

# **Appendix B: Projection methodology**

## Projection methodology

This appendix was compiled from detailed reports supplied by the Australian Bureau of Statistics (ABS) on the methods used to derive the population projections which formed the basis for the results presented in this publication. Depending on the context, the starting point for particular projections was either 1996 estimated resident population data or the latest census data.

### Nature of projections

The nature of the projection method and inherent fluctuations in population dynamics mean that care should be taken when using and interpreting the projection results. The projections are not forecasts, but simply illustrate future changes which would occur if the Stated assumptions were to apply over the projection period. It is important to recognise that the projection results essentially reflect the size and structure of the 1996 State/Territory birthplace populations and the Series H assumptions made about future interstate migration and mortality trends. There can be no certainty that they will be realised.

### Australian projections by birthplace

The cohort, component method was used to produce projections of the Australian population as a whole for selected birthplaces by age and sex from a base population at 30 June 1996 to the year 2026. This general method involves applying fertility and mortality rates and migration-level rates to the base population to produce a projected population for the following year, which in turn becomes the base population for projecting the next year, and so on until the projection horizon is reached. As the focus of interest was the 65+ age group it was not necessary to incorporate any fertility assumptions into the projections and the decision was made to assume zero overseas migration.

The Australian-level projections were constrained to the published Series H projections (which assumes no overseas migration) from the 1997 to 2051 issue of the ABS Population Projections (Cat. no 3222.0) which were the underlying collection of projections used to produce consistency in the overall project.

The projections were produced for a total of 50 overseas birthplaces, all of which are represented in the supplementary tables in detail.

For each birthplace, the population is reduced by the number of deaths in this population each year. Examination of the mortality experience of overseas-born persons revealed that some birthplaces had significantly different death rates from those of the overall Australian population. Consequently, where appropriate, standard mortality ratios (SMRs) were used to adjust Australian mortality rates, which were then applied to the various birthplace populations to produce birthplace projections for Australia.

### State/Territory projections by birthplace

The cohort-component method was not suitable for producing the State/Territory birthplace projections due to the large number of small populations to be projected (resulting in a lack of reliable State/Territory migration data and death data for each birthplace).

Also due to small population sizes, the State/Territory projections and remaining projections at more detailed geographical levels were calculated using 5-year age-group data, as opposed to the single year of age data for which the Australian-level projections were produced.

The data used to produce the projections were:

- Published 30 June 1996 State/Territory estimated resident population (ERP) data split by birthplace and sex aggregated into 5-year age groups (35–39, 40–44, ..., 95+);
- The Australian-level birthplace projections aggregated into 5-year age groups for every fifth year from 2001 to 2026; and
- The Series H projections aggregated into 5-year age groups.

The dimensionality involved makes it difficult to document the basic techniques in a global way without excess technicality, so this section tracks the central ideas involved for a particular case, namely, the State/Territory birthplace projections for the male age groups 45–49, 50–54, 55–59, 60–64, 65–69, 70–74 for the years 2001, 2006, 2011, 2016, 2021 and 2026 respectively.

Firstly, for example, consider birthplace BP(1) and the male age group 40–44.

From the 1996 ERP data, the State/Territory numbers (as indicated in the table below) are, say,  $X_1, X_2, \dots, X_8$ , which give corresponding proportions  $P_1, P_2, \dots, P_8$  summing to unity. Let  $\underline{X}$  be the Australian projection for the birthplace BP(1) for the male age group 45–49 in the year 2001. For this age group the 2001 preliminary projections for State/Territory are estimated as  $P_1 \cdot \underline{X}, P_2 \cdot \underline{X}, \dots, P_8 \cdot \underline{X}$  which for convenience are relabelled  $U_1, U_2, \dots, U_8$  as indicated in the table at step 2. This procedure assumes that the State/Territory distribution of the projected population aged 45–49 takes on the distribution of the age 40–44 population 5 years earlier. This assumes no interstate migration at this stage of the procedure.

Using the same approach for all birthplace categories under consideration, the table at step 2 is fully populated and the column totals for each birthplace category sum to the corresponding Australian birthplace projections for 2001.

