

Feasibility of producing ‘Estimates of the very old’ for England and for Wales separately

This report examines the feasibility of producing population estimates of the very old (EVOs) for England and Wales separately using the Kannisto-Thatcher method.

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1 . Introduction

This report examines the feasibility of producing Estimates of the very old (age 90 and over population estimates by single year of age to age 105 and over, EVOs) for England and Wales separately using the [Kannisto-Thatcher \(KT\) method](#).

Currently the KT method is used to produce single year of age and sex population estimates at age 90 and above for England and Wales as a whole from aggregate deaths data for England and Wales. These estimates are then constrained to our official 90 and over mid-year population estimates and published as Estimates of the very old (EVOs).

The UK Statistics Authority reassesses official outputs with National Statistics status periodically. A requirement of their 2015 to 2016 assessment of the EVOs was to consider producing and publishing EVOs for England and for Wales separately.

Separate 90 and over estimates by single year of age and sex for England and for Wales are required internally as input data for the National life tables for England and for Wales respectively. An external user demand for separate country estimates has also been identified. Currently, separate country estimates are obtained by applying the relative proportions of the England and Wales 90 and over total population estimate for England and for Wales respectively to the England and Wales 90 and over age distribution (in this report referred to as the “split” method). This method makes the assumption that the 90 and over population in England and in Wales have the same age distribution as that for England and Wales combined, which may not be the case.

Alternatively, the KT method could be applied separately to deaths data for England and to deaths data for Wales to produce separate country EVOs. There are a small number of deaths in England and Wales that are not assigned to either England or Wales. A decision would be needed about how these deaths should be treated. Unless otherwise stated, these deaths have been included with England deaths in the analysis presented in the report as England deaths account for the vast majority of total England and Wales deaths. An underlying assumption of the KT method is that net migration at any age in or out of the population is negligible. This assumption would also need to be tested.

The report firstly examines the validity of the assumption of negligible net migration at any age between England and Wales. EVOs calculated for England and Wales as a whole (the current method) are then compared to EVOs calculated for England and for Wales separately and then aggregated.

Next, EVOs calculated using the KT method for England and for Wales separately are compared with estimates for England and for Wales that have been calculated by applying the relative proportions of the England and Wales 90 and over total population estimate for England and for Wales to the England and Wales 90 and over age distribution (the split method). We also examine the differences between life expectancies at age 90 and above for the 2 countries produced from England and Wales EVOs “split” into estimates for the 2 countries and life expectancies produced from EVOs calculated for England and for Wales separately using the KT method.

The plausibility of mortality rates calculated on the basis of EVOs produced separately for England and for Wales are checked, as are the “joins” at ages 89 and 90 between official mid-year estimates for England and Wales and EVOs for England and for Wales. The potential volatility of producing EVOs for a small population (Wales) is also considered. Finally, EVOs for the separate countries, calculated from deaths data where the unassigned England and Wales deaths are combined with England, are compared with EVOs calculated where the unassigned deaths are distributed to England deaths and Wales deaths according to each country's proportion of all deaths at age 90 and over assigned to England or Wales.

2 . Net migration to Wales from England

An underlying assumption of the Kannisto-Thatcher (KT) method is that there is negligible net migration by age for the ages for which Estimates of the very old (EVOs) are calculated. Using the KT method to produce separate EVOs for England and for Wales would therefore only be robust if there is no or negligible migration between the 2 countries at the highest ages. Table 1 shows net migration¹ to Wales from England at age 90 and over, between 2005 and 2014. (Net migration to Wales is presented as the potential impact of migration is bigger for Wales than for England given their relative population sizes, but note that, by definition, net migration to England from Wales will be an exact mirror of the figures presented.)

Table 1: Net migration to Wales from England, 2005 to 2014, by sex for the age group 90 and over

MALES				FEMALES			
	Migration from England to Wales	Migration from Wales to England	Net migration to Wales		Migration from England to Wales	Migration from Wales to England	Net migration to Wales
2005	50	40	10	2005	171	153	18
2006	53	44	9	2006	145	125	20
2007	67	44	23	2007	150	163	-13
2008	40	53	-13	2008	178	136	42
2009	45	50	-5	2009	135	139	-4
2010	46	57	-11	2010	157	191	-34
2011	61	62	-1	2011	151	173	-22
2012	75	61	14	2012	175	176	-1
2013	71	69	2	2013	175	187	-12
2014	65	93	-28	2014	162	209	-47

Source: Office for National Statistics

Flows by single year of age are not available. In-flows and out-flows each year are quite similar; however, the flows fluctuate year on year. Some of the year-on-year fluctuations may be due to changes made to the source administrative data, for example list cleaning, rather than real year-on-year differences. The important point is that net migration figures between the 2 countries are very small in every year.

As a percentage of the overall age 90 and over population in England and in Wales, net migration at age 90 and over from Wales to England and from England to Wales is very low for both males and females.

Figure 1a: Net migration from England to Wales and from Wales to England at age 90 and over by sex as a percentage of population aged 90 and over by sex and by country, 2005 to 2014



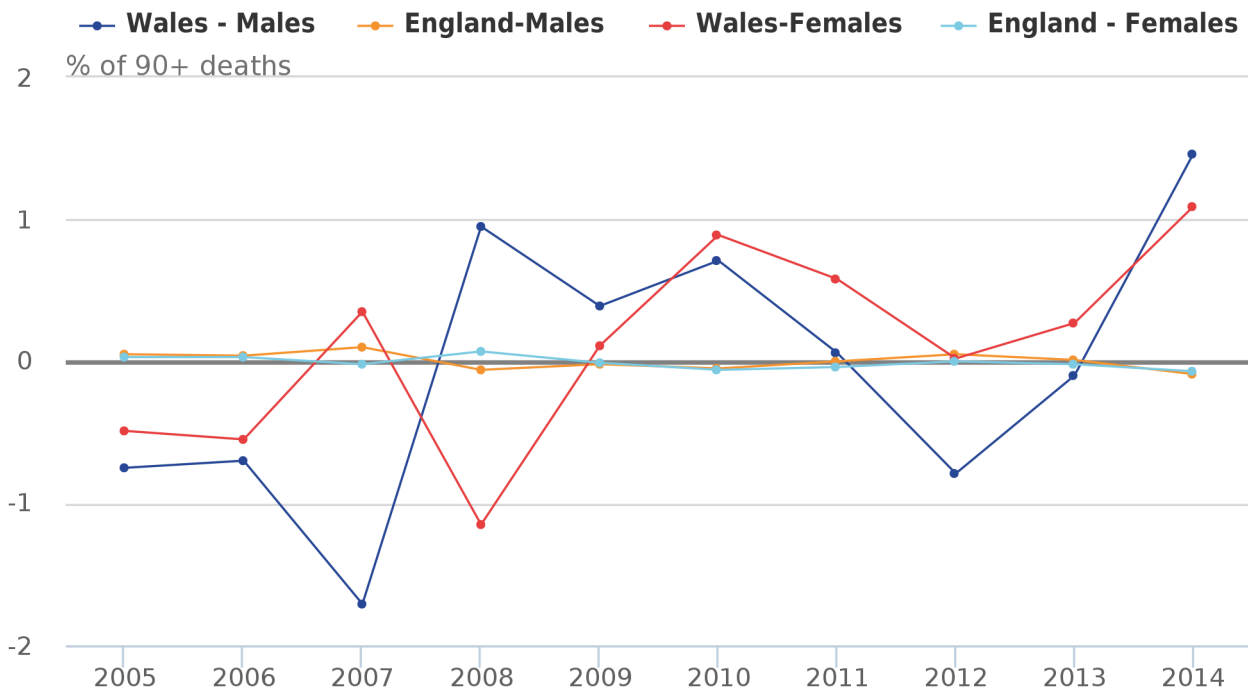
Source: Office for National Statistics

Net migration to Wales from England at age 90 and over as a percentage of the 90 and over population in England is almost zero for both males and females over the period shown. Net migration to England from Wales at age 90 and over as a percentage of the 90 and over population in Wales varies between -0.43% and 0.35% for males and between -0.26% and 0.23% for females.

This is slightly higher than the equivalent figures for net migration between England and Wales and Scotland and Northern Ireland. Data from the 2011 Census shows that net migration from Scotland to England and Wales as a percentage of the population of Scotland (age 90 and over) is 0.05%. Net migration from Northern Ireland to England and Wales as a percentage of the population of Northern Ireland (age 90 and over) is 0.06%.

