



Subnational Population Projections Accuracy Report

August 2015

1. Executive Summary

This report assesses the accuracy of the Subnational Population Projections (SNPPs) that are produced by the Office for National Statistics (ONS) for local authorities in England. The projected population for 2011 from several sets of projections are compared with the Mid-year Population Estimates for 2011. The impacts of rebasing and revisions that occurred following the 2011 Census and methodological improvements that have taken place since are also considered.

In this report, accuracy is measured based on the difference between the population estimates and the population projections; the term “error” will be used to denote this difference. It is difficult to determine what is causing the differences in these comparisons due to the many changes that have occurred during the last decade: to the published population estimates; the population estimates and projection methodologies; and, to demographic trends. However, with this in mind, the report shows:

- the level of error in the projections increases the further ahead they are made from the base year
- the level of error is lower at higher levels of geography
- the local authorities with the largest error between the projections and estimates were also local authorities whose population estimates changed the most following the 2011 Census

2. Summary of Methodology

2.1 Subnational Population Projections

Population projections are produced every two years and project the population 25 years ahead. The Subnational Population Projections (SNPPs) are produced for geographies below the national level (e.g. region and local authority). ONS produces subnational projections for areas in England only. It provides an indication of the possible size and structure of the future population based on the continuation of recent demographic trends (births, deaths and migration). They are produced on a consistent basis for all local authorities and use the cohort component method which is a standard demographic method; high quality data sources are used to inform the components of population change. More information on how they are produced can be found in Annex A-1.

It is also important to emphasise that these projections are not forecasts and do not attempt to predict the impact that future government or local policies, changing economic circumstances or other factors might have on demographic behaviours.

2.2 Mid-Year Population Estimates

The Mid-year Population Estimates (MYEs) are produced every year and provide an estimate of the resident population of England and Wales as at 30 June each year. They are also produced using the cohort component method and are produced on a consistent basis across all local authorities. MYEs also take into account the census which takes place every 10 years. More information on how they are produced can be found in Annex A-2.

3. Overview of accuracy

3.1 How accuracy is assessed

This report updates a [previous accuracy report](#) on the SNPPs which was published in 2008. The accuracy of the projections is assessed by comparing the projected population for 2011 from several sets of SNPPs with the MYEs for 2011; the difference between these is termed as the “error”.

The mid-2011 population estimates are considered to be the best set of population estimates as they are based nearest to the 2011 Census. Estimates are updated every year with recent components of change data (births, deaths and migration).

It is noted that there are many factors which may cause a difference between the population projections and estimates. Firstly, there are differences in the methodology of the two comparators. Projections are produced using past changes and trends to the population components which are then extrapolated into the future. In contrast, MYEs use changes to the population components observed in the previous year. Secondly, the MYEs are subject to revisions, following either a census or methodological improvements. This means that the MYEs used as the base year in the projections may be different to the published MYEs used in the comparisons. There are also a number of other factors which may cause a difference between the population projections and estimates and these are outlined in Section 3.2.

Although these factors make it difficult to determine exactly what is causing the differences between the population projections and estimates, the report provides users with greater understanding of the potential for projections to differ from subsequent reality.

3.2 Issues when measuring accuracy

During the last decade, there have been a number of factors that may have affected the accuracy of the population projections between the two censuses in 2001 and 2011 including:

- methodological changes to MYEs and to the SNPPs
- revisions to the MYEs and its components
- changes in the underlying demographic trends

Methodological improvements during the decade

There have been a series of research programmes which aimed to investigate methodological improvements to migration and population statistics, these included: the [Local Authority Population Studies](#), the [Improving Migration and Population Statistics \(IMPS\) project](#), and the [Migration Statistics Improvement Programme \(MSIP\)](#). These have resulted in a number of methodological changes occurring during the decade and as a consequence of these changes, the population estimates and, in one instance, the SNPPs were revised.

Further details and a timeline outlining these improvements to the methodology and the subsequent revisions can be found in Annex B-1.

Revisions following the 2011 Census

As well as methodological changes, changes to the population estimates occurred following the 2011 Census. The MYEs for 2002 to 2010 were rebased in order to be in line with the 2011 Census results. This means that the population projections produced prior to the 2011 Census are based on MYEs that are different to the MYEs they are being compared to. More information on how the population estimates were revised can be found in the Annex B-2.

Changes in fertility and mortality rates during the decade

The fertility and mortality rates used in the projections have also changed during the decade. Between 2002 and 2008, total fertility rates increased in the UK and have appeared to have stabilised more recently. Mortality rates used in the 2012-based national projections were assumed to be improving with the annual rate of improvement projected to settle at 1.2 per cent after 2037. More information can be found in Annex B-3.

