

COHORT PROFILE

Cohort profile: The Dynamic Analyses to Optimize Ageing (DYNOPTA) project

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How did the study come about?

Like other industrialized countries, Australia is facing major population ageing. From 2000 to 2025, the number of Australians aged 65 years and over will more than double, as a result of the ageing of the baby boom cohort and increasing life expectancy, while the number of people in working age groups will decline.¹ To guide constructive responses to this unprecedented change, the Government's Minister on Ageing released the National Strategy for an Ageing Australia² which set key issues for national policy development, to be underpinned by policy. In 2003, the Australian Prime Minister's Science, Engineering

and Innovation Council (PMSEIC) brought together leading researchers and policymakers who prepared a report articulating an evidence-based vision for healthy ageing in Australia and an associated programme of longitudinal research to guide the achievement of 'an additional 10 years of healthy life expectancy' by 2050.² That same year, the Australian government established 'Ageing Well, Ageing Productively' as a National Research Priority goal. In 2004 the Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC) funded national research networks including the Research Network in Ageing Well (RNAW) to lead and facilitate collaboration in multi-disciplinary large scale research on ageing, build research capacities and international collaborations, and improve communication and translation with key constituencies (www.ageingwell.edu.au).

In 2004, the NHMRC and ARC announced a strategic funding initiative to facilitate research into ageing that is multisectorial, multidisciplinary and cross-institutional. The goal of this was to develop an authoritative evidence base for policy and practice in the priority area of Ageing Well, Ageing Productively. Collaborators from nine Australian Longitudinal Ageing studies, together with demographers, statistical and modelling experts, subsequently proposed the *Dynamic Analyses to Optimize Ageing* (DYNOPTA) project which received funding for a 5-year programme grant that commenced in 2007. The broad aims of DYNOPTA reflect the vision of the PMSEIC report to *identify effective pathways to compressing morbidity and optimizing ageing*.

DYNOPTA has constructed a pooled dataset comprising information from nine Australian Longitudinal Studies of Ageing (LSA).³⁻⁹ Data were harmonized from the contributing studies (described in Table 1) to

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Table 1 Studies contributing to the DYNOPTA dataset

Study	Location	Wave	Year	N	Age	Deceased at wave
Australian Longitudinal Study of Ageing (ALSA) ³	Adelaide	1	1992–93	2087	65–103	0
		2	1993–94	1779	65–104	131
		3	1994–95	1679	66–105	250
		4	1995–96	1504	68–106	630
		5	1998	1171	70–100	723
		6	2000–01	791	72–101	1248
		7	2003–04	487	75–102	1264
Australian Longitudinal Study of Women's Health Mid Cohort (ALSWH-mid), Old Cohort (ALSWH-old) ⁵	National (Mid)	1	1996	13 706	45–51	0
		2	1998	12 329	46–53	50
		3	2001	11 185	49–56	116
		4	2004	10 897	52–59	204
	National (Old)	1	1996	12 431	68–76	0
		2	1999	10 434	71–79	529
		3	2002	8 629	74–82	1098
		4	2005	7 152	77–85	1867
Australian Diabetes and Obesity and Lifestyle Study (AUSDIAB) ⁴	National	1	1999–2000	7296	45–95	0
		2	2004–05	4380	49–93	a
Blue Mountains Eye Study (BMES) ⁶	Blue Mountains	1	1992–93	3654	45–100	0
		2	1997–2000	2334	50–98	a
		3	2001–04	1952	55–99	a
Canberra Longitudinal Study (CLS) ⁷	Canberra, Queanbeyan	1	1990–91	1134	70–103	0
		2	1994–95	637	74–102	306
		3	1998	380	78–101	552
		4	2002	213	82–105	744
Household, Income and Labour Dynamics of Australia (HILDA) ⁸	National	1	2001–02	6164	45–90+	0
		2	2002–03	5454	45–90+	a
		3	2003–04	5089	46–90+	a
		4	2004–05	4769	47–90+	a
		5	2005–06	4658	48–90+	a
Melbourne Longitudinal Study Healthy Ageing (MELSHA) ⁹	Melbourne	1	1994	1000	65–94	0
		2	1995	979	66–95	35
		3	1996	796	67–96	74
		4	1997	718	68–97	91
		5	1998	649	69–98	113
		6	1999	648	70–99	128
		7	2000	542	71–96	143
		8	2002–03	372	73–98	170
		9	2003	347	74–99	193
		10	2004–05	326	75–96	193
		11	2005–06	242	76–97	415
Personality and Total Health through life (PATH) ¹⁰	Canberra, Queanbeyan	1	2001–02	2550	60–66	0
		2	2005–06	2222	64–70	70

