

## Population And Migration Statistics (PAMS) Committee (Scotland)

### Update on the development of single year of age population estimates for administrative areas in Scotland for those aged 90+.

#### 1. Introduction

This paper provides an update of the work carried out by the Population and Migration Statistics team to investigate potential methods for producing single year of age estimates for those aged 90+ at a sub-Scotland level. These estimates are needed because of methodological changes introduced in 2012 by Eurostat, the statistical institute of the European Union, which affect the way age-standardised rates are calculated. These rates cannot be fully produced without population estimates at higher ages.

PAMS members' views are welcome on these estimates

#### 2. Background

- 2.1 National Records of Scotland (NRS) currently publish mid-year estimates by single-year of age from 0 to 89 and then aggregated at ages 90+ for Scotland and administrative areas. These are calculated using the standard Cohort-Component method where the previous year's estimates are aged-on, births added, deaths removed and net migration applied. Further information can be found in the [Mid-Year Population Estimates for Scotland: Methodology Guide](#) (PDF 332Kb) on the NRS website.
- 2.2 Single year of age estimates for 90 to 104 and then aggregated 105+ at Scotland level are produced using the Kannisto-Thatcher (KT) method. The KT method is well-established as a method for estimating the population at higher ages and works on the assumption that a person who dies in the current year will have been alive the previous year. From this assumption a survivor ratio can be determined and used to build a distribution of the people who died in the year; that distribution is then applied to the published 90+ total. The KT method assumes zero migration. While recordings of international migration at higher ages is very low, it is important that this assumption be tested to ensure internal migration can also be considered to be negligible at very old ages. Further information on the [Survivor Ratio Method](#) can be found on the Demographic Research website.
- 2.3 In response to the revised version of the European Standard Population published by Eurostat, the Office for National Statistics (ONS) carried out some research at smaller administrative areas. The method proposed for Lower Layer Super Output Areas (LSOAs) level uses data from the England and Wales Patient Register, along with existing population estimates for LSOAs and for the very old, to provide age-distributions at the smaller area levels. Further information can be found in a [research paper](#) (ZIP file) on the ONS website.

### 3. Options

We are considering the following options and have generated estimates for 2012-2014:

- 3.1 Extend the Cohort-Component method from 90+ to 100+.
- 3.2 Expand the KT method to sub-Scotland level.
- 3.3 Replicate ONS trial method using NHS Central Registrar (NHSCR) data.
- 3.4 Assume a Constant Ratio at age 90+ per sub-Scotland area.
- 3.5 Other.

### 4. Estimates

This section presents some key points which have resulted from the production of estimates and the analysis work so far completed:

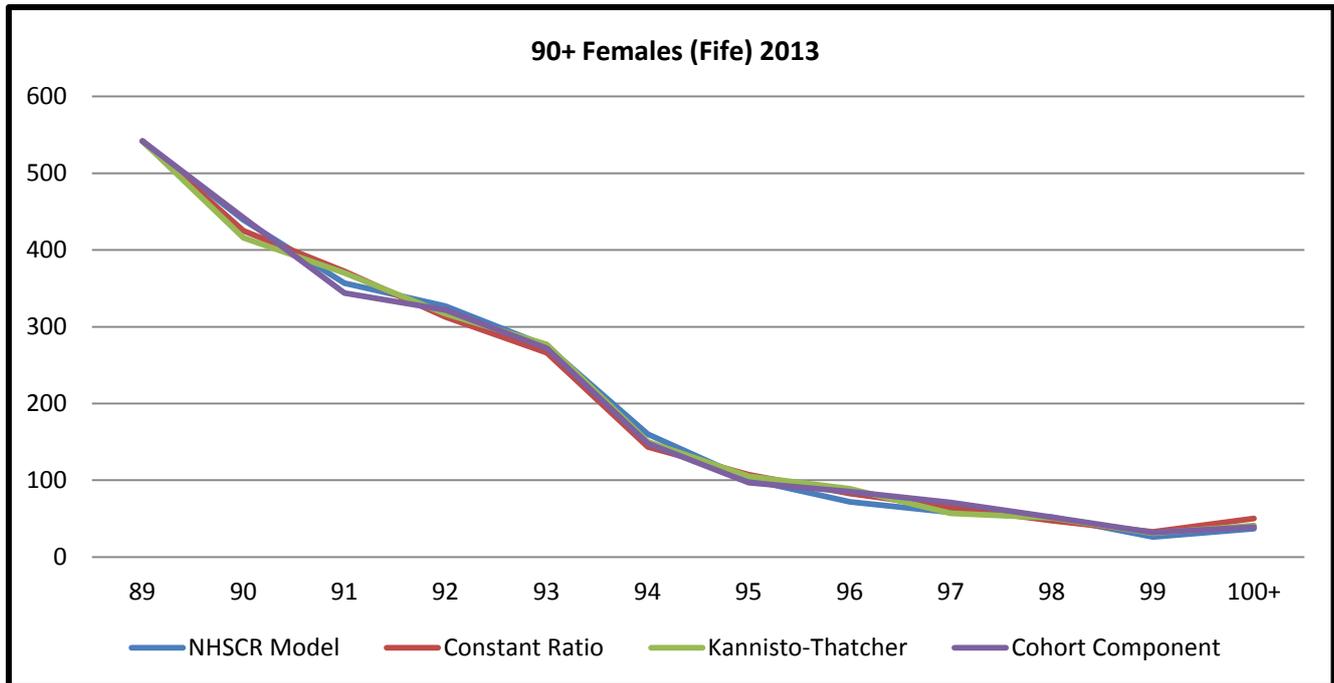
- 4.1 Analysis of census data suggests that a close-to-constant ratio can be assumed