Changes in the movement of international migrants to the UK

Patterns of international migration have changed in the past two decades with the earliest major change in the movement of international migrants occurring in 1998 when net migration to the UK exceeded 100,000 for the first time.

The pattern of international migration to the UK once again changed in 2004 as the European Union (EU) expanded with the accession of the EU10 countries: the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia together with Malta and Cyprus. The rise in the level of EU migration, particularly EU8¹ migrants, was not reflected in the migration data used for the 2004-based and 2006-based SNPPs and as a result, the population was underprojected.

3.3 Approach to analysis

In this report, the projected population for mid-2011 from the 2004-based, 2006-based, 2008-based and 2010-based SNPPs have been compared to the published MYEs for 2011; the differences between these are used as an indicator of accuracy and these are expressed as the MYE minus the projections. An “overprojection” is where the projection is higher than the subsequent population estimate and an “underprojection” is where the projection is lower than the subsequent population estimate.

Similar to the [previous report](#), we will use the root mean square error (RMSE) to summarise the differences at different levels of geography. The RMSE (also known as the root mean square deviation) is a frequently used measure of the differences between values predicted by a model or an estimator and the values actually observed from the thing being modelled or estimated. It is a means to aggregate individual differences into a single measure of predictive power.

¹ EU8 refers to the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia.

Issues to consider

There are a number of issues to consider when interpreting the comparisons in this report. As discussed in Section 3.2, there have been a number of methodological changes which can be attributed to the differences in population projections and estimates for any given year.

Additionally, the issue of Unattributable Population Change (UPC) may also have an impact on these comparisons. This is the difference between the rolled-forward population estimates and the Census-based population estimates for 2011, once allowances were made for methodology changes and error during the decade. To produce the revised series of population estimates for the last decade, the UPC was apportioned across each of the 10 years using the cohort method. More information on UPC can be found in Annex B-4.

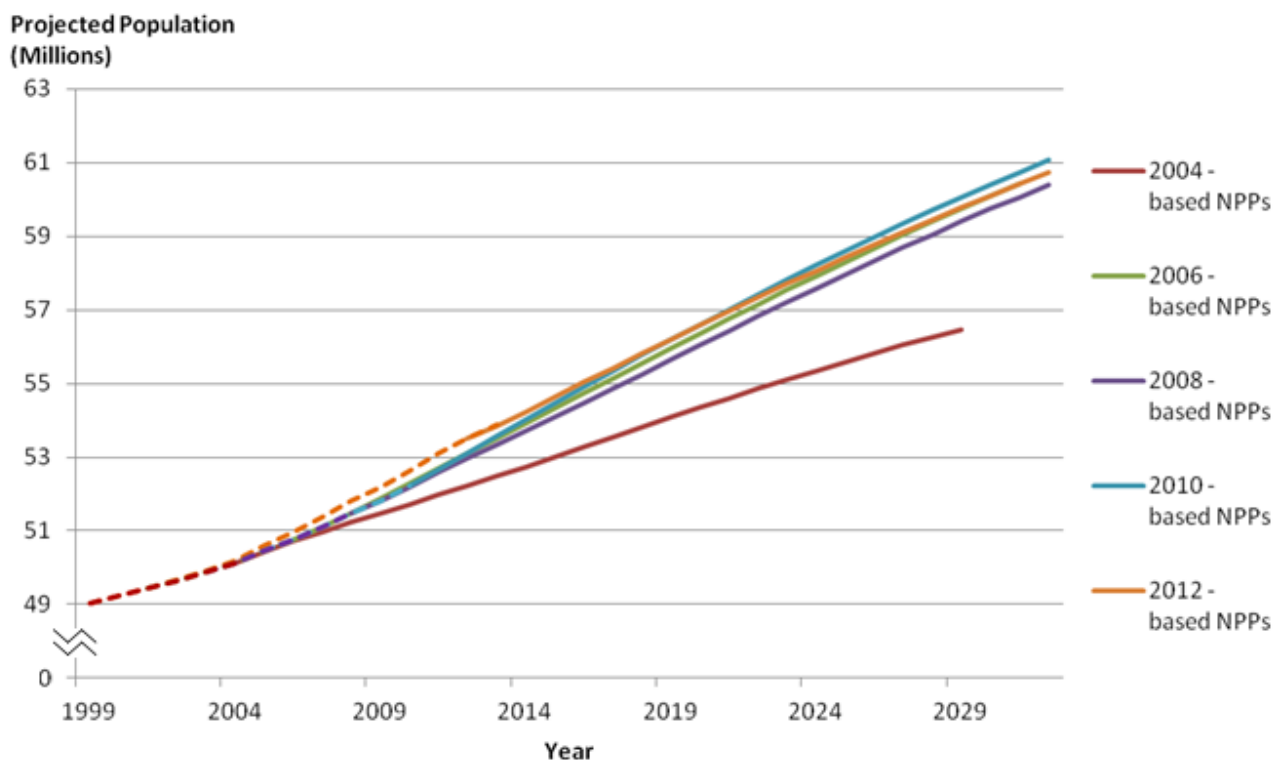
The analysis is further complicated by geography changes that have occurred during the decade which have made some comparisons with the population estimates for 2011 difficult. More information on geography changes can be found in Annex B-5.