(continued)

Table 1 Continued

Study	Location	Wave	Year	N	Age	Deceased at wave
Sydney Older Person's Study (SOPS) ¹¹	Sydney	1	1991-93	630	75-97	0
		2	1994-96	449	78-99	123
		3	1996-97	367	78-100	163
		4	1997-99	299	80-101	226
		5	2001-03	62	84-106	318

^aDeath data not available.

create an entirely new and unique dataset. This dataset is not the summation of the individual datasets, but rather comprises new variables and constructs derived from complex harmonization procedures. Where possible, variables were harmonized to enable comparison with Australian benchmarks. For example, the physical activity data have been harmonized to derive measures reflecting the recommended level of physical activity per week,¹² and the alcohol consumption data have been harmonized to provide classifications in accordance with those endorsed by the National Health and Medical Research Council.¹³

What does DYNOPTA cover?

The research programme focuses on four outcomes that contribute greatly to the burden of disease and disability, namely *dementia and cognition, mental health, sensory impairment and mobility/activity limitations*. Mortality is also included as a key outcome. The four health domains were chosen from recent research into the principal factors contributing to disease burden, or studies of the impact of diseases or conditions leading to injury, disability/impairment or premature death. Lopez and colleagues¹⁴ found that Alzheimer disease and other dementias, depressive disorders, hearing loss and conditions such as osteoarthritis were among the top 10 leading causes of burden of disease with loss of healthy-life years in higher income countries worldwide. Similar findings were made in a recent report from the Australian Institute of Health and Welfare.¹⁵ The DYNOPTA dataset also includes key sociodemographic variables such as marital and partner status, labour force participation and date of death. In addition to being risk factors for the four outcomes, analyses of these will enable a more detailed understanding of demographic and social processes in later life. The research programme is underpinned by an interdisciplinary life course approach to human development and ageing that recognizes interdependencies among demographic, social, lifestyle, economic and health factors.^{16,17}

Who is in the sample?

The geographic scope of the sample is shown in Figure 1. Of the nine contributing studies, three are

nationally representative, comprising 65% of participants at baseline. The remaining six studies are based in specific Australian cities or regions, including Adelaide, the Blue Mountains, the Australian Capital Territory (ACT) and Queanbeyan, Melbourne and Sydney. Most of the sample (90%) live in either highly accessible or accessible areas (i.e. access to metropolitan services) according to the Australian Standard Geographical Classification system.¹⁸

The sample comprises 50 652 baseline participants (wave 1 of each study between 1990 and 2001). Of these, 39 085 (77.2%) were female, reflecting inclusion of the all-female Australian Longitudinal Study of Women's Health (particularly for the 45-54 and 65-74 age groups), and women's greater longevity. Selected sample characteristics are shown in Table 2. This reports frequency of participants' characteristics as a proportion of the baseline sample. In the baseline sample, a total of 69.5% participants were married or partnered, while 16.7% were widowed with increasing proportions of widowed participants at older ages. About half of those with available data at baseline were in the workforce. Only 0.3% had no formal education, and 10.3% reported having attained tertiary education.

