



Department for
Communities and
Local Government

Household Projections 2012-based: Methodological Report



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1. Introduction

The 2012-based projections have been updated to include the ONS 2012-based sub-national population projections published on 28th May 2014 and further information from the Census 2011 where available.

As with the previous projections, the methodology is split into two stages: Stage One produces summary household numbers based on long-term demographic trends and Stage Two gives a more detailed breakdown of household type. The Release on 27th February 2015 presents results from Stage One only. Stage Two outputs will follow as soon as possible. Further work will investigate including more detailed analysis of Census 2011 data on household formation. In the meantime, the projections provide the most up to date and nationally consistent estimates.

The 2012-based projections include the following additional information compared to the 2011-based household projections:

- 2012-based sub-national population projections by sex and age that extend to 2037 (rather than 2021 as was the case for the 2011-based interim projections).
- Household population by sex, age and relationship status consistent with the Census 2011 (rather than estimates for 2011 derived from Census 2001 data, projections and national trends used in the 2011-interim projections).
- Communal population by age and gender consistent with the Census 2011 (rather than previous estimates calibrated to the total communal population from the 2011 Census).
- Further information on household representatives from the Census 2011 relating to aggregate household representative rates by relationship status and age where possible.
- Aggregate household representative rates at local authority level are controlled to the rate based on the total number of households divided by the total adult

household population (rather than the total number of households divided to the total household population).

- Adjustments to the projections of the household representative rates in 2012 based on the LFS.

The methodology for the 2012-based household projections was based upon the 2011-based interim and 2008-based household projections. The household projections are compiled using a two stage process. Stage One produces the national and local projections for the total number of households by age group and relationship status group over the projection period. The total number of households in each local area form the basis of the control totals for Stage Two of the projection methodology which gives the detailed household type breakdown by age.

The Stage one household representative projections use a combination of two fitted trends through the available Census points (1971, 1981, 1991, 2001 and 2011). However, as with the 2011-interim household projections, only partial information is available from the published Census 2011 data to derive household representative rates for 2011.

The Census 2011 uses a different definition of the household representative compared with the historic estimates of household formation used in the Stage One household projections methodology (Household Projections System, known as HOPS). This means that much of the published information on household representatives is not directly comparable with the HOPS derived estimates as the inconsistency produces different results by age, sex and status. The approach therefore was to use as much information as possible from the published Census 2011 data.

For Stage One household representative rates for 2011 have been derived at England level using the aggregate household representative rates by marital status from the 2011 Census, household population by age, sex and marital status from the Census 2011, data on household representative rates by age profile from the LFS and previous household projections. This enables the 2011 Census point to be added to the estimation process for Stage One. At local authority level, the household projections

have been controlled to both the national projections and the aggregate household representative rate from the 2011 Census for each local authority. This approach means that the households projections are consistent with the available information on aggregate household representatives from the Census 2011.

Data has been commissioned from the Census 2011 to be able to fully update the household projections model, however this (partial) data was only available at a late stage in the update process and after initial analysis, differences in the data for some demographic groups were larger than anticipated. Therefore in order to publish in a timelier manner the commissioned data has not been used in this release, but is planned to be in a secondary publication later in the year after further interrogation. This document goes into further detail of the household projections methodology, highlighting where and how changes have been made to the 2012-based projections. The Stage Two methodology will be included in this document when the Stage Two projections are published.

2. Stage One

The methodology for the 2012-based projections follows that used for the 2011-based and 2008-based projections. The 2011-based projections included some changes that were required to incorporate valuable information from the Census 2011. Since then further information from the Census 2011 has become available and has been incorporated into the 2012-based projections where possible – building on the approach used for the 2011-based projections. As noted in the introduction however, the full data needed to update the Stage One household representative rates in 2011 has not been incorporated in the February 2015 release.

The household projections are compiled using a two stage process. Stage One produces the national and local projections for the total number of households by age group and marital status group over the projection period. The total number of households in each local area form the basis of the control totals for Stage Two of the projection methodology which gives the detailed household type breakdown by age.

Stage One applies projected household membership rates to a projection of the private household population disaggregated by age, sex and marital status and summing the resulting projections of household representatives. The method uses a simplified three-way relationship categorisation to represent marital/cohabitational status. The categories are people in couples (including married couples who are living together and cohabiting couples); separated marrieds, divorced and widowed not in couples; and people not in couples (not cohabiting, never married). This is an aggregation of the detailed categories in the previous DCLG (Household Projections System, known as HOPS) model which captures the key household formation characteristics of the relationship status groups while retaining relative simplicity.

As in the 2011-based projections, the projection methodology for Stage One from the 2008-household projections has been maintained but adapted. The 2012-based projections includes information from the 2011 Census which together with data from the LFS has been used to update the estimates for the 2011 point that are then used in the household projections methodology at national level. The updated national projections are

then used to control a set of projections for regions and local authorities that have been derived by applying projections of the household representative rates by sex, age and status to the 2012-based household population by sex, age and status. The regional and local authority projection is then controlled to the 2011 Census aggregate household representative rate.

The projections methodology uses time-series modelling which weights together simple and dampened logistics trends. Cohort modelling is not used. The simplified time-series based projections are referred to as the Stage One projections to distinguish them from the detailed projections by household type described in Stage Two.