4. Data analysis

4.1 Historic Population Projections for England

Both the National Population Projections (NPPs) and the SNPPs are produced every two years. As each new set of projections is produced, both the base year and the trend data will change and in some cases, and methodological improvements will be incorporated. Figure 1 shows the NPPs for England over 25 years from five different sets of projections and illustrates how the projected population changes as each new set is produced.

Figure 1. Population Projections for England, 2004-2037



Note: the solid lines represent projected figures

It shows that the 2004-based projections projected the slowest increase in the population because the increases in international migrants after the EU accession in 2004 were not reflected in the trend data used for that projection run.

4.2 Comparison of population projections for England with 2010 and 2011 population estimates

For the next part of this analysis, the 2010 and 2011 MYEs for England (Table 1) have been compared with the population projections for England; Tables 2 and 3 present these comparisons. The differences are expressed as the MYE minus the projection where a positive difference signifies an underprojection and a negative difference signifies an overprojection.

Table 1. Mid-year estimates for England, 2010 and 2011

MYE	Estimate
Unrevised 2010	52,234,000
Revised 2010 (following 2011 Census)	52,642,000
Rebased 2011 (following 2011 Census)	53,107,000

From the figures below, there is an overall greater difference found when comparing the SNPPs and the MYEs for England which have been revised following the 2011 Census. The comparisons with the MYEs for 2010 prior to the revisions following the 2011 Census show the smallest differences (Table 2). Across these comparisons, the largest differences are seen in the 2004-based population projections which are known to not reflect the changes seen in international migration patterns as a result of the EU accession in 2004 (as discussed in Section 3.2).

Table 2. Comparison of projections for England with the unrevised and revised 2010 MYE

Subnational Population Projection (SNPP)	Projected population for 2010	Difference from unrevised 2010 MYE	Difference from revised 2010 MYE
2004-based	51,715,000	1.00%	1.79%
2006-based	52,297,000	-0.12%	0.66%
2008-based	52,198,000	0.07%	0.85%
2010-based	52,213,000	0.04%	0.82%

Table 3. Comparison of projections for England with the rebased 2011 MYE

Subnational Population Projection (SNPP)	Projected population for 2011	Difference from rebased 2011 MYE
2004-based	51,967,000	2.19%
2006-based	52,706,000	0.76%
2008-based	52,577,000	1.01%
2010-based	52,655,000	0.86%

4.3 Comparison of population projections at local level with 2011 population estimates

The remainder of this report focuses on a comparison of population projections at local levels with the 2011 population estimates based on the 2011 Census.

4.3.1 Assessment of Census and methodology improvement error

As discussed in Section 3, the population estimates have been rebased and revised following the 2011 Census and improvements to the methodology. The comparisons in this report therefore include some differences which are due to these revisions rather than an error in the projections. To help understand how much of the error is due to the revisions, a comparison has been made between the population estimate used as the base year of the projection and the revised population estimate for that year across regions (Table 4). The root mean square error (RMSE) is used to summarise these differences.

Table 4. Comparisons of the base year used in the population projections with equivalent revised population estimate by region

	2010-based SNPPs	2008-based SNPPs	2006-based SNPPs	Revised 2004- based SNPPs
Root Mean Square Error (RMSE)	1.1%	1.2%	0.7%	0.3%

This shows that the revisions made to the population estimates to reflect methodological improvements and the Census had a larger impact in the later years of the decade. The 2004-based population projections show the smallest error.

4.3.2 Comparison of population projections with 2011 population estimates by level of geography

Table 5 compares the population projection for 2011 from the 2004-, 2006-, 2008- and 2010-based projections with the population estimate for 2011 at region, county and local authority level. The RMSE is used to see whether the population projections are more accurate at larger geographical areas.

Table 5. Comparison of projections with population estimates for 2011 by level of geography

Level of geography	2010-based SNPPs (1 year diff.)	2008-based SNPPs (3 years diff.)	2006-based SNPPs (5 years diff.)	Revised 2004- based SNPPs (7 years diff.)
Region RMSE	1.2%	2.2%	2.4%	3.2%
County RMSE	1.9%	2.3%	2.5%	3.2%
Local Authority RMSE	4.2%	5.9%	6.6%	7.2%

The table shows that the error is higher when the period between the projection base year and the reference year (2011) increases and for comparisons made at local authority level. It is harder to estimate the population in areas that have larger flows of international migrants or internal migrants (e.g. persons and students moving to an area to work or study). This would explain the larger error at local authority level which will experience internal moves across local authority boundaries which would fall within larger counties and regions.