Figure 1b shows net migration as a proportion of deaths. As a percentage of the overall number of deaths at age 90 and over in England and in Wales, net migration at age 90 and over from Wales to England and from England to Wales is very low for both males and females.

Figure 1b: Net migration from England to Wales and from Wales to England at age 90 and over by sex as a percentage of deaths at age 90 and over by sex and by country, 2005 to 2014



Source: Office for National Statistics

This chart is very similar to Figure 1a, except in the y-axis scale, which suggests that age 90 and over deaths as a percentage of the age 90 and over population have stayed reasonably constant over time, as we might expect.

Net migration to Wales from England at age 90 and over as a percentage of deaths at age 90 and over in England is almost zero for both males and females over the period shown. Net migration to England from Wales at age 90 and over as a percentage of deaths at age 90 and over in Wales varies between -1.71% and 1.46% for males and between -1.15% and 1.09% for females. In other words, deaths are by far the main route of exit from the population. The assumption of negligible migration between England and Wales can therefore be said to hold.

Notes:

1. Net migration is estimated from Patient Register data (GP registrations).

3 . EVOs produced separately for England and Wales aggregated compared with EVOs produced for England and Wales as a whole

Differences between single year of age Estimates of the very old (EVOs) produced separately for England and for Wales then aggregated, and single year of age EVOs produced for England and Wales as a whole for the period 2002 to 2014 are very small, with the largest difference for males in any year by single year of age being -4 and for females being -9 (Figures 2a and 2b). There are no obvious trends in the data by age or over time. (It should be noted that all EVO figures presented in the report have been constrained to the official mid-year estimate (MYE) 90 and over totals, unless otherwise stated. This means that the differences shown are differences in age distributions. The 90 and over totals will be equal).

These results suggest that the small level of net migration between England and Wales (Table 1 and Figure 1) does not materially affect the robustness of the EVOs produced separately for the 2 countries.

Figures 3a and 3b show percentage differences between the EVOs produced separately for England and for Wales then aggregated and EVOs produced for England and Wales as a whole. These are close to zero except at the higher ages where populations are very small.

Figure 2a: Differences between aggregated EVOs produced separately for England and Wales and EVOS produced for England and Wales as a whole, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	-2	0	0	-1	-1	-1	-4	-2	-1	-3	-1	-3	-3
91	1	-1	0	-2	-1	0	-2	-2	-4	1	-1	-2	-2
92	-1	2	-1	-1	0	0	-2	0	-1	-3	0	-1	-1
93	-1	0	2	0	1	0	-1	0	-1	-2	-2	-1	0
94	-1	-2	0	2	1	0	1	1	-1	1	-1	-1	1
95	-1	0	0	0	1	1	2	-1	0	0	1	-1	-1
96	0	1	0	0	0	1	1	1	0	2	1	2	-1
97	1	0	1	0	-1	0	1	1	0	1	1	1	1
98	0	0	0	1	0	2	1	0	1	1	1	1	0
99	-1	-1	0	0	1	0	1	1	1	0	0	1	1
100	1	-1	-1	0	1	0	1	0	1	1	-1	1	1
101	1	1	0	0	0	0	0	2	1	1	1	0	1
102	0	0	0	-1	-1	-1	0	0	1	0	0	1	0
103	1	0	0	1	1	-1	0	1	2	0	0	0	1
104	1	0	0	0	1	0	-1	0	1	1	0	1	1
105	1	1	0	1	-1	1	1	-2	0	0	1	1	0

Figure 2b: Differences between aggregated EVOs produced separately for England and Wales and EVOS produced for England and Wales as a whole, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	-2	-1	-3	-3	-4	-8	-9	-7	-2	-2	-1	3	1
91	-1	0	-1	-3	-2	-2	-3	-6	-3	-3	-1	-2	1
92	-1	1	0	-1	-1	-1	0	-1	-5	-2	-1	-1	-1
93	0	0	0	1	-2	0	1	0	-2	-3	-2	-1	-1
94	-2	-1	-2	1	1	1	0	0	0	0	-2	-1	-2
95	0	-1	-2	1	0	2	2	2	2	0	0	-2	-3
96	0	0	0	-2	0	2	2	1	0	0	-1	-1	-2
97	1	1	1	0	0	1	1	2	1	1	1	1	-1
98	-2	1	0	0	0	0	1	3	0	0	0	1	0
99	0	-2	1	-1	1	1	-1	0	2	2	1	0	1
100	1	-1	-2	4	1	1	-1	0	2	0	0	0	1
101	1	2	0	0	1	0	-1	1	-1	0	0	0	0
102	1	1	2	0	0	1	1	0	1	0	2	-1	1
103	1	0	1	1	0	-1	2	0	0	1	0	0	0
104	0	0	1	1	1	-1	0	3	1	1	1	0	1
105	0	-1	1	0	0	1	1	1	1	1	0	0	0

Figure 3a: Percentage difference between EVOs produced separately for England and Wales aggregated and EVOs produced for England and Wales as a whole, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
92	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
96	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
97	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
99	-0.2	-0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1
100	0.3	-0.3	-0.2	0.0	0.2	0.0	0.2	0.0	0.1	0.1	-0.1	0.1	0.1
101	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.6	0.3	0.3	0.2	0.0	0.2
102	0.0	0.0	0.0	-0.8	-0.7	-0.6	0.0	0.0	0.5	0.0	0.0	0.4	0.0
103	2.0	0.0	0.0	1.6	1.4	-1.1	0.0	1.1	1.9	0.0	0.0	0.0	0.7
104	3.7	0.0	0.0	0.0	2.9	0.0	-2.1	0.0	2.0	1.6	0.0	1.4	1.3
105	7.1	7.7	0.0	6.3	-5.6	5.6	4.8	-8.3	0.0	0.0	3.1	2.9	0.0

Figure 3b: Percentage difference between EVOs produced separately for England and Wales aggregated and EVOs produced for England and Wales as a whole, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
91	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
92	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
96	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
97	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
99	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100	0.0	0.0	-0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
101	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
102	0.1	0.1	0.2	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.1	-0.1	0.1
103	0.2	0.0	0.2	0.2	0.0	-0.1	0.3	0.0	0.0	0.1	0.0	0.0	0.0
104	0.0	0.0	0.3	0.3	0.3	-0.3	0.0	0.7	0.2	0.2	0.2	0.0	0.2
105	0.0	-0.6	0.6	0.0	0.0	0.5	0.5	0.5	0.4	0.4	0.0	0.0	0.0

4 . EVOs produced for England separately compared with EVOs for England produced by apportioning EVOs for England and Wales as a whole

Currently, where they are required, separate age 90 and over estimates by single year of age and sex for England and for Wales are obtained by applying the relative proportions of the England and Wales age 90 and over total population estimate for England and for Wales to the England and Wales 90 and over age distribution. This method makes the implicit assumption that the age 90 and over populations in England and in Wales have the same age distribution and that this is the same as that for England and Wales combined. (Age distributions at younger ages are not the same for England and Wales.) Adoption of this method was a pragmatic decision to produce an input to National life tables. The assumption is tested in the analysis below.

Estimates of the very old (EVOs) produced for England and for Wales separately were compared with estimates for England and for Wales produced by apportioning the England and Wales (combined) EVOs (the “split” method).

There are notable differences between the estimates produced using the 2 different methods. Differences are larger where populations are larger. There are some cohort effects, and there are larger differences where cohorts are furthest from extinction, that is, at the youngest ages in the most recent years. For males, in the EVOs produced separately for the 2 countries, estimates decrease in England at ages 90 and 91 and then increase and in Wales increase at ages 90 and 91 and then decrease at higher ages compared with EVOs “split” into estimates for the 2 countries by apportioning (Figures 4a and 4c).

For females, in the EVOs produced separately for the 2 countries, estimates increase in England for ages 90 to 93 and then decrease for ages 94 to 98 and vice versa in Wales compared with EVOs “split” into estimates for the 2 countries by apportioning (Figures 4b and 4d).

(The increases and decreases in the estimates of England and Wales when comparing the 2 methods are not an exact mirror image of each other because of the “not assigned” England and Wales deaths that are included with England deaths.)

Percentage differences between the EVOs for England produced using the 2 different methods are presented in Figures 5a (males) and 5b (females). Percentage differences between the EVOs for Wales produced using the 2 different methods are presented in Figures 5c (males) and 5d (females).

There are very small percentage differences in the estimates for males and females in England produced by the 2 different methods. Percentage differences in the estimates for males and females in Wales produced by the 2 different methods are larger, particularly so for males. In general, percentage differences will be larger where populations are smaller.