Selected health characteristics and social contact are reported in Table 3. On a self-reported health measure, 35.9% reported their health as excellent and 3.0% as poor. Of those with available data, about half (52%) reported having never smoked. Of those with visual acuity data, 3% were classified with a visual impairment. Of the baseline sample data reporting information on social contact, 68.6% reported face to face contact with friends or family at least once per week.

What is included in the pooled dataset?

The pooled dataset contains demographic information, outcome variables for the four key domains (cognition, mental health, physical disability and sensory function) and data on risk factors and health behaviours. The risk factors include other medical conditions (e.g. arthritis, hypertension) as well as psychosocial measures, such as social networks. Mortality data are also included, as well as

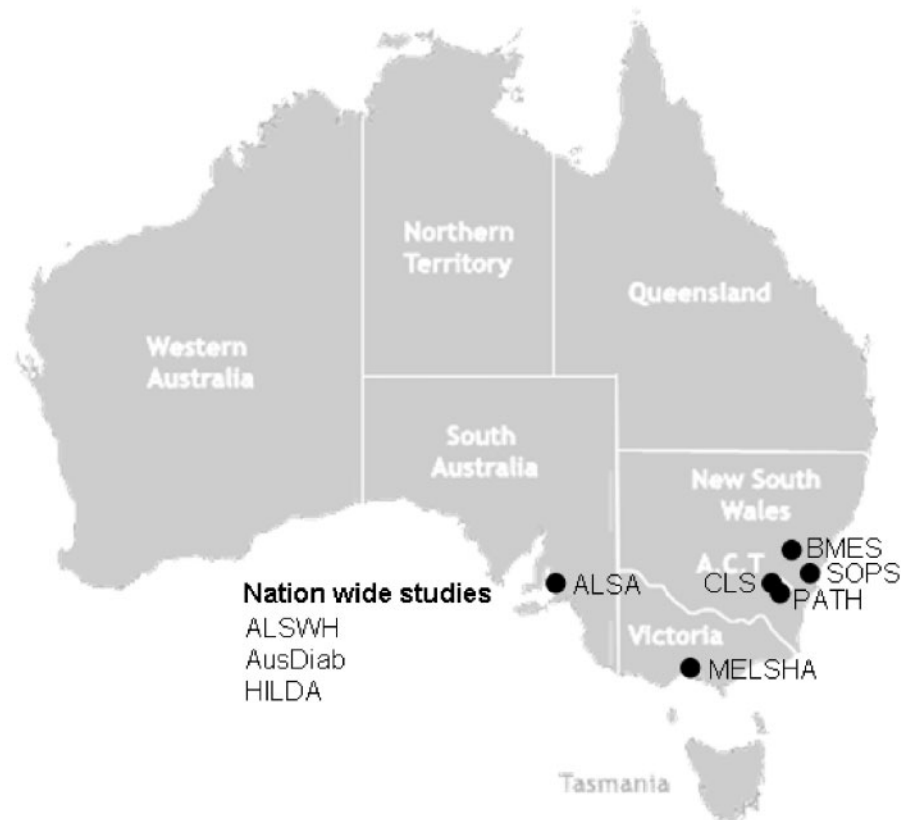


Figure 1 Locations of contributing Australian Longitudinal Ageing Studies

Table 2 Selected demographic characteristics of the DYNOPTA cohort (unweighted)