4.3.3 Assessment of accuracy by individual region

The remainder of this analysis considers the accuracy of the population projections at individual area level.

Table 6 shows that percentage differences between the population projections and population estimates for 2011 for each region in England. Across all regions, the 2010-based projections underprojected the population for 2011. All four sets of projections underprojected the population for 2011 in the North West, West Midlands, South East, and London. The 2004-based projections made the most significant underprojection for each region. Overall, the accuracy of the projections by region has improved over time, particularly for London.

Table 6. Percentage difference between the SNPPs and MYEs for 2011 by region

Region	2010-based (1 year diff.)	2008-based (3 years diff.)	2006-based (5 years diff.)	Revised 2004-based (6 years diff.)
North East	0.0%	-0.2%	0.1%	2.0%
North West	1.1%	1.6%	0.6%	1.4%
Yorkshire and the Humber	0.1%	-1.2%	-1.7%	0.6%
East Midlands	0.1%	0.0%	-1.2%	0.9%
West Midlands	1.6%	2.2%	1.8%	3.0%
East	0.6%	-0.4%	0.5%	0.9%
London	1.7%	4.1%	4.7%	5.9%
South East	1.1%	1.0%	1.2%	2.5%

4.3.4 Assessment of accuracy by type of local authority

The following analysis has grouped local authorities into four types; unitary authorities, county districts, metropolitan county districts and London boroughs, to see whether the accuracy of projections is affected by the type of local authority area.

Table 7. Comparison of projections with population estimates for 2011 by type of local authority area

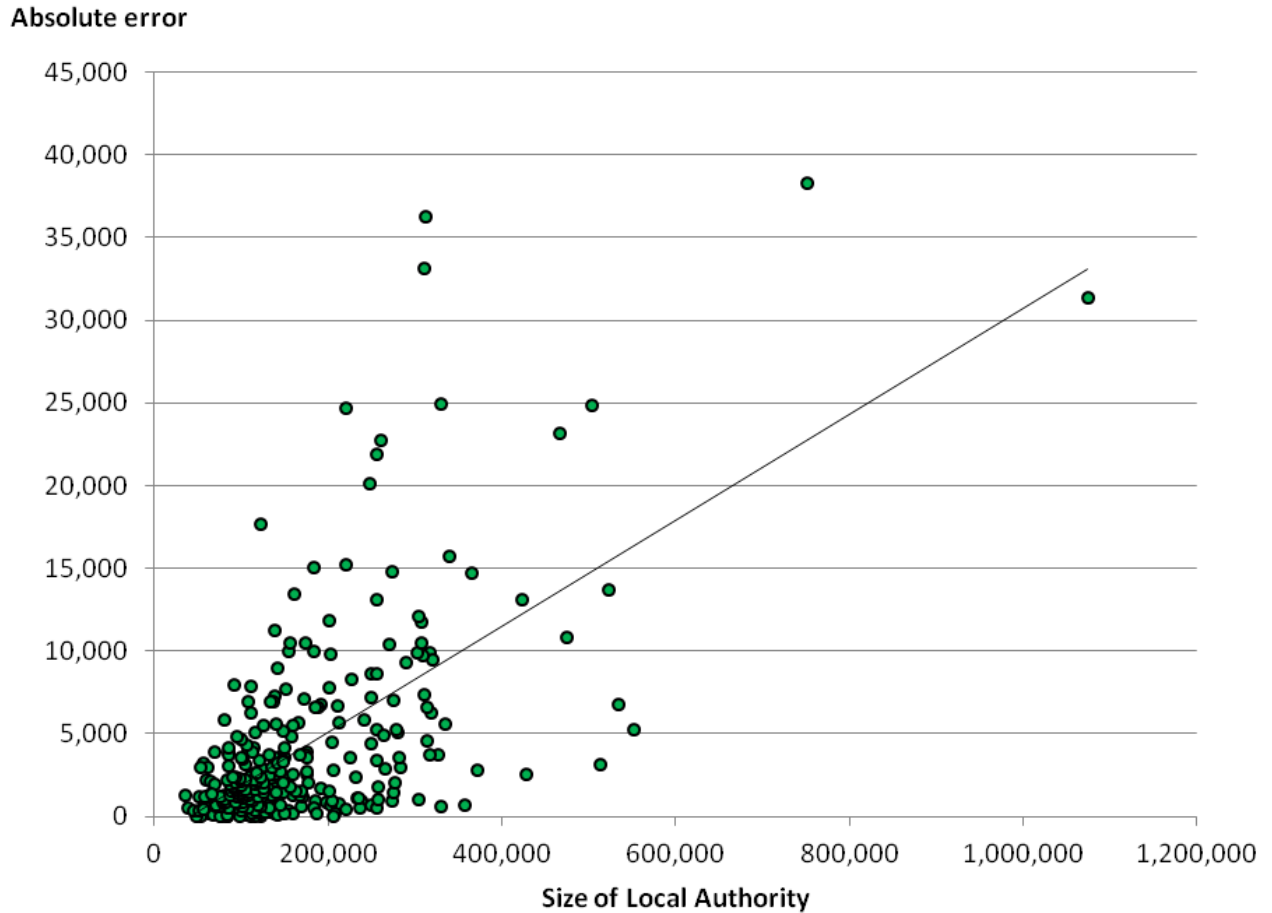
Local Authority type	2010-based (1 year diff.)	2008-based (3 years diff.)	2006-based (5 years diff.)	Revised 2004-based (6 years diff.)
Unitary Authorities RMSE	3.0%	3.5%	5.3%	5.3%
County Districts RMSE	2.7%	2.9%	4.2%	4.0%
Metropolitan County Districts RMSE	3.7%	4.4%	4.1%	4.8%
London Boroughs RMSE	5.5%	9.4%	9.8%	11.0%