These above results imply that the assumption that England and Wales have exactly the same age 90 and over age distribution does not hold (Figures 6a and 6b). Producing EVOs separately for England and for Wales using the KT method would therefore provide more accurate estimates for these individual countries than the current method.

Figure 4a: EVOs produced for England separately minus EVOs for England produced by apportioning EVOs for England and Wales as a whole, England, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	-19	-8	-1	-16	-28	-48	-80	-52	-16	-31	-27	-34	-82
91	5	-8	-3	1	-4	1	-12	-47	-38	-8	-10	-10	-9
92	5	-3	-4	2	5	9	16	-2	-36	-25	-3	-2	16
93	4	4	-2	4	8	8	15	21	3	-18	-10	11	16
94	1	7	-5	-4	9	9	13	22	26	19	-3	0	14
95	0	5	10	-3	-2	9	13	17	19	27	21	-1	7
96	0	1	7	13	0	2	13	16	11	15	23	14	8
97	-1	0	-3	0	10	4	8	14	9	8	7	9	13
98	-2	2	2	-3	1	8	6	6	7	3	0	3	5
99	0	-1	4	5	-1	-1	5	4	6	2	-3	2	3
100	2	-2	-2	4	4	0	1	4	5	2	-2	2	4
101	1	1	0	-1	1	2	0	0	2	2	3	2	3
102	1	1	1	-1	-3	0	2	-1	0	2	2	2	2
103	2	0	-1	0	0	-2	0	1	1	1	1	0	1
104	1	1	0	0	1	-1	-2	0	1	0	0	1	-1
105	1	1	0	1	0	1	0	-3	0	1	1	1	-1

Figure 4b: EVOs produced for England separately minus EVOs for England produced by apportioning EVOs for England and Wales as a whole, England, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	46	42	-5	-46	-109	-168	-162	-90	34	76	43	78	29
91	5	30	42	-7	-25	-45	-90	-121	-81	20	44	8	62
92	-9	4	44	32	0	10	2	-59	-108	-75	9	27	23
93	-20	-6	5	40	38	21	31	14	-50	-96	-62	0	24
94	-17	-34	-22	10	46	55	44	43	6	-54	-80	-61	-10
95	-5	-30	-32	-11	13	55	72	62	34	-9	-51	-73	-51
96	-15	-3	-15	-22	-9	16	49	65	44	14	-10	-38	-60
97	-11	0	2	-4	1	3	16	37	45	32	19	1	-37
98	2	-10	-7	4	10	10	7	16	28	37	28	12	-11
99	7	-9	-14	-4	10	11	3	10	18	23	26	13	2
100	8	1	-10	2	11	8	1	5	12	11	13	13	9
101	4	6	-1	0	6	7	6	3	4	10	8	8	7
102	3	7	4	-3	-2	6	8	6	4	5	7	4	6
103	1	4	5	2	-1	0	4	5	6	2	2	3	2
104	-3	-1	2	4	4	3	2	3	4	4	2	1	3
105	0	-3	-1	0	2	5	3	0	-1	1	1	0	2

Figure 4c: EVOs produced for Wales separately minus EVOs for Wales produced by apportioning EVOs for England and Wales as a whole, Wales, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	17	8	1	15	27	47	76	50	15	28	26	31	79
91	-4	7	3	-3	3	-1	10	45	34	9	9	8	7
92	-6	5	3	-3	-5	-9	-18	2	35	22	3	1	-17
93	-5	-4	4	-4	-7	-8	-16	-21	-4	16	8	-12	-16
94	-2	-9	5	6	-8	-9	-12	-21	-27	-18	2	-1	-13
95	-1	-5	-10	3	3	-8	-11	-18	-19	-27	-20	0	-8
96	0	0	-7	-13	0	-1	-12	-15	-11	-13	-22	-12	-9
97	2	0	4	0	-11	-4	-7	-13	-9	-7	-6	-8	-12
98	2	-2	-2	4	-1	-6	-5	-6	-6	-2	1	-2	-5
99	-1	0	-4	-5	2	1	-4	-3	-5	-2	3	-1	-2
100	-1	1	1	-4	-3	0	0	-4	-4	-1	1	-1	-3
101	0	0	0	1	-1	-2	0	2	-1	-1	-2	-2	-2
102	-1	-1	-1	0	2	-1	-2	1	1	-2	-2	-1	-2
103	-1	0	1	1	1	1	0	0	1	-1	-1	0	0
104	0	-1	0	0	0	1	1	0	0	1	0	0	2
105	0	0	0	0	-1	0	1	1	0	-1	0	0	1

Figure 4d: EVOs produced for Wales separately minus EVOs for Wales produced by apportioning EVOs for England and Wales as a whole, Wales, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	-48	-43	2	43	105	160	153	83	-36	-78	-44	-75	-28
91	-6	-30	-43	4	23	43	87	115	78	-23	-45	-10	-61
92	8	-3	-44	-33	-1	-11	-2	58	103	73	-10	-28	-24
93	20	6	-5	-39	-40	-21	-30	-14	48	93	60	-1	-25
94	15	33	20	-9	-45	-54	-44	-43	-6	54	78	60	8
95	5	29	30	12	-13	-53	-70	-60	-32	9	51	71	48
96	15	3	15	20	9	-14	-47	-64	-44	-14	9	37	58
97	12	1	-1	4	-1	-2	-15	-35	-44	-31	-18	0	36
98	-4	11	7	-4	-10	-10	-6	-13	-28	-37	-28	-11	11
99	-7	7	15	3	-9	-10	-4	-10	-16	-21	-25	-13	-1
100	-7	-2	8	2	-10	-7	-2	-5	-10	-11	-13	-13	-8
101	-3	-4	1	0	-5	-7	-7	-2	-5	-10	-8	-8	-7
102	-2	-6	-2	3	2	-5	-7	-6	-3	-5	-5	-5	-5
103	0	-4	-4	-1	1	-1	-2	-5	-6	-1	-2	-3	-2
104	3	1	-1	-3	-3	-4	-2	0	-3	-3	-1	-1	-2
105	0	2	2	0	-2	-4	-2	1	2	0	-1	0	-2

Figure 5a: Percentage difference between EVOs produced for England separately and EVOs produced for England by apportioning EVOs for England and Wales as a whole, England, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	-0.1	0.0	0.0	-0.1	-0.1	-0.2	-0.4	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2
91	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.1	-0.3	-0.2	0.0	0.0	0.0
92	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	-0.3	-0.2	0.0	0.1
93	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.0	-0.2	-0.1	0.1	0.1
94	0.0	0.1	-0.1	-0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.0	0.0	0.1
95	0.0	0.1	0.2	-0.1	0.0	0.2	0.2	0.3	0.3	0.4	0.3	0.0	0.1
96	0.0	0.0	0.2	0.4	0.0	0.1	0.3	0.4	0.2	0.3	0.5	0.3	0.2
97	-0.1	0.0	-0.2	0.0	0.4	0.2	0.3	0.5	0.3	0.3	0.2	0.3	0.4
98	-0.2	0.2	0.2	-0.2	0.1	0.5	0.4	0.4	0.4	0.2	0.0	0.1	0.2
99	0.0	-0.2	0.5	0.6	-0.1	-0.1	0.5	0.4	0.6	0.2	-0.2	0.2	0.2
100	0.6	-0.6	-0.5	0.9	0.8	0.0	0.2	0.7	0.8	0.3	-0.3	0.3	0.5
101	0.5	0.5	0.0	-0.4	0.4	0.7	0.0	0.0	0.6	0.5	0.7	0.5	0.6
102	1.0	0.9	0.9	-0.8	-2.1	0.0	1.3	-0.6	0.0	1.0	0.9	0.9	0.8
103	4.3	0.0	-1.7	0.0	0.0	-2.4	0.0	1.1	1.0	0.9	0.8	0.0	0.7
104	3.8	3.8	0.0	0.0	3.0	-2.4	-4.5	0.0	2.1	0.0	0.0	1.5	-1.4
105	7.7	8.3	0.0	6.7	0.0	5.9	0.0	-13.0	0.0	3.8	3.3	3.1	-2.8

