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Information Paper

Producing national estimates from State Health Surveys

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AUSTRALIAN BUREAU OF STATISTICS

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INTRODUCTION

PURPOSE OF THIS PAPER

This information paper reports on a recent ABS project which pooled data from state and territory health surveys. It details the methods used to pool the data and the data quality investigations that were undertaken. It also reports experimental national estimates of several chronic disease risk factors produced from the pooled national dataset.

A brief summary of current state health survey methodology is included, along with a description of potential benefits of a harmonised national surveillance system, and an overview of the technical, methodological and practical issues that need to be addressed in pooling data from multiple surveys (whether in health or other topics).

Funding for this project was provided by Australian Governments through the Australian Health Ministers' Advisory Council, and was completed as part of the work plan for the Population Health Information Development Group (PHIDG) in 2007-08.

It is acknowledged that the ABS could only conduct this data pooling exercise with the support and assistance of each of the states and territories and the Australian Government Department of Health and Ageing (DoHA). Particular thanks go to the following agencies for providing their 2004 survey data for the trial:

- NSW Department of Health - NSW Population Health Survey
- Victorian Department of Human Services - Victorian Population Health Survey
- WA Department of Health - WA Health and Wellbeing Surveillance System
- SA Department of Health - SA Monitoring and Surveillance System
- Australian Government Department of Health and Ageing (DoHA) - *Filling the gaps* survey

BACKGROUND

Over the last decade, most states and territories have invested significant resources in developing population health surveillance through surveys using Computer Assisted Telephone Interviewing (CATI). These surveys have been developed to meet the specific needs of each jurisdiction, and as a result there are a number of differences in their design and operation. However, although designed for surveillance at the state and sub-state level, these surveys are generating a large amount of valuable data that could be pooled at the national level. This would generate national estimates of chronic disease and associated risk factors, thus adding to the stock of health information in Australia and potentially contributing to improved public health outcomes.

Data pooling is the process of combining data from different sources while ensuring the accuracy and reliability of the combined information. This can take the form of combining individual survey responses (unit record data or "microdata"), or aggregating and appropriately weighting estimates from previously published survey reports. Combining data allows the possibility of a richer dataset with more available detail, for minimal additional cost.

This data pooling exercise fitted within a broader range of activities overseen by PHIDG over a number of years aimed at harmonising the state-based health collections in order to achieve an ongoing, systematic, and integrated approach to collecting nationwide chronic disease and risk factor surveillance data. It built on previous work by the CATI Technical Reference Group, which comprised representatives from the States and Territories, DoHA, the Australian Institute of Health and Welfare (AIHW), the Public Health Information Development Unit (PHIDU), and the ABS.

BACKGROUND *continued*

Such a systematic approach could have considerable benefits, such as an improved capacity to target, track and evaluate the impact of the significant resources that are being committed to chronic disease prevention programs; and the production of more reliable estimates for sub-populations and groups, especially rural and remote populations, Indigenous Australians, and areas of socio-economic disadvantage. It would also complement the existing national information base, which has the National Health Survey (NHS) as a cornerstone.

As a large household survey conducted by face-to-face interview, the NHS provides a wide-ranging and comprehensive picture of the health of Australians, as it includes information about chronic conditions, health risk factors, and social and demographic determinants. The NHS is currently conducted every three years.

The NHS supports national benchmarking and enables analysis of the relationships between health status and behaviours, and the monitoring of trends on a range of health-related issues.

There has recently been recognition of a need for more frequent monitoring of preventive health behaviours than is currently possible with the three-yearly NHS.

While prevalence of chronic disease does not generally change significantly from year to year, health risk factor behaviours may be more sensitive to change over time, and are often the target of health promotions and other interventions. More frequent data collection, using CATI surveys, could improve evaluation and monitoring of the effects of these interventions.

In 2004, recognising priorities in the health sector relating to chronic disease and associated risk factors, DoHA provided funding to support a one-off collection of information from those states and territories that did not run ongoing health collections at that time (Queensland, Tasmania, the Northern Territory, and the ACT). This project (known as the *Filling the gaps* survey) focused on five risk factor topics known collectively as SNAPS (Smoking, Nutrition, Alcohol consumption, Physical activity and Stress) thus enabling CATI health survey data for the same reference year to be available from all states and territories.

The ABS obtained unit record data from the *Filling the gaps* survey and the equivalent State surveys for 2004. Using these data, the ABS explored pooling and analysis of aggregated data to determine the feasibility of producing national estimates from the state collections.

The trial also provided further information on practical, technical and methodological issues related to obtaining and combining the data, as well as enabling a better understanding of differences between data from different state collections. A data confrontation exercise brought together published estimates from 2004 CATI health surveys, and estimates from the 2004-05 NHS. For ongoing reporting or use in any health performance indicator framework, estimates produced from pooled state CATI health surveys would need to be of high quality and be consistent with equivalent estimates from key national data sources like the NHS.