	Total <i>N</i> (%)	Age group					
		45–54 <i>N</i> (%)	55–64 <i>N</i> (%)	65–74 <i>N</i> (%)	75–84 <i>N</i> (%)	85–94 <i>N</i> (%)	95+ <i>N</i> (%)
Sex							
Male	11 567 (22.8)	2719 (13.9)	3459 (48.5)	2820 (15.8)	2062 (41.4)	492 (45.4)	15 (20.5)
Female	39 085 (77.2)	16 784 (86.1)	3674 (51.5)	15 059 (84.2)	2919 (58.6)	591 (54.6)	58 (79.5)
Marital status							
Married or de-facto	35 180 (69.5)	15 929 (81.7)	5492 (77.0)	10 867 (60.8)	2546 (51.1)	337 (31.1)	9 (12.3)
Divorced or separated	4628 (9.1)	2350 (12.0)	891 (12.5)	1132 (6.3)	236 (4.7)	19 (1.8)	0 (0.0)
Widowed	8468 (16.7)	364 (1.9)	456 (6.4)	5054 (28.3)	1920 (38.5)	635 (58.6)	39 (53.4)
Single/never married	1957 (3.9)	783 (4.0)	286 (4.0)	600 (3.4)	223 (4.5)	58 (5.4)	7 (9.6)
Level of education							
No formal education	130 (0.3)	16 (0.1)	14 (0.2)	82 (0.5)	14 (0.3)	4 (0.4)	0 (0.0)
Primary school or secondary	27 145 (53.6)	10 881 (55.8)	2155 (30.2)	11 538 (64.5)	2234 (44.9)	316 (29.2)	21 (28.8)
Non-tertiary study	11 934 (23.6)	4950 (25.4)	2569 (36.0)	3077 (17.2)	1094 (22.0)	235 (21.7)	9 (12.3)
Tertiary study	5196 (10.3)	2952 (15.1)	1151 (16.1)	830 (4.6)	210 (4.2)	50 (4.6)	3 (4.1)
Employment status							
Employed	17 213 (34.0)	13 416 (68.8)	3178 (44.6)	527 (2.9)	80 (1.6)	12 (1.1)	0 (0.0)
Unemployed	1229 (2.4)	455 (2.3)	144 (2.0)	16 (0.1)	509 (10.2)	100 (9.2)	5 (6.8)
Not in labour force	17 768 (35.1)	4133 (21.2)	3735 (52.4)	5314 (29.7)	3620 (72.7)	915 (84.5)	51 (69.9)

Percentages reported for the full sample and do not add to 100% due to missing data.

Table 3 Selected health and social characteristics of the DYNOPTA cohort (unweighted)

	Total N (%)	Age group					
		45–54 N (%)	55–64 N (%)	65–74 N (%)	75–84 N (%)	85–94 N (%)	95+ N (%)
SRH							
Excellent	18 174 (35.9)	9078 (46.5)	2797 (39.2)	5168 (28.9)	917 (18.4)	200 (18.5)	14 (19.2)
Good	17 138 (33.8)	7304 (37.5)	2047 (28.7)	6205 (34.7)	1340 (26.9)	231 (21.3)	11 (15.1)
Fair	7396 (14.6)	1973 (10.1)	805 (11.3)	3554 (19.9)	845 (17.0)	212 (19.6)	7 (9.6)
Poor	1517 (3.0)	359 (1.8)	197 (2.8)	638 (3.6)	242 (4.9)	78 (7.2)	3 (4.1)
Visual impairment							
Impaired vision: <6/12	1501 (3.0)	12 (0.1)	132 (1.9)	405 (2.3)	684 (13.7)	259 (23.9)	9 (12.3)
Smoking status							
Never smoker	26 362 (52.0)	9965 (51.1)	3530 (49.5)	9765 (54.6)	2499 (50.2)	573 (52.9)	30 (41.1)
Former smoker	15 860 (31.3)	5438 (27.9)	2479 (34.8)	5705 (31.9)	1880 (37.7)	346 (31.9)	12 (16.4)
Current smoker	6285 (12.4)	3440 (17.6)	972 (13.6)	1466 (8.2)	355 (7.1)	51 (4.7)	1 (1.4)
Face to face contact with friends and relatives							
Once a week or more	6479 (12.8)	1184 (6.1)	936 (13.1)	1642 (9.2)	2114 (42.4)	579 (53.5)	24 (32.9)
Less than once a month or more	2941 (5.8)	1110 (5.7)	668 (9.4)	587 (3.3)	448 (9.0)	125 (11.5)	3 (4.1)