Figure 5b: Percentage difference between EVOs produced for England separately and EVOs produced for England by apportioning EVOs for England and Wales as a whole, England, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	0.1	0.1	0.0	-0.1	-0.2	-0.3	-0.3	-0.2	0.0	0.1	0.1	0.1	0.0
91	0.0	0.1	0.1	0.0	-0.1	-0.1	-0.2	-0.3	-0.2	0.0	0.1	0.0	0.1
92	0.0	0.0	0.1	0.1	0.0	0.0	0.0	-0.2	-0.3	-0.2	0.0	0.1	0.0
93	-0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	-0.2	-0.3	-0.2	0.0	0.1
94	-0.1	-0.1	-0.1	0.0	0.2	0.2	0.2	0.2	0.0	-0.2	-0.3	-0.2	0.0
95	0.0	-0.2	-0.2	-0.1	0.1	0.3	0.4	0.3	0.2	0.0	-0.3	-0.4	-0.2
96	-0.1	0.0	-0.1	-0.2	-0.1	0.1	0.3	0.4	0.3	0.1	-0.1	-0.3	-0.4
97	-0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.3	0.2	0.0	-0.3
98	0.0	-0.2	-0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.3	0.1	-0.1
99	0.2	-0.2	-0.3	-0.1	0.2	0.2	0.1	0.2	0.3	0.4	0.4	0.2	0.0
100	0.3	0.0	-0.4	0.1	0.4	0.3	0.0	0.1	0.3	0.3	0.3	0.3	0.2
101	0.3	0.4	-0.1	0.0	0.3	0.4	0.3	0.1	0.2	0.4	0.3	0.3	0.3
102	0.3	0.8	0.4	-0.3	-0.2	0.5	0.7	0.5	0.3	0.4	0.5	0.3	0.4
103	0.2	0.8	0.9	0.3	-0.2	0.0	0.6	0.7	0.8	0.2	0.2	0.3	0.2
104	-1.1	-0.4	0.7	1.3	1.2	0.8	0.5	0.8	0.9	0.9	0.4	0.2	0.6
105	0.0	-2.0	-0.7	0.0	1.1	2.6	1.5	0.0	-0.5	0.4	0.4	0.0	0.7

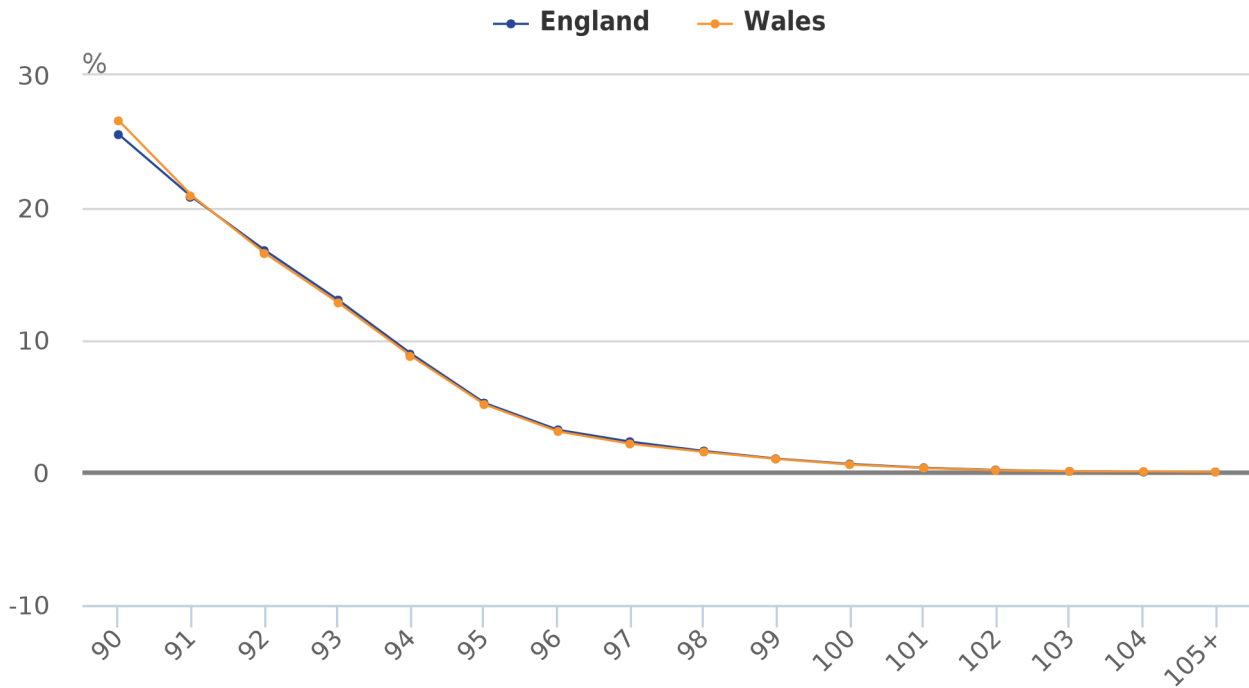
Figure 5c: Percentage difference between EVOs produced for Wales separately and EVOs produced for Wales by apportioning EVOs for England and Wales as a whole, Wales, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	1.3	0.6	0.1	1.1	2.0	3.6	6.1	3.2	0.8	1.4	1.3	1.6	3.9
91	-0.4	0.7	0.3	-0.3	0.3	-0.1	1.0	4.1	2.7	0.6	0.5	0.5	0.4
92	-0.8	0.7	0.4	-0.4	-0.6	-1.0	-2.1	0.2	4.1	2.4	0.3	0.1	-1.3
93	-1.0	-0.7	0.7	-0.7	-1.1	-1.2	-2.4	-2.9	-0.6	2.6	1.1	-1.3	-1.5
94	-0.5	-2.3	1.2	1.4	-1.8	-1.9	-2.5	-3.9	-5.1	-3.7	0.4	-0.2	-1.8
95	-0.4	-1.9	-3.6	1.1	1.0	-2.4	-3.2	-4.7	-4.9	-7.3	-5.5	0.0	-1.9
96	0.0	0.0	-3.8	-6.8	0.0	-0.5	-5.3	-5.8	-4.1	-4.9	-8.1	-4.7	-3.5
97	2.0	0.0	3.4	0.0	-8.3	-2.9	-4.8	-7.7	-5.1	-4.0	-3.2	-4.3	-6.5
98	3.3	-3.0	-2.8	5.4	-1.2	-6.9	-5.6	-5.8	-5.4	-1.8	0.8	-1.6	-3.9
99	-2.9	0.0	-9.3	-11.1	4.2	1.9	-7.4	-4.8	-7.6	-2.9	4.1	-1.3	-2.4
100	-5.0	4.8	4.2	-14.8	-10.3	0.0	0.0	-10.8	-10.3	-2.6	2.3	-2.2	-5.8
101	0.0	0.0	0.0	7.1	-6.3	-11.8	0.0	10.0	-4.5	-4.5	-8.3	-7.7	-6.7
102	-16.7	-16.7	-16.7	0.0	25.0	-11.1	-22.2	9.1	8.3	-16.7	-15.4	-7.1	-12.5
103	-33.3	0.0	33.3	33.3	25.0	20.0	0.0	0.0	16.7	-14.3	-14.3	0.0	0.0
104	0.0	-50.0	0.0	0.0	0.0	50.0	33.3	0.0	0.0	33.3	0.0	0.0	50.0
105	0.0	0.0	0.0	0.0	-100.0	0.0	100.0	100.0	0.0	-50.0	0.0	0.0	50.0

Figure 5d: Percentage difference between EVOs produced for Wales separately and EVOs produced for Wales by apportioning EVOs for England and Wales as a whole, Wales, females, 2002 to 2014 (mid-year point)