Table 7 shows that the population projections for London boroughs are the least accurate when compared to the 2011 population estimates. London boroughs experience large population churn due to high volumes of migration, both international and internal, which in addition, has an impact on fertility and mortality rates in these areas. These factors will make it harder to project the population in these areas. Metropolitan county districts showed the second highest error. These are large urban areas such as Manchester, Leeds, Liverpool and Birmingham which also experience high volumes of migration.

4.3.5 Assessment of accuracy by size of local authority

The accuracy of the projections has also been considered by population size irrespective of type of local authority area. We would expect absolute error to be larger for local authorities with a large population size and this is illustrated by the positive trend shown in Figure 2. In the following sections, we will further explore this trend by investigating individual local authorities.

Figure 2. Differences between the 2010-based population projection for 2011 and the mid-year estimate for 2011 by area size



4.3.6 Assessment of accuracy by individual local authority

In this part of the analysis, both percentage and actual numerical differences between four sets of population projections and the population estimate for 2011 have been investigated.

Table 8 shows the five local authorities with the largest positive percentage difference between population projections and the population estimate for 2011. In these areas, the population projections underprojected the population for 2011. They are predominantly London boroughs which have grown at a faster rate than was projected. In the 2010-based projections, the largest difference is in Brent where the population projection for 2011 was almost 12% lower than the 2011 population estimate. Whilst still an underprojection, the accuracy improved between the 2008-based and the 2010-based projections.

Table 8. Top five local authorities with largest percentage positive difference between population projections and the mid-year estimate for 2011

Local Authority	2010-based SNPPs	2008-based SNPPs	2006-based SNPPs	Revised 2004- based SNPPs
Brent	11.6%	19.2%	11.4%	12.8%
Newham	10.7%	22.9%	20.1%	16.7%
Waltham Forest	8.8%	14.0%	14.0%	16.0%
Hackney	8.2%	12.8%	14.4%	14.8%
Slough	6.4%	7.8%	14.6%	17.0%

Table 9 shows the five local authorities with the largest positive actual difference between the population projection sets and the population estimate for 2011. These areas are similar to those listed in Table 8 but it also includes Birmingham, a metropolitan county district, whose population for 2011 was underprojected in the 2010-based projections by 31,428.

Table 9. Top five local authorities with largest positive actual difference between population projections and the mid-year estimate for 2011

Local Authority	2010-based SNPPs	2008-based SNPPs	2006-based SNPPs	Revised 2004- based SNPPs
Brent	36,336	59,977	35,721	40,045
Newham	33,186	71,285	62,383	51,760
Birmingham	31,428	31,389	33,300	51,583
Waltham Forest	22,807	36,413	36,340	41,542
Hackney	20,159	31,562	35,667	36,582

Table 10 shows the five local authorities with the largest negative percentage difference between four sets of population projections and the population estimate for 2011. In these areas, the population projections overprojected the population for 2011. The largest percentage difference is in Westminster where the 2010-based population projection for 2011 was 11% higher than the 2011 population estimate. Whilst still an overprojection, the accuracy of the projections in these areas improved markedly between the earlier and later sets of projections. The 2004-based projections for Westminster and Kensington and Chelsea overprojected their population for 2011 by 24.9% and 32.7% respectively.