Table 4 Domains included in the DYNOPTA pooled dataset

Domain	Example measures within domain
Health outcomes	
Cognition/dementia	Probable dementia, cognitive impairment, processing speed, memory, verbal ability
Mobility	Activities of daily living, instrumental activities of daily living, driving
Mental health	Depression, psychological distress, self-rated health, life satisfaction
Sensory functioning	Visual acuity, self reported visual impairment, ability to read print, audiometry, self-reported hearing difficulties
Mortality	Age at death
Predictors and correlates	
Sociodemographic	Age, sex, partner status, education, occupation, socioeconomic status, retirement status, domicile
Medical conditions, health behaviours, social support	Arthritis, cancer, stroke, high blood pressure, cholesterol, falls history, anthropometric data, smoking, alcohol use, physical activity, grip strength, social support and networks
Service use	Hospital visits, medical practitioner visits, other health professional visits, community services use

self-reported use of services. Table 4 lists the domains included in the dataset.

over 11 years. The mean number of surveys completed by each participant was 3.1 (SD = 1.51), with a mode of 4 and median of 3 surveys per participant.

How often have they been followed?

The number and dates of waves for each study are shown in Table 1. Studies have an average of 4.4 waves over an average period of 9.4 years (SD = 2.99), though this is inflated by MELSHA with 11 waves over 12 years, and by ALSA with seven waves

Development of weights for the DYNOPTA dataset

The contributing studies use a variety of survey designs and differ in their geographic and demographic coverage. Some surveys are results of simple random samples, for others stratified, or cluster

designs were used. The demographic coverage also differs between studies. Estimation weights are being developed for DYNOPTA that will reflect the different sample sizes and selection probabilities of the studies and ensure that the different studies are appropriately combined when they cover the same geographical and demographic subpopulations. Other complexities of the design will also have to be accounted for in analyses and any study effects identified and adjustments made.

How were data harmonized?

Data were mostly harmonized using the 'by fiat' method.¹⁹⁻²² This method assumes a common scoring system across studies¹⁹⁻²² and is recommended when the possibility of dispute is small, the number of categories is relatively consistent across studies and a clear authority can endorse the system. In some instances, variables were harmonized at several levels. The most generic level is most inclusive of the largest number of participants, while a more detailed level would be that which is most inclusive of information, but which may result in the inclusion of fewer participants. A latent variable approach is being used to harmonize different depression measures.

Due to the nature of the studies that contributed to the creation of the pooled dataset, coverage of information varies considerably across the total sample. For example, at the first measurement occasion (wave 1 for all studies), self-rated health is available for 44 224 participants, whilst information about visits to a general practitioner is available for only half that number ($n = 28\ 639$).

What are the main strengths and weaknesses of DYNOPTA?

A major strength of this innovative study is the large sample size and multiple occasions of measurement. The increase in statistical power enables more reliable analyses than has hitherto not been possible in the Australian setting. This allows for the study of conditions that are relatively rare such as Parkinson disease, or for those conditions that Australian policy makers had previously relied on European data (e.g. Dementia¹⁵). The study also provides data on under-represented groups, for whom comparisons are often not feasible due to small sample sizes (e.g. adults aged 85+). The inclusion of cohorts studied at varying points of time will allow for the evaluation of cohort effects.

The national coverage of this large sample adds to the utility of the findings as does the depth and breadth of this dataset. Although some epidemiological studies with large datasets include information gained purely from mailed questionnaires, limiting

the type of data collected, a significant proportion of the data included in DYNOPTA is based on personal interview and assessments. Another strength of the study is the development of the infrastructure, documentation of Australian longitudinal research and the development of methodologies for harmonization. This will facilitate future research involving the harmonization of the DYNOPTA dataset with other Australian sources, and international sources such as U.S. Health and Retirement Survey,²³ the Surveys of Health and Retirement in Europe²⁴ and the Comparison of Longitudinal European Studies on Aging (CLESA) which has undertaken a similar harmonization and pooling approach to analyse data from six longitudinal studies.²⁵