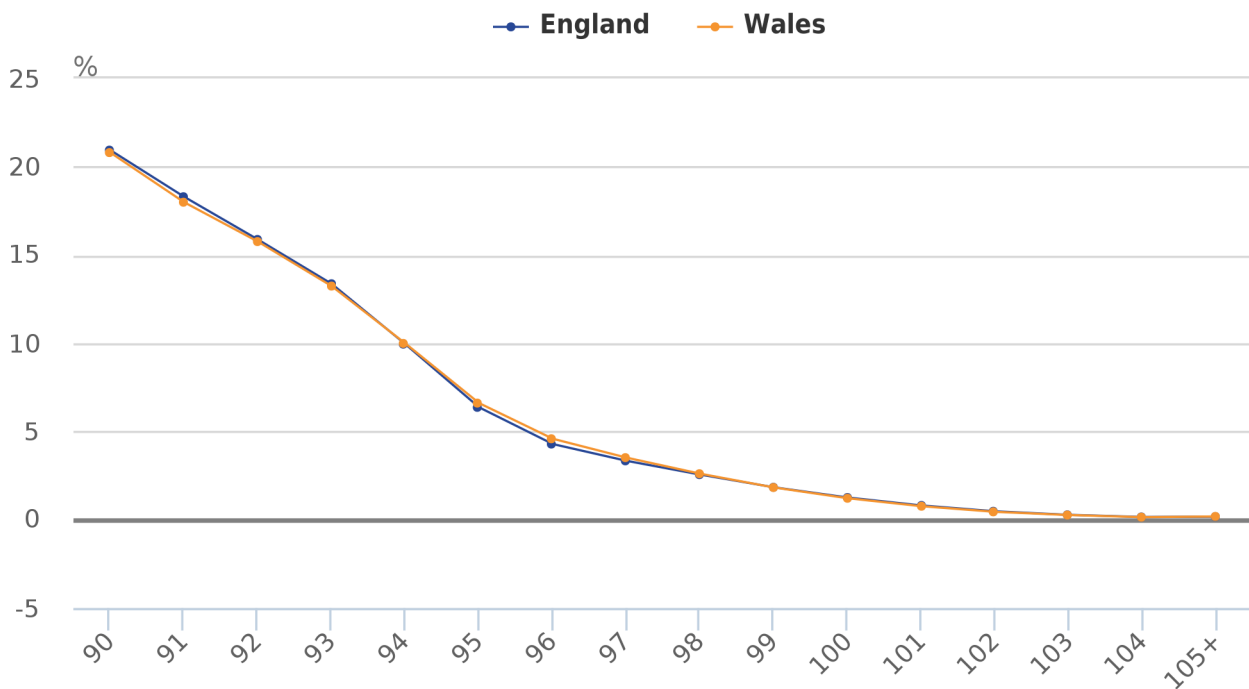
age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	-1.3	-1.2	0.1	1.2	3.1	5.0	4.9	2.3	-0.8	-1.6	-0.9	-1.7	-0.6
91	-0.2	-1.0	-1.4	0.1	0.8	1.5	3.1	4.3	2.5	-0.6	-1.1	-0.3	-1.6
92	0.3	-0.1	-1.8	-1.3	0.0	-0.4	-0.1	2.5	4.5	2.8	-0.3	-0.8	-0.7
93	1.1	0.3	-0.3	-2.0	-2.0	-1.0	-1.5	-0.7	2.4	4.9	2.8	0.0	-0.9
94	1.0	2.3	1.4	-0.6	-2.9	-3.3	-2.7	-2.5	-0.4	3.4	5.1	3.6	0.4
95	0.5	2.6	2.7	1.1	-1.1	-4.4	-5.5	-4.5	-2.4	0.7	4.1	6.0	3.6
96	2.0	0.4	1.8	2.4	1.1	-1.6	-5.1	-6.5	-4.3	-1.4	0.9	4.0	6.5
97	2.3	0.2	-0.2	0.7	-0.2	-0.3	-2.3	-5.1	-5.9	-4.0	-2.3	0.0	5.2
98	-1.1	3.0	1.8	-1.0	-2.4	-2.3	-1.3	-2.7	-5.5	-6.8	-5.0	-2.0	2.1
99	-2.9	2.8	6.0	1.2	-3.2	-3.4	-1.3	-3.1	-4.7	-5.8	-6.5	-3.4	-0.3
100	-4.5	-1.3	4.9	1.2	-5.7	-3.7	-1.0	-2.4	-4.5	-4.8	-5.3	-5.2	-3.1
101	-3.2	-4.2	1.0	0.0	-4.6	-6.1	-5.6	-1.5	-3.6	-6.9	-5.3	-5.2	-4.2
102	-3.6	-10.5	-3.4	4.8	3.0	-7.2	-9.7	-7.5	-3.5	-5.6	-5.4	-5.4	-5.1
103	0.0	-12.9	-12.1	-2.9	2.7	-2.5	-4.9	-11.1	-12.0	-1.9	-3.6	-5.5	-3.4
104	18.8	6.3	-5.9	-15.8	-15.0	-18.2	-8.7	0.0	-11.1	-10.0	-3.2	-3.2	-6.1
105	0.0	22.2	22.2	0.0	-18.2	-33.3	-16.7	7.7	14.3	0.0	-5.9	0.0	-10.5

Figure 6a: Age distribution calculated from 2014 EVOs produced separately for England and for Wales, males, age 90 to 105



Source: Office for National Statistics

Figure 6b: Age distribution calculated from 2014 EVOs produced separately for England and for Wales, females, age 90 to 105



Source: Office for National Statistics

5 . 2014 period life expectancies calculated from EVOs produced separately for England compared with life expectancies for England calculated from EVOs for England and Wales as a whole split by country

The impact of calculating period life expectancy (2014) for England and for Wales using EVOs produced separately for England and for Wales rather than Estimates of the very old (EVOs) for England and Wales “split” by country is examined in Tables 2a to 2c.

Period life expectancy decreases with age in England for both males and females but for males in Wales there is not a consistent decrease in life expectancy after age 96. These patterns are apparent regardless of whether England and Wales age 90 and over estimates “split” by country are used in the calculation of the life table or separately calculated age 90 and over estimates for England and for Wales are used.

The impact on both male and female period life expectancy at age 90 and above in England is negligible, 0.01 years difference up to age 100 for males and no differences for females.

The impact on period life expectancy at age 90 and over in Wales is more noticeable but also small. For males, life expectancy in Wales at age 90 and over decreases by approximately 0.1 of a year from ages 91 to 96 and by 0.2 of a year for ages 97 to 100; for females, life expectancy is very slightly higher at ages 90 to 97 (0.07) and lower at ages 98 to 100 (-0.07). (Life expectancy figures are published to 2 decimal places and up to age 100 only.)

At ages 85 and below, the impact on the life table for both England and Wales is zero.

The differences between life expectancy figures calculated using the 2 alternative sets of age 90 and over estimates as a percentage of life expectancies calculated using England and Wales (combined) age 90 and over estimates “split” by country are shown in Table 2c.

The largest percentage differences in life expectancies figures for England up to age 100 (published) is 0.41% for males and between -0.14% and 0.14% for females. However, in Wales the percentage differences are larger; up to -6.12% for males and between -2.73% and 2.16% for females.

Table 2a: Differences between 2014 period life expectancies for England calculated from EVOs produced separately for England and life expectancies calculated from EVOs for England and Wales as a whole split by country

ENGLAND: 2014 Expectation of life

MALES				FEMALES			
Age	LE -calculated from 'split' EVOs	LE -calculated from separate EVOs	Differences in LE - Separate - Split	Age	LE -calculated from 'split' EVOs	LE -calculated from separate EVOs	Differences in LE - Separate - Split
90	4.162164	4.163512	0.00	90	4.809093	4.808339	0.00
91	3.877318	3.880790	0.00	91	4.466187	4.465025	0.00
92	3.584136	3.588583	0.00	92	4.123633	4.121559	0.00
93	3.345598	3.350541	0.00	93	3.808450	3.805660	0.00
94	3.141197	3.146699	0.01	94	3.523577	3.519760	0.00
95	2.972790	2.978912	0.01	95	3.320774	3.316221	0.00
96	2.752018	2.759179	0.01	96	3.039531	3.035753	0.00
97	2.582350	2.590352	0.01	97	2.817259	2.816064	0.00
98	2.418153	2.425222	0.01	98	2.634686	2.636255	0.00
99	2.346099	2.353967	0.01	99	2.468678	2.472141	0.00
100	2.259850	2.269206	0.01	100	2.344559	2.349215	0.00

Source: Office for National Statistics

Table 2b: Differences between 2014 period life expectancies for Wales calculated from EVOs produced separately for Wales and life expectancies calculated from EVOs for England and Wales as a whole split by country

WALES: 2014 Expectation of life

MALES				FEMALES			
Age	LE -calculated from 'split' EVOs	LE -calculated from separate EVOs	Differences in LE - Separate - Split	Age	LE -calculated from 'split' EVOs	LE -calculated from separate EVOs	Differences in LE - Separate - Split
90	4.007458	3.981049	-0.03	90	4.670628	4.679488	0.01
91	3.742969	3.681057	-0.06	91	4.316064	4.330796	0.01
92	3.527417	3.446907	-0.08	92	3.996413	4.025887	0.03
93	3.359989	3.269240	-0.09	93	3.732930	3.774612	0.04
94	3.157396	3.055148	-0.10	94	3.445064	3.503181	0.06
95	2.915435	2.799528	-0.12	95	3.280956	3.351835	0.07
96	2.895511	2.754560	-0.14	96	3.089875	3.148463	0.06
97	3.024165	2.864846	-0.16	97	2.880119	2.900652	0.02
98	3.040388	2.897384	-0.14	98	2.746716	2.724499	-0.02
99	2.945183	2.792102	-0.15	99	2.515329	2.467587	-0.05
100	3.186022	2.991048	-0.19	100	2.464484	2.397256	-0.07

