in the [methodology article](#).

The difference between the 2011 prison population and the prison population of the year in question is added to the CE totals from the 2011 Census and this total amount removed from the SNPPs. The size of the prison population for years after 2016 is assumed to be the same as in mid-2016.

While these adjustments have a very small impact at the England level, they provide a more realistic picture of the CE population for local authorities where prisons have opened or closed between the 2011 Census and the base year of the household projections in 2016.

Prison population data are also used in the production of MYEs. A [Quality Assurance of Administrative Data report](#) has been produced about prison population data used in the MYEs and will be updated in due course to reflect the use of published prison population data from [Offender Management Statistics Quarterly](#) in household projections.

Household representative rates

The HRR is the proportion of people in a particular demographic group who were the household reference person (HRP). The value of the HRR will be between zero and one.

The change of HRP definition means it is no longer possible to use the 1971, 1981 and 1991 Census data used in the previous methodology in the production of the 2016-based household projections. Household data from these censuses used the eldest male definition of HRP, therefore to include data from them in the methodology would require making complex adjustments of a similar nature to the adjustments made to 2011 Census data in the previous methodology. Our investigations have found that existing tables from the 1991 Census are not available in the required age-sex breakdowns to produce HRRs and we have confirmed that it is no longer possible to commission bespoke tables from these censuses.

As a result of these findings, base HRRs for the 2016-based household projections are calculated using 2001 and 2011 Census data. For each age group, sex, area and year (2001 or 2011), the number of HRPs is divided by the household population (those who could be a HRP), to produce the HRR. It should be noted that the household population used is taken from the relevant census, as opposed to the mid-year population estimate (MYE) for 2001 or 2011. This is to account for the difference in reference date of the censuses and MYEs⁸.

The base HRRs calculated using 2001 and 2011 Census data are then smoothed across age groups for males and females using a three-point moving average. This smoothing was carried out to reduce the impact of an apparent cohort effect that was identified in 2001 Census data and produces a more plausible set of HRRs and projected households when figures are broken down by age and sex of HRP.

Demonstrations of smoothing and further information are included in the [methodology article](#).

Projecting base HRRs forward

Once smoothed, the base HRRs for 2001 and 2011 are projected forward to produce HRRs for the other years of the projection period.

In the 2014-based household projections, the base HRRs (for 1971 to 2011) were projected forward using a combination of two fitted trends, the results of which were combined using assumptions based on Labour Force Survey (LFS) data⁹. Because of the changes to how base HRRs are calculated, we have also changed the methodology used for projecting forward HRRs.

The 2016-based household projections use a two-point exponential model¹⁰ to project forward HRR calculated using 2001 and 2011 Census data for each demographic group. The formula for projecting forward base HRRs is as follows:

$$y_i = k + ab^{x_i}$$

Where:

- i is the year, from 2001 to 2041
- y_i is the headship rate in year i
- c is the most recent census year (2011)
- d is the furthest away census year (2001)
- k is 1 if $y_c = y_d$ and k is 0 if $y_c < y_d$
- a is y_d minus k
- b is $(y_c - k) / (y_d - k)$
- x_i is $(i - d) / (c - d)$

The values of c and d are constants; that is, for each year of the projection period, c will equal 2011 and d will equal 2001.

HRRs calculated using 2001 and 2011 Census data for each demographic group are projected forward using this formula through to 2021. From 2022 to 2041, HRRs by age, sex and geography are held constant at 2021 rates. Given that we are using a 10-year trend in HRRs for projection, limiting the use of this projected trend to a maximum of 10 years into the future mitigates the risks of projecting forward a potentially more uncertain trend for the entire projection period.

Numbers of households and geographical constraining

Although the HRRs for the 2016-based Stage 1 household projections have not been geographically constrained, we have retained an element of geographical constraining in the methodology overall. Once projected numbers of households have been calculated for England, regions and local authorities (by multiplying the household population by the HRR for each age, sex and local authority group), the regional numbers of households are constrained to the England total and local authority-level numbers of households are constrained to the regional totals. This constraining takes place on the assumption that England- and regional-level projections will be less subject to variation due to smaller populations than household projections for local authorities. This approach also provides consistency across geographies.

Stage 2 household projections

Timing

The Stage 2 household projections will be published on 3 December 2018. We will update this report when the Stage 2 projections are published, so that it includes full details about both stages of the methodology. In the future, we intend to publish both stages of the household projections on the same day. This has not been possible for the 2016-based household projections due to the methodological changes being applied following the transfer of the household projections from the Ministry of Housing, Communities and Local Government (MHCLG) to Office for National Statistics (ONS).

Methodology

The detailed method used to project household-type breakdowns is dependent on the household types that are finalised for the Stage 2 data. Whatever method is used, projected household-type breakdowns from Stage 2 will be constrained to overall totals from Stage 1 to provide consistent figures.