The pooled dataset does however have limitations. As not all contributing datasets were nationally representative, the sample needs to be weighted to produce population estimates. Most of the data on medical conditions is self-report although clinical data are available for sensory function, blood pressure, cognition, grip strength and some other functional measures. There is variability in the sampling methods used by the contributing studies, the inclusion and exclusion criteria, and modes of survey administration and this potential for heterogeneity will need to be tested and adjusted for. Finally, as with all longitudinal studies of ageing, there is sample attrition and missing data due to withdrawal, mortality and other non-response that increases with each occasion of measurement.

What are some of the anticipated research questions and implications for the DYNOPTA project?

With the breadth of domains assessed and the extent of longitudinal data, DYNOPTA will provide a unique window through which to investigate ways to optimize ageing outcomes, using an interdisciplinary approach. Epidemiological analyses of the pooled dataset will identify key incidence rates and risk factors for the targetted health outcome areas, as well as for mortality.

Longitudinal analyses will model the transition from states of health to states of disability. These transitions will be used in the construction of a dynamic microsimulation model that will also allow for the costs of disability to be estimated. Scenarios involving modification of risk factors and rates of disability will be evaluated to inform Australian policy makers. One goal is to estimate the expected years of disability-free life expectancy within each targetted health outcome area. The DYNOPTA dataset will also provide an excellent platform in cross-national analyses.²⁰ Similar longitudinal datasets from Europe and the United States offer the opportunity to explore

similarities and differences in ageing trajectories in countries with broadly similar populations, including the impact of particular policies, such as different retirement ages.

Where can I find out more?

Further information is available on the DYNOPTA website <http://DYNOPTA.anu.edu.au>. The pooled dataset is governed by a Collaborative Research Agreement among several institutions. The first version of the dataset was released in November 2008. Those interested in collaborating on the project can contact the Scientific Committee at DYNOPTA@anu.edu.au.

Acknowledgements

The data on which this research is based were drawn from several Australian longitudinal studies including: the Australian Longitudinal Study of Ageing (ALSA), the Australian Longitudinal Study of Women's Health (ALSWH), the Australian Diabetes, Obesity and Lifestyle Study (AusDiab), the Blue Mountain Eye Study (BMES), the Canberra Longitudinal Study of Ageing (CLS), the Household, Income and Labour Dynamics in Australia study (HILDA), the Melbourne Longitudinal Studies on Healthy Ageing (MELSHA), the Personality And Total Health Through Life Study (PATH) and the Sydney Older Persons Study (SOPS). These studies were pooled and harmonized for the Dynamic Analyses to Optimize Ageing (DYNOPTA) project. All studies would like to thank the participants for volunteering their time to be involved in the respective studies. Details of all studies contributing data to DYNOPTA, including individual study leaders and funding sources, are available on the DYNOPTA website (<http://DYNOPTA.anu.edu.au>). The findings and views reported in this paper are those of the author(s) and not those of the original studies or their respective funding agencies.