Source: Office for National Statistics

Table 2c: Percentage differences between 2014 period life expectancies calculated from EVOs produced separately for England and for Wales and 2014 life expectancies calculated from EVOs for England and Wales as a whole split by country

ENGLAND				WALES			
MALES		FEMALES		MALES		FEMALES	
Age	Percentage differences in LE (%)	Age	Percentage differences in LE (%)	Age	Percentage differences in LE (%)	Age	Percentage differences in LE (%)
90	0.03	90	-0.02	90	-0.66	90	0.19
91	0.09	91	-0.03	91	-1.65	91	0.34
92	0.12	92	-0.05	92	-2.28	92	0.74
93	0.15	93	-0.07	93	-2.70	93	1.12
94	0.18	94	-0.11	94	-3.24	94	1.69
95	0.21	95	-0.14	95	-3.98	95	2.16
96	0.26	96	-0.12	96	-4.87	96	1.90
97	0.31	97	-0.04	97	-5.27	97	0.71
98	0.29	98	0.06	98	-4.70	98	-0.81
99	0.34	99	0.14	99	-5.20	99	-1.90
100	0.41	100	0.20	100	-6.12	100	-2.73

Source: Office for National Statistics

6 . Plausibility tests

In the next section a number of plausibility tests are reported.

Mortality rates

Crude mortality rates have been calculated for males and females in England and males and females in Wales using Estimates of the very old (EVOs) calculated separately for the 2 countries.

Figures 7a and 7b show crude mortality rates for England, males and females respectively; Figures 7c and 7d show crude mortality rates for Wales, males and females respectively. We would expect mortality rates to increase with age. The rates look plausible for both sexes in both countries. They generally increase smoothly with age, and only appear to be implausible where populations are very small. A small improvement in mortality rates over time is evident.

There is an expectation that mortality rates for males will be higher than those for females at all ages and years. This assumption does not always hold in single-year life tables at the highest ages where populations are very small. This is the case regardless of whether England and Wales age 90 and over estimates "split" by country are used in the calculation of the life table or separately calculated age 90 and over estimates for England and for Wales are used.

We publish National life tables calculated for a 3-year period and only up to age 100. This averaging results in mortality rates that are higher for males than for females for age 90 to at least age 100 for both England and Wales, regardless of whether England and Wales (combined) age 90 and over estimates “split” by country are used in the calculation of the life table or separately calculated age 90 and over estimates for England and for Wales are used.

Figure 7a: Mortality rates, England, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	0.20	0.21	0.19	0.20	0.19	0.20	0.19	0.16	0.19	0.18	0.18	0.18	0.18
91	0.23	0.23	0.22	0.22	0.22	0.20	0.22	0.19	0.18	0.21	0.21	0.20	0.19
92	0.25	0.26	0.24	0.24	0.24	0.23	0.24	0.23	0.21	0.19	0.24	0.23	0.22
93	0.28	0.29	0.26	0.26	0.26	0.26	0.26	0.24	0.25	0.24	0.23	0.27	0.25
94	0.30	0.29	0.29	0.27	0.28	0.27	0.28	0.27	0.28	0.26	0.26	0.25	0.27
95	0.34	0.34	0.31	0.31	0.30	0.31	0.32	0.31	0.30	0.29	0.31	0.30	0.27
96	0.35	0.35	0.34	0.34	0.33	0.33	0.36	0.32	0.32	0.32	0.35	0.34	0.31
97	0.37	0.37	0.36	0.38	0.37	0.38	0.40	0.35	0.34	0.37	0.38	0.38	0.33
98	0.42	0.37	0.39	0.41	0.38	0.43	0.40	0.38	0.39	0.38	0.40	0.39	0.39
99	0.45	0.41	0.42	0.41	0.37	0.44	0.45	0.39	0.38	0.43	0.46	0.41	0.40
100	0.51	0.51	0.43	0.46	0.44	0.44	0.51	0.41	0.49	0.43	0.46	0.47	0.36

Figure 7b: Mortality rates, England, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	0.17	0.17	0.16	0.16	0.15	0.15	0.15	0.13	0.16	0.14	0.15	0.15	0.14
91	0.19	0.18	0.18	0.18	0.18	0.17	0.18	0.16	0.15	0.17	0.17	0.16	0.15
92	0.21	0.21	0.20	0.20	0.19	0.20	0.20	0.19	0.18	0.16	0.20	0.19	0.17
93	0.23	0.24	0.21	0.23	0.21	0.22	0.23	0.20	0.21	0.19	0.19	0.23	0.19
94	0.25	0.26	0.25	0.24	0.24	0.24	0.25	0.23	0.23	0.22	0.22	0.21	0.23
95	0.27	0.29	0.26	0.27	0.26	0.27	0.27	0.26	0.25	0.25	0.25	0.25	0.23
96	0.30	0.31	0.29	0.30	0.29	0.30	0.30	0.28	0.28	0.27	0.29	0.30	0.27
97	0.32	0.35	0.32	0.32	0.31	0.31	0.33	0.30	0.31	0.30	0.31	0.31	0.30
98	0.36	0.38	0.34	0.35	0.34	0.35	0.37	0.33	0.33	0.32	0.34	0.34	0.33
99	0.39	0.39	0.37	0.39	0.35	0.38	0.40	0.35	0.36	0.35	0.38	0.38	0.36
100	0.42	0.44	0.39	0.39	0.39	0.41	0.43	0.38	0.40	0.38	0.41	0.41	0.36

Figure 7c: Mortality rates, Wales, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	0.22	0.23	0.20	0.22	0.20	0.21	0.20	0.17	0.19	0.20	0.20	0.20	0.18
91	0.20	0.23	0.23	0.21	0.23	0.23	0.24	0.19	0.18	0.21	0.22	0.22	0.21
92	0.22	0.26	0.26	0.25	0.24	0.23	0.24	0.19	0.25	0.21	0.25	0.26	0.24
93	0.29	0.29	0.25	0.29	0.26	0.26	0.28	0.23	0.28	0.27	0.26	0.30	0.25
94	0.32	0.31	0.25	0.30	0.29	0.26	0.27	0.27	0.32	0.35	0.25	0.27	0.25
95	0.31	0.38	0.37	0.33	0.28	0.31	0.36	0.30	0.28	0.30	0.33	0.34	0.34
96	0.39	0.29	0.34	0.35	0.37	0.38	0.36	0.33	0.33	0.38	0.29	0.29	0.40
97	0.39	0.40	0.31	0.31	0.36	0.39	0.52	0.28	0.32	0.34	0.34	0.38	0.36
98	0.37	0.49	0.49	0.51	0.43	0.35	0.39	0.29	0.42	0.36	0.36	0.43	0.31
99	0.41	0.44	0.46	0.40	0.36	0.43	0.50	0.46	0.52	0.25	0.44	0.47	0.41
100	0.26	0.45	0.44	0.52	0.38	0.55	0.48	0.24	0.46	0.32	0.61	0.60	0.33

Figure 7d: Mortality rates, Wales, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	0.18	0.17	0.17	0.16	0.16	0.17	0.15	0.14	0.17	0.14	0.15	0.15	0.14
91	0.19	0.19	0.19	0.17	0.18	0.18	0.19	0.16	0.15	0.17	0.16	0.18	0.17
92	0.21	0.24	0.21	0.21	0.20	0.20	0.20	0.20	0.18	0.16	0.20	0.20	0.19
93	0.26	0.23	0.22	0.24	0.22	0.22	0.22	0.21	0.21	0.19	0.20	0.22	0.20
94	0.26	0.25	0.26	0.26	0.24	0.26	0.28	0.24	0.22	0.21	0.23	0.22	0.25
95	0.27	0.29	0.29	0.27	0.27	0.27	0.28	0.29	0.25	0.25	0.25	0.26	0.25
96	0.34	0.33	0.32	0.31	0.29	0.31	0.28	0.28	0.27	0.27	0.31	0.32	0.25
97	0.38	0.35	0.32	0.37	0.36	0.31	0.35	0.29	0.33	0.30	0.34	0.31	0.29
98	0.33	0.36	0.33	0.37	0.34	0.35	0.36	0.37	0.34	0.32	0.34	0.35	0.29
99	0.39	0.36	0.40	0.44	0.40	0.34	0.40	0.44	0.37	0.36	0.35	0.39	0.38
100	0.45	0.42	0.40	0.58	0.43	0.39	0.39	0.37	0.41	0.39	0.42	0.39	0.34

a) Join between mid-year population estimates and EVOs at ages 89 and 90

We produce mid-year estimates by single year of age and sex up to age 89 for England and for Wales using the cohort component method. The “join” between the estimates at age 89 in year t-1 produced using this method and EVOs at age 90 in year t, produced for England and for Wales separately, was checked for plausibility.