Additionally, adjustments will be applied to projected household-type breakdowns from Stage 2 to ensure that the total number of adults and dependent children implied by the projected household-type breakdowns for each geographical area and year are not greater than the total number of adults and dependent children in the household population of that geographical area and year.

How we analyse the data

Sensitivity analysis

To help users, we have carried out sensitivity analysis to help distinguish the effects of the changes made to the 2016-based household projections methodology from the effects of the move from using 2014-based subnational population projections (SNPPs) to 2016-based SNPPs. Two tests were carried out.

In test one, the 2014-based SNPPs and unrevised mid-year population estimates (MYEs) were input through the 2016-based household projections methods, instead of the 2016-based SNPPs and revised MYEs.

In test two, the 2014-based Stage 2 age-only household headship rates were applied to the 2016-based SNPPs to isolate the effects of the methodological changes to the household formation rates on the resulting projection.

The details of these analyses are shown in the [methodology article](#).

Variant household projections

Variant national population projections (NPPs) are based on alternative assumptions about future fertility, mortality and migration for England. These illustrate what the population of England would look like if one or more assumptions are varied and provide an indication of uncertainty. Variant NPPs are produced for England and can be input into the household projections system to produce household projection variants alongside the principal household projection. Applying the communal establishment assumptions and household representative rates from the household projections to the variant NPPs gives a broad indication of the sensitivity of the household projections to demographic assumptions at national level. Five variant projections have been run:

- low life expectancy
- high fertility
- high migration
- low migration
- zero migration

The details of these analyses are shown in the [methodology article](#).

How we quality assure the data

Rigorous quality assurance is carried out at all stages of production. Specific procedures include:

- scrutinising input data to investigate the accuracy of any abnormal values
- scrutinising trends in the total population, household population and household representative rates projected over time for plausibility
- comparing current household projections with previous household projections and household estimates, to see where large changes are taking place and understand the reasons for these
- examining sex ratios to find any areas of imbalance
- comparison between local authorities, to check for outliers
- checking output tables to ensure that there are no errors or inaccuracies during the creation of published tables

How we disseminate the data

Household projections are available online, by local authority and region for 2001 to 2041 (for the 2016-based methodology). Previous sets of household projections for England are available on the [MHCLG website](#).

Links from the [release calendar](#) make the release date and location of each new set of household projections clear. Household projections can be downloaded free of charge in Microsoft Excel format. A statistical bulletin accompanies each publication. The underlying data for the charts and tables in the bulletin can be downloaded. Supporting documentation is also available on the [household projections webpage](#).

Other data not published on the web are available on request by emailing pop.info@ons.gov.uk. Metadata describing the limitations of the data for more detailed tables are provided with each individual request. Most queries can be answered from the website datasets or supporting methods documents. Any additional enquires regarding the household projections can be made by emailing pop.info@ons.gov.uk.

How we review the data

Future revisions to the household projections may be required to reflect occasional or post-census revisions to the subnational population projections. This is in line with the [ONS revision policy for population statistics](#).

Notes about Methods used to produce the household projections

1. In the 2016-based household projections, the household reference person (HRP) is the eldest economically active person in the household.
2. [Household Projections for England, comparing with other sources, 2001 to 2018](#) provides an analysis of how household projections for past years compare with household estimates and other sources of household and planning data.
3. It should be noted that the base year of the SNPPs and the MYEs for that year are the same. For example, the mid-2016 population estimates and the population projections for 2016 from the 2016-based SNPPs are the same.
4. Previous household projections documentation sometimes referred to the communal establishment population as the “institutional” population – this report uses the term communal establishment (CE) throughout, for consistency.
5. For more information, see 2001 Census [table CS001, age by sex and resident type](#).
6. For more information, see 2011 Census [table CT0731, sex by age – local authorities in England](#).
7. See pages 28 to 32, DCLG (2010) [Updating DCLG's household projections to a 2008 base: methodology](#).
8. The reference date for the 2001 Census is 29 April. The reference date for the 2011 Census is 27 March. The reference date for the mid-year population estimates (MYEs) is 30 June.
9. These issues are described in section 2f (pages 16 to 17) of the [Household Projections 2014-based: Methodological Report](#).
10. This model is also used by National Records of Scotland in the production of [Household Projections for Scotland \(2016-based\)](#) – see page 62.

7 . Other information

Useful links

[Subnational population projections for England](#) are available. Supporting documentation includes a [methodology document](#) and a [quality and methodology information article](#).

[2016-based subnational population projections: frequently asked questions](#) provides answers to questions on the 2016-based subnational population projections.

[Household projections for England: comparisons with other sources](#) provides analysis comparing household projections with household estimates and other sources of households and planning data.

[Methodology used to produce the 2016-based household projections for England](#) provides a detailed explanation of how household projections for England are produced.

Previous releases of [household projections](#) can be found on the Ministry for Housing, Communities and Local Government (MHCLG) website. In January 2017, the responsibility for household projections was transferred to Office for National Statistics (ONS). Queries on these projections should be directed via email to pop.info@ons.gov.uk.