Table 10. Top five local authorities with largest negative percentage difference between population projections and the mid-year estimate for 2011

Local Authority	2010-based SNPPs	2008-based SNPPs	2006-based SNPPs	Revised 2004- based SNPPs
Westminster	-11.3%	-19.7%	-19.5%	-24.9%
Tendring	-8.2%	-10.4%	-10.6%	-11.7%
Camden	-7.0%	-8.1%	-18.2%	-14.9%
East Lindsey	-5.1%	-5.7%	-8.0%	-9.5%
Kensington and Chelsea	-3.5%	-10.9%	-24.0%	-32.7%

Table 11 shows the five local authorities with the largest actual negative difference between four sets of population projections and the population estimate for 2011. These areas are similar to those in Table 10 but also includes Leeds which was overprojected by 38,348 in the 2010-based projections for 2011.

Table 11. Top five local authorities with largest negative actual difference between population projections and the mid-year estimate for 2011

Local Authority	2010-based SNPPs	2008-based SNPPs	2006-based SNPPs	Revised 2004- based SNPPs
Leeds	-38,348	-61,656	-49,162	-6,417
Westminster	-24,735	-43,327	-42,717	-54,618
Camden	-15,286	-17,935	-40,048	-32,813
Tendring	-11,273	-14,349	-14,621	-16,138
Kensington and Chelsea	-5,554	-17,249	-37,931	-51,749

4.3.7 Impact of the rebasing exercise following the 2011 Census

Following the 2011 Census, an [assessment](#) was made of the difference between the rolled forward population estimates for 2011 and the 2011 Census based population estimates. Table 12 presents the local authorities from Tables 9 and 11 alongside projected population for 2011 from the 2010-based SNPPs, the rolled-forward MYEs for 2011 and the rebased MYEs for 2011. The assessment found these areas were among the areas that had the

largest positive or negative actual differences between the rolled forward and the 2011 Census based estimates for 2011. This further suggests that the areas with the largest overprojection were also among the areas with the largest overestimation of the population noted in the rebasing exercise. Conversely, the areas with the largest underprojection were also among the areas with the largest underestimation of the population noted in the rebasing exercise.

Table 12. Population projections and mid-year estimates for 2011 for selected local authorities

	Local Authority	2010-based SNPPs	Rolled-forward MYE 2011	Rebased 2011 MYE
Under- projected LAs	Brent	275,900	277,500	312,200
	Newham	277,300	281,700	310,500
	Birmingham	1,031,900	1,043,000	1,074,300
	Waltham Forest	236,900	237,500	259,700
	Hackney	227,000	227,600	247,200
Over- projected LAs	Westminster	244,300	246,500	219,600
	Camden	235,400	238,700	220,100
	Kensington and Chelsea	163,800	161,900	158,300
	Tendring	149,300	148,300	138,100
	Leeds	789,000	808,963	750,683

5. Conclusions and further work

This report has given an overview of the accuracy of the population projections by comparing the population projection for 2011 from a number of sets of projections with the population estimate for 2011. This comparison has not been straightforward for a number of reasons which include:

- Revisions to the MYEs following the 2011 Census mean that the population estimates used as the base year of each set of projections has since been revised
- Methodological improvements made to the population estimation methodology have resulted in further revisions to the population estimates
- Changes to demographic trends (e.g. patterns of international migration) have affected the projections and their accuracy

With these limitations in mind, the main findings are that the projections are less accurate for smaller geographical areas and when the period between the projection and the reference year (2011) increases.

In order to estimate the error due to the population estimate revisions, the population estimate used as the base year in the projections was compared against the revised population estimates for the same year. The difference between these two population estimates represents the revisions made to the population estimate for the 2011 Census and methodological improvements. It was found that the error was higher for the 2008-based and 2010-based projections and the revised 2004-based projections had the smallest error.

It was also found that at regional level, the population estimate was higher than the projection for 2011 in all areas but the accuracy of projections had improved over time, particularly in the region of London. Furthermore, accuracy differed across local authority types with London boroughs having the highest error due to the high population churn they experience.

Analysis of individual local authorities showed that those areas with the largest overprojection were also among the areas with the largest overestimated population following the 2011 Census rebasing exercise. Conversely, the areas with the largest underprojection were also among the areas with the largest underestimated population noted in the rebasing exercise.

We note that further analysis could be carried out with regards to the accuracy of the SNPPs (e.g. by age and by sex; or to analyse the error in the distribution of the population across the local authorities after removing the effects of the NPPs on the SNPPs) and we would welcome comments from users on further analysis they would find valuable.