Figures 8a and 8b show the join at ages 89 and 90 in the estimates for England, males and females; figures 8c and 8d show the join in the estimates for Wales; figures 8e and 8f show the join in the estimates for England and Wales combined (current method). Each cell represents age x, year t as a proportion of age x-1, year t-1.

As some people in each cohort will die every year we would not expect values of 1 or more. Cohort decline generally looks smooth across the “join” at ages 89 and 90 for both sexes in both countries. There are a few oddities; however, these are observed in the join in both the separate country estimates and also in the join in the estimates for England and Wales combined.

b) Volatility of EVOs over time

The smaller a population the more likely there is to be volatility in population estimates over time. It is therefore to be expected that EVOs produced for Wales would show more volatility than the combined England and Wales EVOs, particularly for males and at the highest ages where numbers are lowest. Equivalent 90 and over single year of age population estimates are, however, produced by NISRA, which has a substantially smaller population than Wales. In 2015 the total population in Northern Ireland was 1.85 million with 12,400 aged 90 and over. The equivalent figures for Wales were 3.1 million and 29,000.

Figure 8a: Join from MYE (age 89) to EVO (age 90), England, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
85	0.88	0.88	0.89	0.88	0.89	0.89	0.89	0.90	0.90	0.90	0.91	0.90	0.91
86	0.86	0.87	0.86	0.89	0.87	0.87	0.88	0.88	0.89	0.89	0.89	0.89	0.90
87	0.85	0.85	0.85	0.86	0.88	0.86	0.87	0.87	0.88	0.88	0.88	0.88	0.89
88	0.84	0.85	0.84	0.84	0.85	0.88	0.84	0.85	0.87	0.87	0.87	0.87	0.88
89	0.82	0.83	0.83	0.83	0.84	0.84	0.87	0.83	0.84	0.85	0.85	0.85	0.86
90	0.85	0.86	0.86	0.85	0.89	0.87	0.90	0.79	0.88	0.89	0.86	0.86	0.86
91	0.80	0.79	0.80	0.80	0.79	0.81	0.79	0.84	0.81	0.80	0.82	0.81	0.84
92	0.78	0.77	0.78	0.78	0.77	0.79	0.78	0.82	0.79	0.78	0.80	0.80	0.82
93	0.76	0.75	0.76	0.77	0.76	0.77	0.76	0.80	0.77	0.76	0.78	0.78	0.80
94	0.74	0.74	0.74	0.75	0.74	0.75	0.74	0.78	0.75	0.74	0.77	0.76	0.78
95	0.72	0.72	0.72	0.73	0.72	0.74	0.72	0.76	0.72	0.72	0.75	0.74	0.76

Figure 8b: Join from MYE (age 89) to EVO (age 90), England, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
85	0.91	0.91	0.92	0.91	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.93	0.93
86	0.90	0.90	0.90	0.92	0.90	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.93
87	0.89	0.89	0.89	0.90	0.91	0.90	0.90	0.90	0.91	0.91	0.91	0.91	0.92
88	0.88	0.88	0.88	0.88	0.88	0.91	0.88	0.89	0.90	0.90	0.90	0.90	0.91
89	0.87	0.87	0.87	0.87	0.87	0.87	0.89	0.87	0.88	0.89	0.89	0.88	0.89
90	0.87	0.87	0.86	0.85	0.88	0.87	0.91	0.83	0.87	0.87	0.89	0.88	0.89
91	0.84	0.84	0.84	0.84	0.84	0.85	0.84	0.86	0.86	0.86	0.86	0.85	0.87
92	0.82	0.82	0.82	0.83	0.83	0.84	0.82	0.84	0.84	0.84	0.84	0.83	0.86
93	0.80	0.80	0.80	0.81	0.81	0.82	0.80	0.83	0.83	0.82	0.82	0.81	0.84
94	0.78	0.78	0.78	0.79	0.79	0.80	0.78	0.81	0.81	0.81	0.81	0.79	0.82
95	0.77	0.76	0.76	0.77	0.77	0.78	0.76	0.79	0.79	0.79	0.79	0.78	0.80

Figure 8c: Join from MYE (age 89) to EVO (age 90), Wales, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
85	0.87	0.87	0.90	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.90
86	0.87	0.87	0.85	0.89	0.87	0.86	0.87	0.88	0.88	0.89	0.89	0.88	0.89
87	0.86	0.85	0.85	0.85	0.87	0.86	0.85	0.86	0.87	0.87	0.88	0.87	0.88
88	0.84	0.84	0.85	0.84	0.84	0.88	0.84	0.83	0.85	0.85	0.87	0.87	0.87
89	0.83	0.81	0.81	0.83	0.83	0.83	0.88	0.83	0.83	0.85	0.84	0.83	0.87
90	0.87	0.83	0.86	0.85	0.86	0.87	0.92	0.72	0.88	0.91	0.83	0.84	0.84
91	0.79	0.79	0.80	0.78	0.80	0.79	0.77	0.86	0.80	0.77	0.82	0.80	0.83
92	0.78	0.78	0.78	0.76	0.79	0.78	0.76	0.85	0.78	0.75	0.80	0.79	0.80
93	0.75	0.75	0.76	0.74	0.77	0.77	0.75	0.83	0.76	0.72	0.78	0.76	0.78
94	0.73	0.72	0.75	0.74	0.74	0.75	0.73	0.81	0.72	0.69	0.75	0.74	0.78
95	0.71	0.70	0.71	0.71	0.73	0.73	0.71	0.78	0.71	0.68	0.74	0.73	0.75

Figure 8d: Join from MYE (age 89) to EVO (age 90), Wales, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	0.91	0.91	0.92	0.91	0.92	0.92	0.91	0.92	0.92	0.92	0.92	0.92	0.92
91	0.90	0.90	0.90	0.91	0.91	0.91	0.90	0.91	0.90	0.92	0.91	0.91	0.92
92	0.89	0.90	0.89	0.89	0.91	0.89	0.90	0.90	0.90	0.91	0.90	0.90	0.92
93	0.88	0.87	0.88	0.88	0.88	0.90	0.89	0.89	0.90	0.89	0.90	0.89	0.89
94	0.87	0.86	0.86	0.86	0.87	0.87	0.90	0.88	0.89	0.88	0.89	0.88	0.89
95	0.85	0.87	0.85	0.85	0.87	0.86	0.87	0.79	0.82	0.85	0.87	0.87	0.88
96	0.84	0.83	0.83	0.84	0.84	0.84	0.84	0.87	0.87	0.86	0.86	0.84	0.86
97	0.82	0.81	0.81	0.82	0.83	0.83	0.82	0.85	0.85	0.85	0.84	0.82	0.84
98	0.80	0.79	0.80	0.80	0.81	0.81	0.81	0.83	0.83	0.83	0.82	0.80	0.83
99	0.78	0.78	0.79	0.78	0.79	0.79	0.79	0.81	0.82	0.82	0.81	0.79	0.81
100	0.77	0.77	0.76	0.76	0.77	0.77	0.76	0.78	0.79	0.80	0.79	0.77	0.79

Figure 8e: Join from MYE (age 89) to EVO (age 90), England and Wales combined, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
85	0.88	0.88	0.89	0.88	0.88	0.89	0.89	0.90	0.90	0.90	0.91	0.90	0.91
86	0.86	0.87	0.86	0.89	0.87	0.87	0.88	0.88	0.89	0.89	0.89	0.89	0.90
87	0.85	0.85	0.85	0.86	0.88	0.86	0.87	0.87	0.88	0.88	0.88	0.88	0.89
88	0.84	0.85	0.84	0.84	0.85	0.88	0.84	0.85	0.87	0.87	0.87	0.87	0.88
89	0.82	0.83	0.83	0.83	0.84	0.84	0.87	0.83	0.84	0.85	0.85	0.85	0.86
90	0.85	0.85	0.86	0.85	0.89	0.87	0.90	0.78	0.88	0.89	0.86	0.86	0.85
91	0.80	0.79	0.80	0.80	0.79	0.81	0.79	0.84	0.81	0.79	0.82	0.81	0.83
92	0.78	0.77	0.78	0.78	0.77	0.79	0.78	0.82	0.79	0.78	0.80	0.80	0.82
93	0.76	0.75	0.76	0.76	0.76	0.77	0.76	0.80	0.77	0.76	0.78	0.77	0.80
94	0.74	0.73	0.74	0.75	0.74	0.75	0.74	0.79	0.75	0.74	0.77	0.76	0.78
95	0.72	0.71	0.72	0.72	0.72	0.74	0.72	0.76	0.72	0.72	0.75	0.74	0.76