There are six key components to the household projections produced in Stage One each of which is given in detail below:

1. Population projections
2. Marital status composition
3. Institutional population
4. Household representative rates
5. LFS adjustments
5. Regional and local household projections

a. Population estimates and projections

Revised population estimates¹ for local authorities in England for mid-2002 to mid-2010 were published by ONS in May 2013 following the 2011 Census. The revised series provides a consistent time-series of population estimates to mid-2010 for each local authority in England. Mid-2011 (2011 Census-based)² population estimates for each local authority in England were published in September 2012. These mid-year estimates have been included in the derivation of the household estimates for 2002 to 2011. The household estimates are produced as part of the 2012-based household projections. National and subnational populations are taken from the most recent population projections published by ONS on 29th May 2014. For the 2012-based household

¹ <http://www.ons.gov.uk/ons/rel/pop-estimate/population-estimates-for-england-and-wales/mid-2002-to-mid-2010-revised--subnational-/index.html>

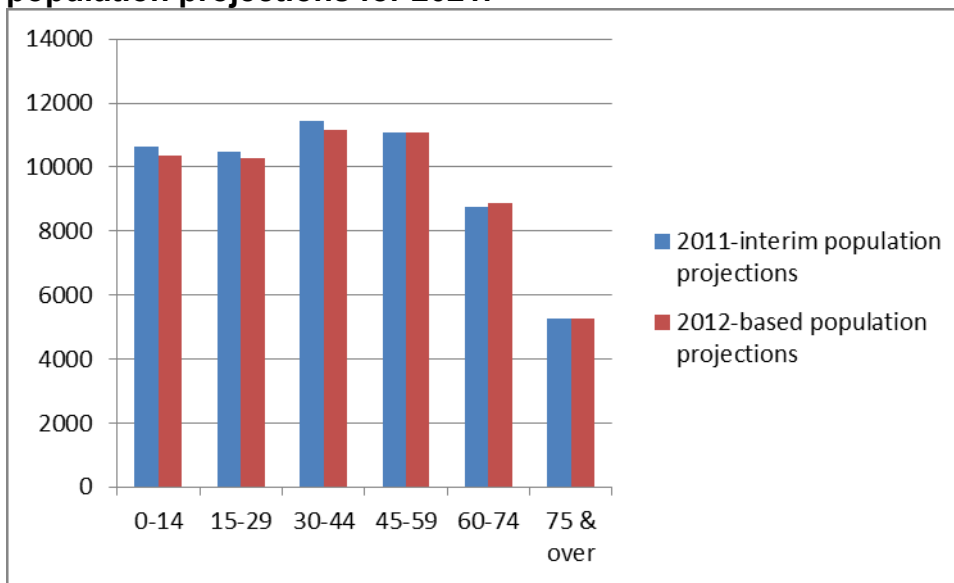
² <http://www.ons.gov.uk/ons/rel/pop-estimate/population-estimates-for-england-and-wales/mid-2011--2011-census-based-/index.html>

projections, the 2012-based³ population projections are used by sex and five-year age band at both national and subnational levels.

The population projections are trend-based, making assumptions about future levels of fertility, mortality and migration based on levels observed over a five-year reference period. Therefore, they give an indication of what the future population, by age and sex structure, might be if recent trends continue, and take no account of policy or development aims in local authorities. The projections take as their starting point the 2012 mid-year population estimates released on 26 June 2013 and assume that recent trends continue. To model recent trends, data for the six preceding years are used, so in the case of the 2012-based projections, trends are based on data from the years 2007 to 2012. The projections are produced for 25 years, for each local authority by age and sex. The population of the UK is projected to grow at a slower rate in the 2012-based projections than the 2011-based projections. The slower projected growth is due to the change in the assumptions made for the 2012-based projections, with the assumptions for migration being lower and those for fertility being higher in the long term, but lower in the short term than the 2011-based projections. Figure 1 shows that by 2021, the 2012-based projections show fewer people in most age bands with the exception of 45-59 year olds and 75 and over where the population level is comparable.

³ <http://www.ons.gov.uk/ons/rel/snpp/sub-national-population-projections/2012-based-projections/index.html>

Figure 1: Comparison of 2012-based population projections and 2011-based population projections for 2021.



Source: ONS

b. Marital Status Composition

The Census 2011 provided data on the structure of the household population by 5 year age band, sex and relationship status which have been included in the household projections methodology by controlling the estimates to the 2011 mid-year population estimates.

The 2008-based population projections by marital status for England & Wales were published on the 24 June 2010 by the ONS and incorporated into the household population projections for the 2012-based household projections. ONS have not produced updated marital status projections since. While the 2012-based household projections were being calculated the ONS were running a consultation on the future of the marital status projections. Since more recent marital status projections are unavailable, the existing 2008-based marital status projections have therefore been controlled to the 2012-based population projections by age and sex across all geographic levels.

The marital status projections cover both legal marital status and (opposite-sex) cohabitation for the period to 2033. As the household formation behaviour of married and unmarried cohabiting couples is similar and distinct from the characteristics of other marital

status groups, cohabiting as well as married couple households need to be identified. This means that the following marital status types are initially identified:

Single	-	not cohabiting
Married	-	not cohabiting
		(other than with spouse, i.e. either living with spouse or living alone)
Widowed	-	not cohabiting
Divorced	-	not cohabiting
Single	-	cohabiting
Married	-	cohabiting (not with spouse)

Widowed - cohabiting

Divorced - cohabiting

The marital status projections are at national level only. Population estimates of resident population by single year of age, sex and legal marital status which ONS has updated to include marriages abroad are also included at the national level from 2002 to 2010. No official cohabiting population estimates which are consistent with the revised marital status estimates were available for this period. We have therefore produced estimates for the cohabiting population by marital status between 2002 and 2010 using trends in cohabitation shares of total marital status population as found in the marital status projections. Estimates of marital status in future years at subnational level are made by applying national/local differentials in marital status from the Census to projected marital status factors.