**Birthplace Step 1: 1996 ERP data - age group 40-44**

	BP(1)	BP(2)	...				BP(R)	Total
<b>State/Territory Numbers</b>								
NSW	X1	Y1					Z1	T1
Vic	X2	Y2					Z2	T2
Qld	X3	Y3					Z3	T3
SA	X4	Y4					Z4	T4
WA	X5	Y5					Z5	T5
Tas	X6	Y6					Z6	T6
ACT	X7	Y7					Z7	T7
NT	X8	Y8					Z8	T8
Australia	X	Y					Z	T

**Birthplace Step 2: 2001 preliminary estimates for 45-49 age group based on Australian birthplace projections.**

	BP(1)	BP(2)	...				BP(R)	
<b>State/Territory Numbers</b>								
NSW	U1	V1					W1	T1*
Vic	U2	V2					W2	T2*
Qld	U3	V3					W3	T3*
SA	U4	V4					W4	T4*
WA	U5	V5					W5	T5*
Tas	U6	V6					W6	T6*
ACT	U7	V7					W7	T7*
NT	U8	V8					W8	T8*
Australia projection	U	V					W	T

At this stage, the column totals U, V, ..., W will total to the correct number for the group under consideration but the individual row totals ( e.g.  $U1 + V1 + \dots + W1$  ) may not agree with corresponding Series H projection numbers. A forcing process uses an iterative procedure until rows and columns add to the required numbers so that the columns sum to the relevant Australian level projections and rows sum to the relevant Series H numbers. The forcing of the projections to Series H incorporates the interstate migration assumptions inherent in the Series H projections.

For later years in the projection process (beyond 2001) the previous completed *derived* table is used as the starting point but the same method is applied.

For example, once the last table has been forced to the required internal consistency, it becomes the starting point for males aged 50–54 years in 2006.

### **Interstate migration assumptions by birthplace**

Interstate migration by birthplace was implicitly assumed by the process, such that the change in the population of any birthplace within a particular State/Territory was dependant upon the initial size of that population within the State/Territory and the overall change in population of the State/Territory, subject to the constraint of the Australia-level projection of that birthplace.

The majority of change (in absolute terms) in any State/Territory therefore occurs to the Australian birthplace category, as it comprises the majority of population in all States and territories.

### **Statistical Local Area (SLA) projections by birthplace**

In the preceding example on State/Territory projections we noted that the first step uses the 30 June 1996 ERP and later years build on derived results.

In the case of the SLA projections the methodology is essentially the same but the starting point to get to the 2001 projections comes from 1996 Census data.

Once the initial table is populated with this data and brought in line with the published June 1996 ERP, the method of obtaining forward projections follows in the same way, using the ageing method and forcing consistency with Series H.

### **Australian projections by language spoken at home (by birthplace)**

As with the SLA projections the starting point is the 1996 Census data.

Question 17 asks: Does the person speak a language other than English at home?

Each respondent was allocated to the language they indicated.

Thus, for example, the number of people speaking French at home was obtained from Census data. Contributions to the number speaking a particular language could thus come from a number of countries.

Birthplace by language for 1996 was constrained to the 1996 ERP results.

The ageing method as described was then applied, again forcing consistency with Series H.

### **State/Territory projections by language spoken at home (by birthplace)**

To obtain State/Territory language projections, the Australian-level birthplace by language projections produced above were disaggregated using the method described above, using propensities calculated from the 1996 birthplace by language Census data for each State/Territory again constrained to 1996 ERP for the first step.

## **SLA-level projections**

Due to extremely small population sizes at the SLA level, language by birthplace data was not an appropriate starting point, and the SLA language projections were produced by disaggregating only the State/Territory-level language projections using 1996 Census by SLA data adjusted to 1996 ERP data. Future years in the projection applied the ageing methods described previously.

## **Religion projections**

Religion projections were produced by the same method as the language projection.

The Census question (which is optional) is Question 10: What is the person's religious denomination?

Around 9% of the population did not provide a response to this question. Furthermore, the question does not provide information on the strength of a person's identification with a particular denomination. Interpretation of data produced from this question should therefore be treated with caution.

The projections were prepared by the ABS according to the assumptions reflecting prevailing trends agreed to by the Department of Health and Aged Care.

Although the ABS takes responsibility for the method employed, the assumptions used are the final responsibility of the client, and the projections are not official ABS population statistics.