Annex A

1 - Subnational Population Projections (SNPPs) Methodology

The SNPPs are produced for each local authority in England by age and sex. They are produced using the cohort component method, which is a standard demographic method and use high quality data sources to inform the components of population change. They take the local authority population estimates as their starting point and then apply assumptions about future fertility, mortality and migration levels based on trends in recent estimates over the previous five to six years. These projections are not forecasts and take no account of policy nor development aims that have not yet had an impact on observed trends.

The population from the previous year is aged on by one year and local fertility and mortality rates are applied to calculate projected numbers of births and deaths, and then the population is adjusted for projected internal, cross-border and international migration. Prior to ageing on, the population of armed forces are removed as these are a 'static population', whose size and age-sex structure does not change over the projection period. Each of these components (except internal migration) is constrained to its respective total from the corresponding national population projections, and once the static population has been added back, the projected population is controlled to the national population projections total for England. This process is repeated for each year of the projection period. The population at the end of each cycle becomes the base population of the next cycle.

The latest set of projections are based on the 2012 population estimates and are consistent with the principal 2012-based national population projections for England. Further detail on the subnational population projections methodology can be found on the ONS website at <http://www.ons.gov.uk/ons/rel/snpp/sub-national-population-projections/2012-based-projections/rpt-snpp-2012-based-methodology-report.html>

2 - Mid-Year Population Estimates (MYEs) Methodology

The population estimates are also produced using the cohort component method. Firstly, the population is aged on by one year. Then births are added on and deaths are removed, by age and sex, and usual area of residence. Movement of people in and out of the UK (international migration) and movements between different areas in the UK (internal migration) are then accounted for. Internal migration includes both cross-border moves between countries of the UK and moves between local authorities within England and Wales. Adjustments are made for prisoners and armed forces as they are not captured by the usual internal or international migration estimates. They are referred to as 'static populations' because they have specific age structures which remain fairly constant over time.

The method above is applied in years when there is no census. For every tenth year when there is a census, the population estimates are based on the most recent census estimates following an adjustment for population change between Census day and 30 June. The latest

set of population estimates were published in 2014 and estimate the population as at 30 June 2013. Further detail on the population estimates methodology can be found on the ONS website at <http://www.ons.gov.uk/ons/guide-method/method-quality/specific/population-and-migration/pop-ests/index.html>

Annex B

1 - Revisions following improvements to the methodology

In addition to the revisions made to the population estimates following the 2011 Census, a number of revisions were made during the decade to reflect improvements made to the population estimates methodology.

In 2004, the MYEs were revised for 2001 and 2002 following the [Local Authority Population Studies](#) and adjustments for persons that were missed in the 2001 Census. These revisions were taken into account for the 2003-based SNPPs.

In 2007, following the [Improving Migration and Population Statistics \(IMPS\)](#) project, there were improvements made to the methodology for visitor switchers and the estimation of international migration across local authorities. As a result, there were revisions made to the MYEs for 2002 to 2005 with the release of the 2006 MYEs. Consequently, revisions were then made to the 2004-based projections.

In 2010, further improvements were made to the methodology for estimating international migration and the distribution of migrants to local areas as part of the cross-government [Migration Statistics Improvement Programme \(MSIP\)](#) which included the use of administrative data sources. These were incorporated into the 2009 MYEs and revisions were also made to the MYEs for 2002 to 2008.

For the 2008-based SNPPs, the methodology was changed which removed the use of the Rogers-Castro curve for smoothing the age distributions in the internal migration methodology and the international migration stream in accordance with the MSIP. Also, quinary age groups were extended from 85+ to 90+.

The 2010-based projections, published in 2012, were based on [indicative population estimates](#) which took into account the further improvements made to the methodology for estimating international migration and the internal migration of students. These were not published as part of the official MYE series which had not been revised to take on board improved methods. The interim 2011-based SNPPs were based on the census-based MYE for 2011 but utilising trends from the previous 2010-based SNPPs.

The following timeline outlines the implementation of these improvements to the methodology and the revisions made after.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
MYE published and revisions	MYE 2003	MYE 2004	MYE 2005	MYE 2006	MYE 2007	MYE 2008	MYE 2009	MYE 2010	MYE 2011 (Census-based)	MYE 2012	MYE 2013
	2001-2002 revised			2002-2005 revised			2002-2008 revised			2002-2010 rebased	
MYE notes	Revisions implemented as a result of LA population studies			Revisions implemented as a result of IMPS project			Revisions implemented as a result of MSIP programme	2006-2010 indicative estimates research report		Rebased MYEs based on 2011 Census	
SNPP published and revisions	2003-based		2004-based	Revised 2004-based	2006-based		2008-based		2010-based		2012-based
								Interim 2011-based			
SNPP notes				Revisions implemented as a result of IMPS project			Removed Rogers Curve from internal migration methodology		2010-based used indicative estimates produced in 2011		
								Interim 2011-based on MYE 2011 (Census-based) but used trends from 2010-based SNPPs			
Other information	Accession of EU10 countries (e.g. Poland) to EU			Accession of Romania and Bulgaria (EU2) to EU				2011 Census		EU2 restricted movement lifted	