Population estimates from the eight marital status / relationship categories are aggregated to three broader groups. This has the advantages of presenting a smaller and hence simpler set of groupings to aid user understanding and to minimise the potential impacts of errors in the projection data sets but which still captures the key features of household formation behaviour:

1. People who are part of a mixed-sex couple. This includes both married couples (where they live together) and cohabiting couples. This does not include people in same-sex couples;
2. Male and female separated, divorced or widowed (once married) people⁴;
3. Male and female single people who have never been married, and are not cohabiting (single as in not in a couple or separated, divorced or widowed; not necessarily a one-person household⁵);

c. Institutional Population

The household projections are based on the projected household population rather than the total population. The difference between the two is the population in communal establishments, also termed the 'institutional' population. This population comprises all people not living in private households. These include people living in nursing homes, halls of residence, military barracks and prisons.

Estimates of the institutional population by age and sex were available from the 2011 Census at England and local authority level. However the household projections methodology requires that estimates of institutional population are split by age, sex *and* relationship status. The relationship status of the communal population in 2011 is therefore estimated from the previous household projections.

For the household projections, the assumption is made that the institutional population stays constant at 2011 levels by age, sex and marital status for the under 75s and that the share of the institutional population stays at 2011 levels by age, sex and relationship status for the over 75s. The rationale here is that ageing population will lead to greater level of population aged over 75 in residential care homes that would not be picked up if levels were held fixed but holding the ratio fixed will.

⁴ Does not include previously cohabiting (not married) people who are now separated

⁵ This group, for example, will include single (never married) lone parents and people living in other multi-person households. It will also include those who previously cohabited although never married.

The institutional population is subtracted from the total resident population projections by age, sex and marital status to leave the private household population, analysed by sex, age and marital status status in the years required for household projections.

d. Household Representative Rates

The number of households is essentially the household population multiplied by the appropriate household representative rate. The household representative rate is the probability of anyone in a particular demographic group being classified as being a household representative and can take any value between 0 and 1.

A household representative is a person chosen for statistical reasons by virtue of age and/or sex as the representative of a household. The total number of projected households is equal to the sum of households represented by all age, sex and marital/relationship status types.

Note that the eldest male is taken as the household representative in the Stage One methodology. This is to preserve consistency with earlier Censuses.

The household representative rates can be represented algebraically for any year as:

$$HH_{total} = \sum_{a=0-4}^{85+} \sum_{s=m}^f \sum_{r=c}^s HRR_{a,s,r} \cdot HP_{a,s,r}$$

Where:	HH	is the number of households
	HRR	is the household representative rate
	HP	is the household population
	<i>a</i>	are age groups (0-4....85+)
	<i>s</i>	is male or female
	<i>r</i>	is marital/relationship status

e. Incorporating the Census 2011

The 2012-based projections used data from the 1971, 1981, 1991 and 2001 Censuses and partial information from the 2011 Census to project household representative rates by demographic group. Published data from the Census 2011 uses a different definition of the household representative than used in the household projections model. The Census 2001 and Census 2011 both identify household reference persons (HRP) based primarily on economic activity, whilst the household representatives in the household projections model is a person chosen for statistical reasons by virtue of age and/or sex as the representative of a household. By convention this is the oldest male on the Census form.

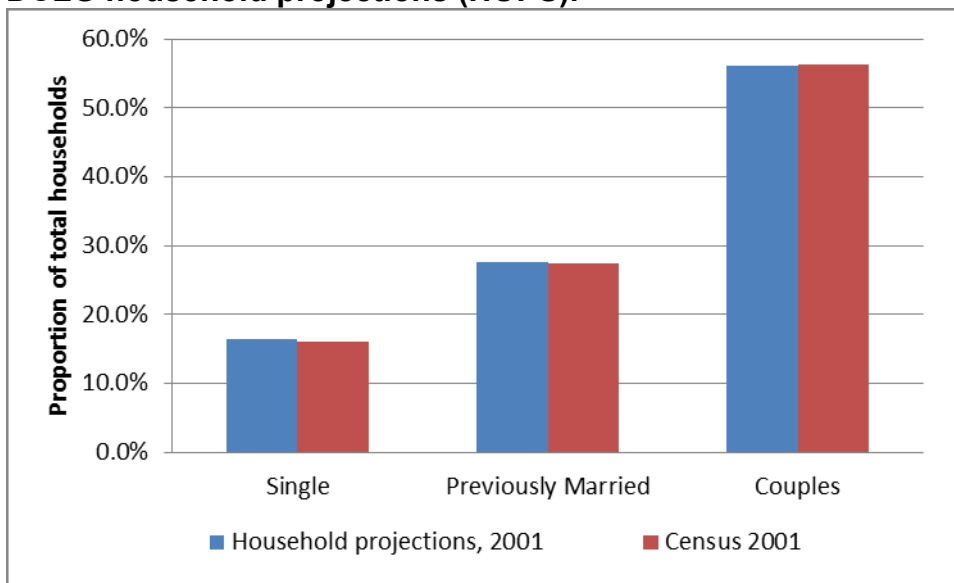
To produce household representative rates for 2011 by demographic group consistent with the previous Censuses requires detailed non-standard data from the Census. This data was commissioned by DCLG with the aim of producing a full set of household representative rates by sex, age and relationship status and included in the Stage One projection methodology. However a sub-set of the commissioned data was only available at the end of January 2015. Initial work to incorporate the commissioned Census 2011 data into the projections raised a number of issues with the underlying data that need to be investigated further and as a result were not used in this update. The data suggested significant departures in trend for some demographic groups and it is not currently understood whether these are genuine trends or if the algorithm used to produce the commissioned Census data has been applied in a consistent way since similar data was commissioned from the 2001 Census.

The approach therefore was to use as much information from the existing published Census 2011 data as possible at the England level. Further details on this approach are set out below.

The Census 2011 showed that the aggregate household representative rate (total households/ total adult population) was lower than the value suggested by the 2008-based projections. However no published information was available from the Census 2011 to split this aggregate figure across age, sex and relationship status that was consistent with the data in the household projections model.