Figure 8f: Join from MYE (age 89) to EVO (age 90), England and Wales combined, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
85	0.91	0.91	0.92	0.91	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.93	0.93
86	0.90	0.90	0.90	0.91	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.93
87	0.89	0.89	0.89	0.90	0.91	0.89	0.90	0.90	0.91	0.91	0.91	0.91	0.92
88	0.88	0.88	0.88	0.88	0.88	0.91	0.88	0.89	0.90	0.90	0.90	0.90	0.90
89	0.87	0.87	0.87	0.86	0.87	0.87	0.89	0.87	0.88	0.89	0.89	0.88	0.89
90	0.87	0.87	0.86	0.85	0.88	0.87	0.91	0.83	0.87	0.87	0.89	0.88	0.89
91	0.84	0.84	0.84	0.84	0.84	0.85	0.84	0.86	0.86	0.86	0.86	0.85	0.87
92	0.82	0.82	0.82	0.83	0.83	0.83	0.82	0.85	0.84	0.84	0.84	0.83	0.85
93	0.80	0.80	0.80	0.81	0.81	0.82	0.80	0.83	0.83	0.82	0.82	0.81	0.84
94	0.78	0.78	0.78	0.79	0.79	0.80	0.78	0.81	0.81	0.81	0.81	0.79	0.82
95	0.77	0.76	0.76	0.77	0.77	0.78	0.76	0.79	0.79	0.79	0.79	0.78	0.80

7 . Apportioning unassigned deaths

There are a small proportion of deaths that are registered in England and Wales that are not assigned to either England or to Wales. On average, these account for around 0.04% of all deaths at age 90 and over registered in England and Wales per year. This is not an issue for Estimates of the very old (EVOs) produced for England and Wales as a whole; however, if EVOs are produced for England and for Wales separately a decision is required about how to treat these deaths.

In the analysis presented to this point in the report, these unassigned deaths have been included with England deaths in the calculation of the separate country EVOs.

In the following analysis the unassigned deaths for a given age have been apportioned to England deaths and Wales deaths according to each country's proportion of all deaths at age 90 and over assigned to England or Wales. EVOs for England and for Wales have then been calculated from these deaths.

Figures 9a and 9b show the difference between EVOs produced for England from deaths data where unassigned deaths have been apportioned between England and Wales deaths and EVOs calculated from deaths where all unassigned deaths have been included with England deaths. Figures 9c and 9d show the differences between the EVOs for Wales calculated from the alternative versions of deaths data.

Figures 9a to 9d show the 2 approaches to dealing with the unassigned deaths produce minimal differences. This is unsurprising since the vast majority of deaths occur in England, so apportioning unassigned deaths rather than including them all with England only changes the number of England and Wales deaths slightly. Also the estimates calculated from the 2 versions of the deaths data are constrained to the same MYE totals.

Although the 2 approaches to dealing with unassigned deaths produce very similar results, it could be argued that apportioning the deaths is sounder methodologically.

Figure 9a: Difference between EVOs produced when unassigned deaths are apportioned to England and to Wales and EVOs produced when unassigned deaths are included in England deaths, England, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	1.00	0.00	0.00	-1.00	0.00	0.00	1.00	-1.00	0.00	1.00	1.00	0.00	0.00
91	-1.00	0.00	1.00	0.00	-1.00	-1.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00
92	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
93	1.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
94	-1.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	-1.00	0.00	0.00
95	0.00	1.00	-1.00	0.00	0.00	0.00	-1.00	1.00	0.00	0.00	0.00	0.00	0.00
96	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00
97	0.00	0.00	-1.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00
101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00	0.00	0.00
104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	0.00
105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 9b: Difference between EVOs produced when unassigned deaths are apportioned to England and to Wales and EVOs produced when unassigned deaths are included in England deaths, England, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	0.00	0.00	0.00	0.00	-1.00	-1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
91	-1.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00	1.00	0.00	0.00
92	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-1.00	1.00	-1.00	0.00	0.00	0.00
93	-1.00	0.00	0.00	-1.00	1.00	0.00	-1.00	0.00	0.00	1.00	0.00	0.00	0.00
94	1.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	-1.00	0.00	0.00
95	0.00	1.00	1.00	0.00	-1.00	-1.00	0.00	0.00	-1.00	0.00	0.00	0.00	0.00
96	0.00	0.00	-1.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
97	1.00	-1.00	-1.00	-1.00	0.00	0.00	0.00	0.00	-1.00	0.00	-1.00	0.00	0.00
98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
99	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101	0.00	0.00	0.00	0.00	0.00	0.00	1.00	-1.00	0.00	0.00	0.00	0.00	0.00
102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 9c: Difference between EVOs produced when unassigned deaths are apportioned to England and to Wales and EVOs produced when unassigned deaths are included in England deaths, Wales, males, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	0.0	0.0	1.0	2.0	2.0	2.0	3.0	4.0	5.0	4.0	4.0	4.0	2.0
91	0.0	1.0	1.0	1.0	2.0	1.0	1.0	2.0	2.0	2.0	3.0	3.0	4.0
92	1.0	-1.0	0.0	0.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	3.0
93	-1.0	0.0	0.0	0.0	-1.0	0.0	0.0	1.0	0.0	0.0	1.0	2.0	2.0
94	0.0	0.0	0.0	0.0	-1.0	0.0	0.0	-1.0	1.0	-1.0	1.0	0.0	0.0
95	0.0	0.0	0.0	-1.0	-1.0	0.0	-1.0	0.0	0.0	1.0	-1.0	0.0	0.0
96	0.0	-1.0	-1.0	0.0	0.0	0.0	0.0	-1.0	-1.0	0.0	-1.0	-1.0	-1.0
97	0.0	0.0	-1.0	-1.0	0.0	0.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
98	0.0	0.0	0.0	-1.0	0.0	-1.0	-1.0	-1.0	0.0	-1.0	-1.0	-1.0	-1.0
99	0.0	1.0	0.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
100	0.0	0.0	0.0	0.0	-1.0	-1.0	-1.0	0.0	-1.0	-1.0	-1.0	-1.0	-1.0
101	0.0	0.0	0.0	0.0	0.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
102	0.0	0.0	0.0	1.0	0.0	0.0	0.0	-1.0	-1.0	0.0	0.0	-1.0	-1.0
103	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-2.0	-1.0	0.0	0.0	-1.0
104	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-1.0	-1.0	0.0	-1.0
105	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-1.0	0.0

Figure 9d: Difference between EVOs produced when unassigned deaths are apportioned to England and to Wales and EVOs produced when unassigned deaths are included in England deaths, Wales, females, 2002 to 2014 (mid-year point)

age\year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
90	1.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00
91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	1.00	-1.00	0.00	0.00
92	0.00	-1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	-1.00	0.00
93	-1.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00	0.00	-1.00
94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	-1.00	-1.00	0.00	-1.00	0.00
95	0.00	0.00	-1.00	0.00	1.00	1.00	-1.00	0.00	0.00	0.00	0.00	1.00	0.00
96	0.00	0.00	0.00	0.00	-1.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
97	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	-1.00	1.00	0.00	0.00	0.00	0.00
98	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	-1.00	1.00	0.00	0.00	1.00	0.00
99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00	0.00
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
104	0.00	0.00	0.00	0.00	0.00	1.00	0.00	-1.00	0.00	0.00	0.00	0.00	0.00
105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

8 . Recommendations and outcome

The following recommendations were made on the basis of the research findings reported above:

- produce 2002 to 2015 Estimates of the very old (EVOs) for England and for Wales separately using the Kannisto-Thatcher (KT) method; supply these estimates to produce the 2013 to 2015 National life tables and publish the EVOs at the end of September 2016
- apportion unassigned England and Wales deaths to England and to Wales for a given age according to each country's proportion of all deaths at age 90 and over

These recommendations were considered by a group of internal and external methodology experts. The recommendations were accepted by the review group and actioned for the September 2016 releases, [Estimates of the Very Old \(including Centenarians\): England and Wales, and United Kingdom, 2002 to 2014](#) and the [National life tables, UK: 2013–2015](#).