	Percentage of Persons per SYOA (Scotland)										
	90	91	92	93	94	95	96	97	98	99	100
Dundee	3%	3%	3%	2%	3%	3%	3%	2%	3%	2%	2%
Inverclyde	2%	2%	2%	2%	2%	2%	1%	1%	2%	2%	2%
Midlothian	1%	1%	1%	1%	1%	1%	1%	1%	2%	1%	1%
South Lanarkshire	5%	5%	5%	6%	5%	6%	6%	5%	5%	6%	5%
West Lothian	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%

#### Sample of results from analysis of 2011 Census Data for applicability of the Constant Ratio method

- 4.2 Analysis of census data against published migration figures shows that the scale of NHSCR migration is robust at older ages. Between 2011-2013 NHSCR data shows for 90% of council areas, net migration for those aged 90+ is less than 2%, while for over half of council areas this figure was less than 1%.
- 4.3 Iterative proportional fitting is used throughout to ensure that estimates produced are consistent with both existing local authority mid-year estimates and the published Scotland level estimates at single year of age up to 90+.

4.4 All methods trialled give broadly similar estimation results, particularly for the larger council areas:



Comparative sample of results for females (Fife) from all 2013 estimates

4.5 Results from correlation analysis on a random selection of results show a high correlation between all methods trialled but the correlation between the estimates produced via the NHSCR and Cohort-Component methods is particularly high. This is considered a positive result as they are each constructed from largely independent data sources<sup>1</sup>.

2013 Males	Aberdeen	Argyll	Clackmannanshire	Fife	Glasgow	Shetland	Average
NHSCR / CR	0.9785	0.9906	0.9337	0.9911	0.9987	0.8659	0.9597
NHSCR / KT	0.9704	0.9718	0.9360	0.9923	0.9967	0.8392	0.9511
NHSCR / CC	0.9979	0.9956	0.9602	0.9978	0.9935	0.9447	0.9816
CR / KT	0.9740	0.9811	0.9808	0.9897	0.9967	0.8261	0.9581
CR / CC	0.9737	0.9854	0.9456	0.9903	0.9954	0.9471	0.9729
KT / CC	0.9620	0.9711	0.9565	0.9869	0.9941	0.8169	0.9479

Correlation analysis between all method results for males from six samples for 2013 estimates

**Footnote**

1) NHSCR flow data is used to determine net migration in the Cohort-Component method.

## 5. Summary and analysis

- 5.1 The use of the NHSCR method going forward is being considered, however the same data is not easily available retrospectively before 2012. It was intended that estimates be produced both going forward, and looking back to 2011.
- 5.2 The Cohort-Component method, also being considered, directly uses death data from the NRS Vital Events team. This is considered to be very reliable and can also be used to produce estimates retrospectively.
- 5.3 The Cohort-Component method used at these ages is particularly vulnerable to the problems of small area estimation and a small under-estimation one year has the potential to result in a negative population estimate the following year.
- 5.4 Cohort-Component is ultimately based on the last census so is subject to sampling-error and non-sampling error. Furthermore, any errors in estimation one year would be retained until the following census.
- 5.5 The KT method used at Scotland-level uses the past five years' data to calculate the survival ratio in order to minimise the effect of irregularities in death rates. Initial trials carried out at council area level suggest that this technique may in fact distort results at smaller population levels.
- 5.6 Techniques used in estimation of mortality rates, such as logistic regression, were considered but were rejected as overly complex and less transparent.

**6. Further work**

- 6.1 Extend the correlation analysis beyond the sample group to include results for all council areas.
- 6.2 Investigate the use of data from the Community Health Index (CHI) in place of the NHSCR for producing estimates prior to 2012.
- 6.3 Adjust the KT method to include fewer years in the survival ratio to determine whether this eliminates or reduces possible distortion.
- 6.4 Produce trial estimates at smaller geographical areas to determine feasibility.
- 6.5 Produce estimates using a form of combination method and compare results.

**7. Recommendations**

- 7.1 We aim to make a final recommendation by the end of June and publish trial estimates for council areas in September alongside the 90+ estimates for Scotland which will continue to be produced using the KT method.
- 7.2 Views from the PAMS Committee are sought on the points outlined as options and issues raised in the main body of the text.

NRS: Population and Migration Statistics branch  
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