Analysis of the 2001 Census against the HOPS data for 2001 showed that the proportion of households represented across the three broad relationship status groups were comparable at the national level (Figure 2) but when these are further disaggregated by age/ and or gender then the data is inconsistent for couples and those previously married. It was therefore decided that in lieu of more detailed commissioned Census 2011 data, the household representative rates in 2011 could also be aligned to the aggregate status types from the Census 2011 and the rates by age and gender for singles.

Figure 2: Proportion of total households by relationship status, Census 2001 and DCLG household projections (HOPS).



Source: DCLG, ONS

Data for household representative persons was taken from the 2011 Census to infer how the changes in the representative rates for each relationship status changed between 2001 and 2011. Information was also taken from the Census 2011 data regarding the age profile of singles (since the definition of this category is broadly consistent with the HOPS definition). Further guidance on how this data was used is detailed below.

Aside from the (broad) age profile of singles, the published Census 2011 data cannot be used to derive the age profile of the household representatives in 2011. As a result (and consistent with the 2011 interim projections) LFS data has been used to inform the age profile of household representatives in 2011. Analysis of the LFS suggests that there have been some steep falls in household representative rates for some age groups since the 2001 Census and the 2011 Census results – although not split by age – reinforce the trends observed in the LFS. It was therefore decided to use changes in the household representative rates by age-band from the LFS to estimate the changes that have occurred between the 2001 and 2011 Census. The LFS uses the same definition of household representatives as the household projections model.

Unweighted LFS data was used and processed as follows:

1. The quarterly LFS household representative rate data by age (but not) sex are seasonally adjusted

2. The seasonally adjusted data are smoothed using a Henderson 9-point moving average
3. The smoothed quarterly LFS data are converted to annual series and are further smoothed using another Henderson 9-point moving average
4. The smoothed LFS household representative rates are spliced onto the 2001 Census data points.

The 2011 LFS based household representative rates by age were then applied to the household population by age to produce an initial estimate of households by age band. The total was then controlled to the 2011 Census aggregate household representative rate and the final 2011 household representative rates by age were then calculated. Household representative rates by age, sex and relationship status for 2011 were estimated using the following data:

- Census 2001-2011 change in household proportions by relationship status
- Census 2011, household population by age, gender and relationship status
- Census 2011, household representative rates for singles by sex and broad age band
- 2008-based household representative rate projections by age, gender and relationship status
- 2012-based household population projections by age, gender and relationship status

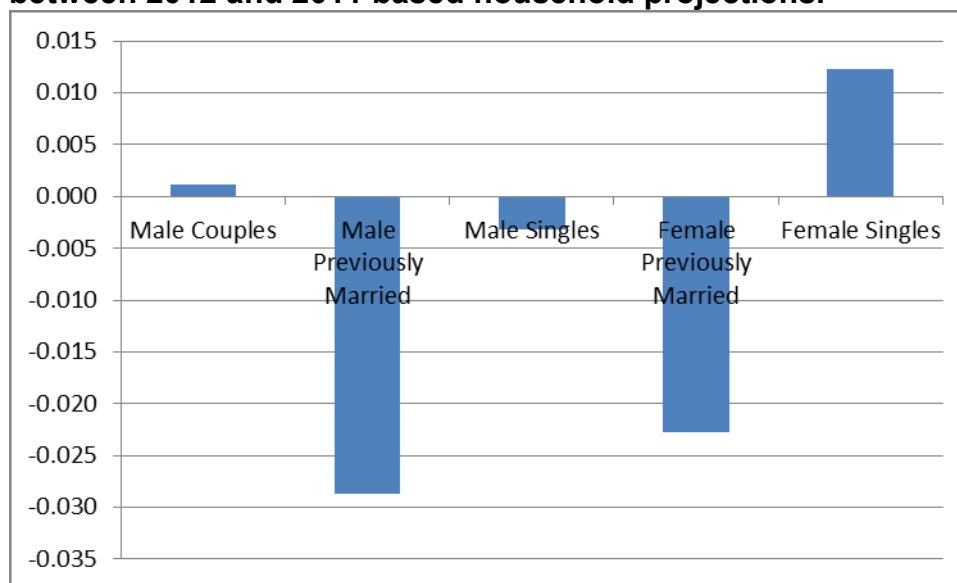
An iterative process was used to ensure that the estimated household representative rates meet the following criteria:

- Must take a value between 0 and 1.
- Consistent with the aggregate household representative rate from the Census 2011
- Consistent with the aggregate household representative rates by age derived from the LFS
- Consistent with the derived aggregate household representative rate by relationship status from the Census 2001.
- Consistent with the aggregate representative by broad age and sex for singles.

Incorporating additional information from the Census 2011 (including households and household population by sex, age and relationship status) results in changes to the estimates of the 2011 household representative rates by sex and relationship status as shown in Figure 3. Whilst the representative rates are consistent with the 2011-based household rates by age band at the aggregate level, the process for constructing the 2011

estimates in the 2012-based rates leads to differences in the representative rates by age by relationship status. The differences in household representative rates for 2011 between the 2011-based and 2012-based projections are shown in figures 6 and 7 at the back of this document.

Figure 3: Comparison of 2011 representative rates by relationship status and gender between 2012 and 2011 based household projections.



Source: DCLG

The largest impact on the household representative rates by relationship status is for the previously married categories for both sexes. Male couples rates are slightly lower in 2011 than previously estimated, whilst male couple rates are slightly higher. The estimated rates for single females experience the greatest upward revision compared with the 2011-based household representative rates.