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References

- Booth H, Tickle L. The future aged: new projections of Australia's elderly population. *Australas J Ageing* 2003;**22**:38-44.
- Andrews K. *Department of Health and Ageing (DoHA) National Strategy for an Ageing Australia: An Older Australia, Challenges and Opportunities for All* (reprint with amendments February 2002). Canberra, ACT: DoHA, 2001.
- Luszcz MA, Giles L, Eckermann S, Edwards P, Browne-Yung K, Hayles C. *The Australian Longitudinal Study of Ageing: 15 Years of Ageing in South Australia*. South Australian Department of Families and Communities, 2007.
- Dunstan DW, Zimmet PZ, Welborn TA *et al*. The Australian Diabetes, Obesity and Lifestyle Study (AusDiab)—methods and response rates. *Diab Res Clin Pract* 2002;**57**:119-29.
- Lee C, Dobson AJ, Brown WJ *et al*. Cohort profile: The Australian Longitudinal Study of Women's Health. *Int J Epidemiol* 2005;**35**:987-91.
- Blue Mountains Eye Study. (Online), 2007. Available at: URL: <http://www.cvr.org.au/bmes.htm> (Accessed November 12, 2008).
- Christensen H, Mackinnon A, Jorm AF *et al*. The Canberra longitudinal study: design, aims, methodology, outcomes and recent empirical investigations. *Ageing Neuropsychol C* 2004;**11**:169-95.
- The Household, Income and Labour Dynamics in Australia (HILDA) Survey. (Online), 2008. Available at: URL: <http://www.melbourneinstitute.com/hilda/> (Accessed November 12, 2008).
- Unsworth CA, Wells Y, Browning C, Thomas SA, Kendig H. To continue, modify or relinquish driving. Findings from a longitudinal study of healthy ageing. *Gerontology* 2007;**53**:423-31.
- PATH Through Life Project. (Online), 2008. Available at: URL: <http://cmhr.anu.edu.au/path/> (Accessed November 12, 2008).
- Project summary. The Sydney Older Persons Study: 1992 to 2003. (Online), 2003, [3 screens]. Available at: URL: <http://www.sesiahs.health.nsw.gov.au/powh/arc/dwnlds/SOPS%20Project%20Summary.pdf> (Accessed November 12, 2008).
- Department of Health and Ageing (DOHA). *An Active Way to Better Health: National Physical Activity Guidelines for Adults*. Canberra, ACT: DoHA, 2005.
- National Health and Medical Research Council (NHMRC). *Australian Alcohol Guidelines: Health Risks and Benefits*. Canberra, ACT: NHMRC, 2001.
- Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *Lancet* 2006;**376**:1747-57.
- Australian Institute of Health and Welfare (AIHW). *Australia's Health 2008*. Canberra, ACT: AIHW, 2008.
- Baltes PB, Staudinger UM, Lindenberger U. Lifespan psychology: Theory and application to intellectual functioning. *Annu Rev Psychol* 1999;**50**:471-507.
- Kuh D, Ben-Shlomo Y, Lynch J, Hallqvist J, Power C. Life course epidemiology. *J Epidemiol Community Health* 2003;**57**:778-83.
- Pink B. *Australian Standard Geographical Classification. ABS Catalogue No. 1216.0*. Canberra, ACT: Australian Government Publishers, 2007.
- Lipnicki D. *DYNOPTA technical report #1: Data harmonisation (unpublished)*. Canberra, ACT: Australian National University, 2006.
- van Buuren S, Eyres S, Tennant A, Hopman-Rock M. *Response Conversion: A New Technology for Comparing Existing*

- Health Information*. Leiden, Holland: TNO Prevention and Health, 2001.
- ²¹ van Buuren S, Eyres S, Tennant A, Hopman-Rock M. Assessing comparability of dressing disability in different countries by response conversion. *Eur J Public Health* 2003;**13**:15-9.
- ²² van Buuren S, Eyres S, Tennant A, Hopman-Rock M. Improving comparability of existing data by response conversion. *J Off Stat* 2005;**21**:53-72.
- ²³ Hauser RM, Willis RJ. Survey design and methodology in the health and retirement study and the Wisconsin Longitudinal Study. In: Waite LJ (ed.). *Aging, Health and Public Policy: Demographic and Economic Perspectives*. New York: Population Council, 2005. pp. 209-35.
- ²⁴ Borsch-Supan A, Agar B, Hendrik J, Johan M, Johannes SWG. *Health, Ageing and Retirement in Europe: First Results from the Survey of Health, Ageing and Retirement in Europe*. Mannheim, Germany: Mannheim Research Institute for the Economics of Aging, 2005.
- ²⁵ Minicuci N, Noale M, Bardage C *et al*. Cross-national determinants of quality of life from six longitudinal studies on aging: The CLESA project. *Aging Clin Exp Res* 2003;**15**:187-202.