2 - Rebasing and revisions following the 2011 Census

The population estimates are produced each year by ageing on the population from the previous year and making adjustments for the components of population change. For each year in which a census has taken place, the methodology changes. For example, the 2011 Census estimates were used as the base population for the 2011 population estimates and adjustments were made for births, deaths and migration that took place between Census Day and 30th June 2011. At this time, the population estimates for the previous decade were also revised so that they were in line with the new Census based population estimates. This practice of rebasing and revisions means that the SNPPs produced during the decade will be based on population estimates that are not consistent with the population estimates that they are being compared to, which will have been rebased and revised following the 2011 Census. Further information can be found on the ONS website at:

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

3 - Changes in fertility and mortality rates during the decade

Between 2002 and 2008, total fertility rates increased in the UK although they now appear to have stabilised. Fertility rates have generally been rising faster among women in their thirties and forties than for women in their twenties, so mean age at childbirth has continued to rise.

The 2012-based national population projections assume that mortality rates are improving and that the annual rate of improvement will settle at 1.2 per cent after 2037. The rate of improvement between 1960 and 2011 appeared to be higher in the second half of this period, particularly for males, which is partly due to differential trends in smoking behaviour between males and females. More recently, mortality rates for males at older ages have shown improvements because relatively large numbers of men now abstain from smoking.

Further information on the fertility and mortality rates used in the NPPs can be found in Chapters 3 and 4 of the [National Population Projections, 2012-based Reference Volume](#). Information on how the national fertility and mortality rates are incorporated into the SNPPs can be found in the methodology section of [the 2012-based SNPPs release](#).

4 - Unattributable Population Change (UPC)

Following the 2011 Census, the intercensal population estimates were rebased so that the population estimates for the period mid-2002 to mid-2011 were in line with the 2011 Census. After making allowances for methodology changes and estimated errors in the components during the decade, the remaining difference between the rolled forward 2011 population estimates and the 2011 Census based population estimates for England was 103,700. This is referred to as 'Unattributable Population Change' (UPC). In order to produce the revised series of population estimates for the last decade, the UPC was apportioned across each of

the 10 years using the cohort method which takes account of the fact that individuals age as the decade progresses. This method was applied to both the national and subnational population estimates.

The UPC is likely to be due to a combination of sampling variability, or other issues, in the following:

- international migration estimates
- census estimates, both 2001 and 2011
- internal migration estimates (at subnational level only)

No adjustment was made in the 2012-based population projections for UPC. An adjustment would only be made if it could be shown that the UPC measured a bias in the trend data that would continue into the future. The UPC is unlikely to be seen in continuing subnational trends as:

- it is unclear what proportion of the UPC is due to sampling error in the 2001 Census, adjustments made to the population estimates after the 2001 Census, sampling error in the 2011 Census and/or error in the intercensal components (mainly migration)
- if it is due to either 2001 Census or 2011 Census, then the components of population change will be unaffected
- if it is due to international migration, it is likely that the biggest impacts will be seen earlier in the decade and will have less of an impact in the later years, because of improvements introduced to migration estimates in the majority of these years

Although no adjustment has been made for UPC in the population projections, the migration data used in the 2012-based population projections include the adjustments described above that were made to the population estimates revised after the 2011 Census. However, earlier years' projections will not include these adjustments. UPC therefore introduces another level of error into the comparisons between the population projections prior to 2012-based and the rebased and revised MYEs.

5 - Changes in geography

Changes in geography can occur following changes to ward boundaries or following more major local government restructuring. Electoral ward boundaries are reviewed to ensure that the population size of each ward is broadly equal. As there is a constant movement of people between areas, the boundaries need frequent review to ensure that this requirement is met.

In England, the Local Government Boundary Commission for England (LGBCE) undertakes reviews of higher administrative areas. These reviews can lead to major boundary changes, creation of new administrative areas and splitting, merging or abolition of others. During the last decade, the most significant changes occurred in 2009 when 10 new unitary authorities were created. These involved the counties of Bedfordshire and Cheshire being abolished and split into two unitary authorities each, and a further five counties were abolished and

created as five separate unitary authorities – Cornwall, County Durham, Northumberland, Shropshire and Wiltshire. These changes to local authority administrative boundaries have meant that for some areas, direct comparisons between population projections and estimates have not always been possible. In these instances, local authorities have been merged into larger areas to aid analysis.

Further information on ONS geography can be found on the ONS website at <https://geoportal.statistics.gov.uk/geoportal/catalog/main/home.page>