To produce the household projections between 2002 and 2010, the household population estimates have been applied to a linear interpolation of the household representative rates by sex, age and status between 2001 and 2011. In contrast, for the 2008 households projections, the Labour Force Survey (LFS) was used to adjust the household representative rates by age-band at the national level between 2002 and 2009. After 2009 the projections reverted to pre-LFS adjustment trends and the post-2009 projections were not affected directly by the LFS adjustments between 2002 and 2009. The LFS data was also weighted, with a greater weight given to data further away from the 2001 Census point.

In the 2012-based projections, the LFS has been used to adjust the projection post-2011. Further detail on how this was done is presented in part e of this section.

f. Projecting household representative rates

The procedure followed to project the household representative rates at the national level is consistent with the 2011-interim projections, with 5 observations to project forward but there are remain issues that some of the Census points (particularly the 1991 Census) look to be quite strange.

The projections of the household representative rates use a combination of two fitted trends:

1. A simple logistics trend - a straight line fitted to $\ln(X_t / (1-X_t))$
2. A dampened logistics trends where an S-shaped curve is fitted to $\ln(X_t / (1-X_t))$

These functions were developed as part of the development for the Stage One [methodological review](#) to fit through the Census points as some of the trends are linear whilst others have a curve.

As with previous vintages of the projections, it is still not clear which of these is the most appropriate. The dampened trend provides a better fit for the Census data. But consideration has to be given to the extent to which data errors may have affected measured past trends and also to the fact that the data for 2011 by demographic type are estimates based on the trends by age from the LFS as well as some data from the 2011 Census. Further detail on concerns with some of the previous Census points (particularly 1991) is provided in the 2008-based methodology document.

Given the uncertainty, the alternative projections are weighted together using the following weights:

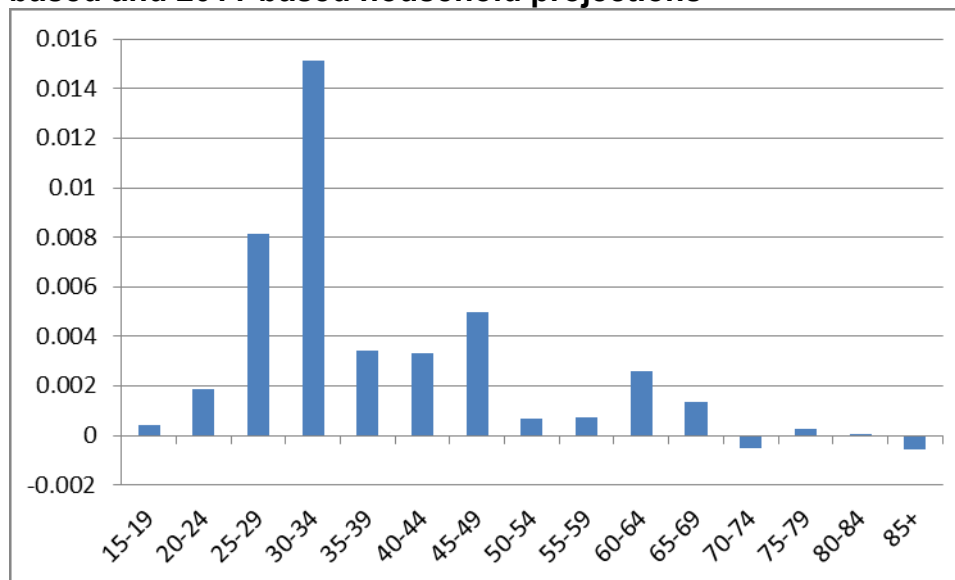
<i>15 to 29 year olds:</i>	80:20 weights for dampened / simple trend
<i>30 year olds and over:</i>	60:40 for dampened/ simple trend

The reason for the differential weights is that Labour Force Survey (LFS) data indicate declining aggregate household representative rates for the younger age groups and, consequently, there is evidence that it is more appropriate to give a bigger weight to the dampened trend in these cases.

The 2012-based household representative rates are higher than the 2011-based representative rates by 2021 across almost all age groups, with the exception of 70-74 year olds and the 85 and over age group (Figure 4). This is a result of the changes to the

estimates of the representative rates in 2011 by age, sex and relationship status, which impacts on the long-term trends. The largest changes to the household representative rates are for 25-29 and 30-34 year old age groups.

Figure 4: Difference in the representative rates by age band in 2021 between 2012-based and 2011-based household projections



Source: DCLG

g. LFS Adjustments

The LFS is a sample survey and as such subject to a margin of error but the data are far more up-to-date than the Census and some allowance for recent movements in the LFS are considered necessary. The LFS data has been incorporated into the England level projections for the 2012 period. The LFS data is seasonally adjusted and smoother as presented in the previous section. The smoothed LFS household representative rates are spliced onto the 2011 census data points.

Adjustments are then made to all age and relationship status groups so that they move towards the smoothed LFS value with:

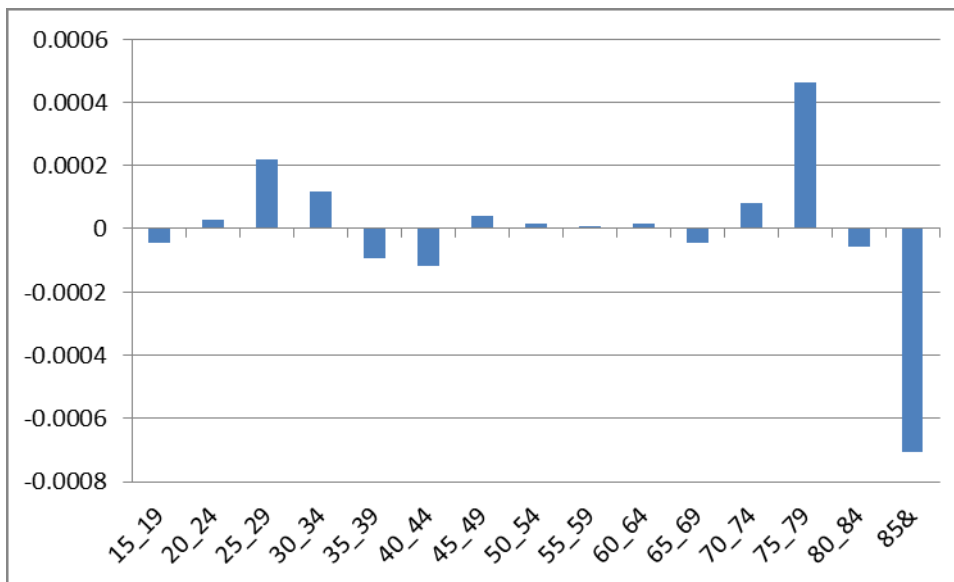
- The maximum weight of 50% to reflect uncertainty over accuracy and
- the LFS weight is linked to the time since the last census (the longer the time elapsed since the last census, the less time there is for household representative rates to get back on to trend).

For example in the 2012-based projections, the LFS data receives a 5% weight derived as the maximum weight (50%) multiplied by the time in years elapsed since the 2011 census divided by the maximum years between censuses (1/10). After 2012, the projections revert

to the pre-LFS adjustment trends, reflecting the importance of retaining a view of long term trends. The post-2012 projections are not affected directly by the 2012 LFS adjustments.

The revisions, shown in Figure 5, are extremely small but the largest changes were to the household representative rates for males and females aged 75 to 79 and 85+.

Figure 5: Impact of the LFS adjustment on household representative rates by age in 2012



Source: DCLG

The overall impact is extremely small and increased the projected number of households in 2037 by 1,000 or 0.004 per cent compared to what would have been produced using the unadjusted household representative rates.

h. Regional and local projections

The Stage One household projections model uses a top-down approach with projections first produced at England level, then regional level and then finally local authority district level.

Household representative rates by age, sex and status from the Census 2011 consistent with the definitions used in the household projections model were used for any geographic level. At the England level the process imposed the change in household representative rate by age in the LFS between 2002 and 2011 on to the 2011 Census point and incorporated other information from the Census 2011 as outlined above.

At the regional and local level the LFS data does not provide estimates which are considered robust enough to use the same approach as used at the national level. In

consultation with the Steering Group when producing the 2011-based projections it was decided to control the 2008-based regional household representative rates to both the England 2011-based projections and to the Census 2011 aggregate household representative rate for each area. The same process was then repeated for the local authority areas, controlling the local household representative rates to the regional household representative rates and the Census 2011 aggregate household representative rate. The same approach has been used for the 2012-based projections, however the national, regional and local rates have been controlled to the aggregate Census 2011 household representative rates based on the adult household population. The 2011-based projections controlled to the total aggregate household representative rate (total household representatives/ total household population).

The process was to apply the regional 2008-based household rate to the regional 2012-based household population projection (and household population estimates between 2002 and 2011) by age, gender and marital status to produce a first cut set of Stage One household estimates and projections. The regional totals by age, gender and marital status were then controlled to the England totals by age, gender and marital status and the aggregate household representative rate by region from the 2011 Census to produce a final set of Stage One household projections by region. The process was then repeated at local authority level.

The regional and local controlling procedure adjusts the household projections so that there is consistency across spatial levels and in the age/ sex/ marital/relationship status composition of the population as given in the ONS resident population projections. Priority has been given to ensure internal consistency within a given area before consistency across demographic type at regional and national level. The controlling process ensured that the data is consistent across local authority level and demographic types to England totals by demographic type to within a tolerance of 0.01%.

3. Sensitivity testing

For previous household projections, variant household projections have been run alongside the main projection. These variant projections used the Office for National Statistics variant national population projections which demonstrated the effect of assumptions regarding fertility, life expectancy and net migration on future levels of population. Applying the household formation rates from the household projections to the variant population projections gave a broad indication of the sensitivity of the household projections to demographic assumptions at national level. Variant projections have not yet been produced for the 2012-based household projections but will be available in future releases.

To help users, sensitivity tests have been performed by applying the 2012-based assumption of household formation to the 2011-based household population projections, which were used for the 2011-based interim household projections. A further sensitivity test has been performed by applying the 2011-based assumptions of household formation to the 2012-based household population projections. These sensitivity tests were run at local authority level to help users understand the impact of the changes to the population projections and the changes in household formation on the household projections. The results of the sensitivity tests for local authorities are available in live tables 429a and 429b.

Table 1: Sensitivity analysis results and 2012-based and 2011-based household projections

		2012	2021	Total Change (000s)	Average Change (000s)	Percentage Change
2012-based Household Projections	Households (000s)	22,305	24,290	1,985	221	8.9%
	Household Population (000s)	52,536	55,945	3,409	379	6.5%
	Average Household Size	2.36	2.30			
2012-based Household Projections using 2011-based population	Households (000s)	22,384	24,558	2,174	242	9.7%
	Household Population (000s)	52,655	56,690	4,035	448	7.7%
	Average Household Size	2.35	2.31			
2012-based population and 2011-based household formation	Households (000s)	22,265	24,063	1,798	200	8.1%
	Household Population (000s)	52,536	55,945	3,409	379	6.5%
	Average Household Size	2.36	2.33			
2011-based interim Household Projections	Households (000s)	22,323	24,307	1,984	220	8.9%
	Household Population (000s)	52,626	56,660	4,034	448	7.7%
	Average Household Size	2.36	2.33			

4. Uncertainty in the projections

As with any set of projections, the household projections are subject to error if any of the components – household population, relationship status or household representative rate – are wrong.

At the present time the results from the Census 2011 show that the 2008-based projections were overestimating the rate of household formation and support the evidence from the Labour Force Survey that household representative rates for some (particularly younger) age groups have fallen markedly since the 2001 Census. However for this update, it has not been possible to include detailed data on Stage One household representative from the Census 2011. By imposing the change in household representative rates by age from the LFS onto the aggregate Census points in 2011 we are assuming that the aggregate trends observed in the LFS by age are correct. It is possible that the full results from the Census 2011 will reveal that the trends by age group were different to those observed in the LFS but at this stage it is not possible to quantify the differences. The changes in household representative rates between 2001 and 2011 have an impact on the projections of household representative rates, so if the decline in the household rate for a given age band has not been as great as suggested by the LFS then the projected growth rate would have been stronger than originally projected and vice versa.

The 2012-based household projections use the 2008-based marital status projections which have not been updated with the results from the 2011 Census. It is not clear at this stage whether updated marital status projections will be available in the future. The trends in marital status impact the projections of future household formation. However the scale of this impact has not been quantified as part of this update. The Stage One projections are designed to capture long-term trends in household formation and projections of these long-term trends are used to control the Stage Two projections by age and type. The projections for Stage Two do not depend on relationship status so the key factor here is to understand the sensitivity of the Stage One household projections to changes in relationship status.

There could also be cohort effects that are ignored by the current methodology. Recent falls in household representative rates for younger age groups may carry forward through a cohort process into older age groups in future years. It is unlikely that analysis of the commissioned tables from the 2011 Census will identify whether such cohort effects are occurring at the present time. However it may be important to fully consider and explore the impact on future household numbers if falling household representative rates for the younger age groups continue as these younger age groups move into older age groups through time. If there is evidence in the future from the Census 2011 and the LFS of cohort effects then it would be necessary to consider whether introducing cohort effects into the model would improve the household projections – especially given the additional complexity and data requirements that this approach would entail.

5. Properties of the System

- The household representative rate method used to produce the projections has a number of basic characteristics that tend to shape the projections:
- All other things being equal, the higher the adult population the higher the number of households. Similarly, higher adult population growth means higher household number growth;
- For a given population, the number of households will be determined by the age, sex and marital status composition of the population;
- Household representative rates tend to be higher the higher the age band (figure 6 and figure 7);
- Because of the convention that the male is the household representative in couple households the household representative rates for males will be close to one for older age groups and zero for females.
- Singles' (never married) household representative rates tend to be below previously married rates for both genders and all age groups. The male and female under 30's singles household representative rates tend to be lower than the others and reflect a higher degree of living at home and sharing.
- Household representative rates for those aged between 40-44 to 65-69 tend to trend upwards over time though the scope of household representative rates that are already close to one is obviously more limited than those that are low.
- Household representative rates for younger age groups (35-39 and below) tend to be flat over time.
- Household representative rates for older groups (70 and over) tend to show very gradual decline.
- Socio-demographic events can have a marked impact on the number of households given the size of the population. These include the increase in marriage and divorce rates and the ageing of the population both of which will tend to increase household numbers relative to population.

Figure 6: Male Household Representative Rates in England (2011), 2012-based and 2011-based household projections

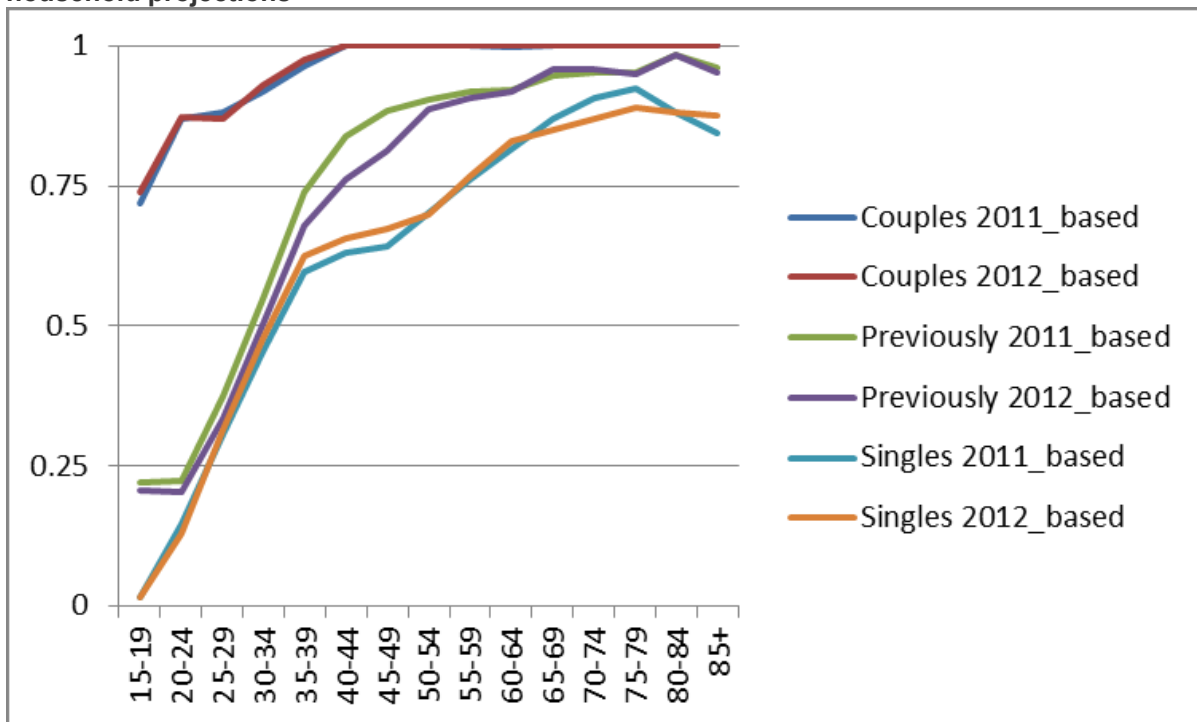
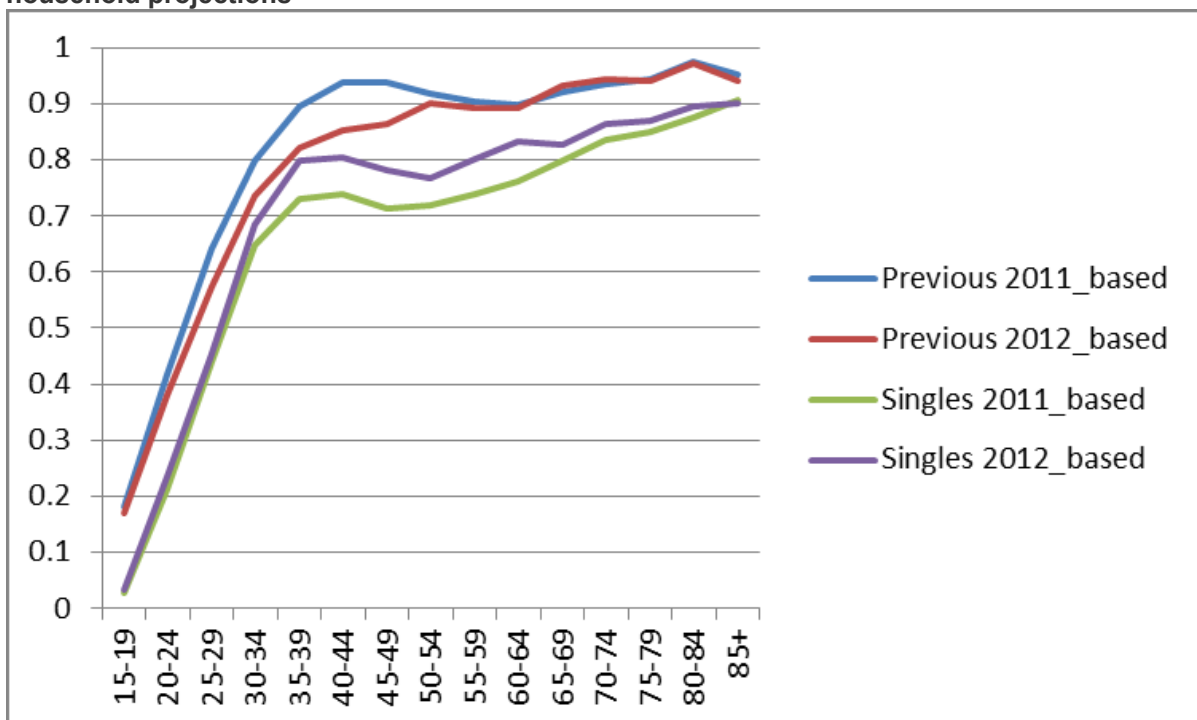


Figure 7: Female Household Representative Rates in England (2011), 2012-based and 2011-based household projections



6. Glossary

Average Household Size – The average household size is the average number of people within a private 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 Population – The communal population (also known as the institutional population) includes all people not living in private households; such as medical establishments (for example hospital, sheltered housing, and care homes), educational establishments (schools and university), military, religious and detention facilities, and those living in temporary accommodation.

Dependent Child – A dependent child is a person in a household aged 15 and below or aged between 16-18, single, still in full-time education and living with parent(s)/guardian(s).

Headship Rate – The proportion of individuals in a specific group considered the head of household. The variables defining each group are; geography, age group, sex and household type. The formula differs from the household representative rate as it uses the variable of household type, rather than relationship status.

Household – The definition of a household in the 2011 Census 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 was a change from the 2001 Census to take into account social changes and modern living arrangements. Previously the 2001 definition was:

‘one person living alone or a group of people (not necessarily related) living at the same address with common housekeeping – that is, sharing either a living room or sitting room or at least one meal a day’.

This change was not considered significant enough to realign the data to the old definition.

Household Formation Rate – This is the same as the headship rate and household representative rate.

Household Population – The household population is the total population after the communal population has been removed.

Household Reference Person – The Household Reference Person (previously known as Head of Household or Household Representative) is the individual that is taken to represent the household for statistical purposes. The definition of the household reference person has changed over time from being the eldest male within a household to the eldest economically active person within a household.

Stage One household projections have historically used the eldest male definition.

Stage Two household projections use the current Census definition of eldest economically active person in the household as the household reference person.

More detail is provided in the article [Defining a Household Representative Person](#) by Jean Martin.

Household Representative Rate – The household representative rate is the probability of a person from a specific demographic group (based on geography, age group sex and relationship status) being considered the household reference person. The value of the household representative rate will be between 0 and 1. The formula differs from the headship rate as it uses the variable of relationship status, rather than household type.

Household Type – The Household Type (also known as the Household Composition) classifies each household by the number of adults and children living within it and the nature of those relationships. It is divided into five categories, of which there are 17 sub-categories, depending on the number of dependent children within a household.

Living Arrangements – The living arrangements variable in the 2011 Census is divided into two categories and seven sub-categories. These are initially divided on the whether the household representative person is living in a couple in the household, before subdividing into further marital status definitions. These were considered consistent with previous household projections, which categorised the Stage On demographic groups into; single, married (or co-habiting) and previously married.

Other Households – This is a household type within Stage Two of the household projections. This category is of multi-person households and will contain the majority of adults living in house shares.

Total Population – The total population is all usually resident population in the UK based upon their local authority residence, whatever their nationality.