SUMMARY OF RESULTS

The results of this exercise show that it is feasible to produce national estimates from state and territory health surveys. While it is theoretically possible to produce national

SUMMARY OF RESULTS *continued*

estimates from published aggregate state and territory estimates, creating a national dataset by pooling unit record data from the state surveys produces higher quality statistics.

The results of the pooling of state and territory CATI health survey data show that while most of the estimates appear similar to the results from the NHS, the differences are statistically significant for each variable. This is largely reflective of the difference in procedures and methodology. As shown in Table 1 below, estimates for smoking, overweight and obesity, and high levels of psychological distress were all lower than the NHS, while inadequate fruit consumption and inadequate vegetable consumption were higher than the NHS. Notably, estimates for physical activity were extremely different to the NHS due to different questions and definitions used.

COMPARISON OF ESTIMATES AND 95% CONFIDENCE INTERVALS, STATE HEALTH SURVEYS AND NHS

	POOLED STATE SURVEYS			NHS		
	estimate	*lower confidence interval*	*upper confidence interval*	*estimate*	*lower confidence interval*	*upper confidence interval*
	%	%	%	%	%	%
Smoking prevalence - current smokers	21.1	20.3	21.9	23.2	22.4	24.0
Smoke-free households	85.5	84.9	86.1	87.3	86.6	88.0
Inadequate fruit consumption(a)	49.6	48.7	50.6	46.2	45.4	47.0
Inadequate vegetable consumption(b)	90.9	90.3	91.4	85.6	84.9	86.3
Persons who usually consume regular/full cream milk	48.3	47.4	49.2	43.2	42.4	44.0
Persons overweight or obese	51.0	50.0	52.0	53.6	52.7	54.5
Sufficient exercise (c)	52.0	51.0	52.9	24.0	23.1	24.9
High/very high level of psychological distress(d)	11.8	11.2	12.4	13.0	12.5	13.5

(a) less than two serves per day
(b) less than five serves per day
(c) more than 150 minutes on five occasions per week
(d) K10 score greater than or equal to 22

National estimates produced from pooled state and territory CATI data could potentially provide a complementary source of estimates on a more regular basis than the three-yearly NHS, augmenting the health information base. Further harmonisation of standards, question modules, and data set specifications would be required to streamline the compilation process, improve confidence in the findings, improve comparability with the NHS, and enable comparisons between states and territories. In addition, further analysis should be undertaken on the effects of seasonality on the estimates.

The national estimates that were produced are shown in Table 9 on page 14.

CHAPTER 1 DATA QUALITY INVESTIGATIONS

DATA QUALITY INVESTIGATIONS

To determine the validity and quality of estimates produced from the pooled dataset, an assessment was made of the level of consistency across the data sources that were being pooled. A number of analyses were undertaken, including metadata analysis, comparing distributions, and comparison with data from the National Health Survey (NHS).

Metadata analysis assessed comparability across surveys in terms of sample design, scope, coverage, questionnaire wording, sample size, response rate, mode of survey, reference period, and weighting methodology. Information on the feasibility of data pooling was provided by comparing the surveys using a range of statistical measures.

The CATI health survey data sets were analysed to assess:

- Differences in survey methodology
- The impact of different weighting methods
- The adequacy of effective sample size in each collection
- The effect of missing data from each jurisdiction on national estimates
- The effects of seasonality on national estimates

DIFFERENCES IN SURVEY METHODOLOGY

Most CATI health surveys covered demographics, chronic disease, and key health risk factors (ie Smoking, Nutrition, Alcohol, Physical activity and Stress). Some CATI surveys also covered a range of other health-related topics (for example, the NSW Population Health Survey also collected information on topics such as cancer screening, dental services and injury prevention). The *Filling the gaps* survey asked only about the SNAPS topics and key demographics, and this project was limited to assessing the feasibility of pooling these variables.

The length of the CATI surveys interview times ranged from 5 minutes for the *Filling the gaps* survey to 15-25 minutes in NSW and 22-23 minutes in WA, as these surveys contained a range of other content.

The NHS was conducted in private dwellings only, including in self-care accommodation for the aged. Those in non-private dwellings, including those in cared accommodation such as hospitals and nursing homes (whose health status may be expected to be worse than those in private dwellings), were excluded from the scope of the survey. The scope of the CATI surveys was broadly similar, in that they covered persons with private telephones only. Generally, these are people in private dwellings, though a small number of people in non-private dwellings may have a private telephone connection and therefore would be in scope of the CATI surveys.

Sample design for the CATI surveys varied from survey to survey, although as telephone interviews, only those with telephone connections were in scope for selection. For some states and territories, including those in the *Filling the gaps* project, the design was a random sample of telephone numbers taken from the Electronic White Pages (EWP). Samples drawn from the EWP may include a number of people with mobile telephones, though exclude those with unlisted numbers. In other collections, random digit dialling (RDD) was used to generate a sample of landline telephone numbers, which was stratified by departmental health region and with non-metropolitan areas tending to be oversampled. The NHS uses a random multi-stage area sample of private dwellings, designed to provide reliable national estimates and key state-level information.

DIFFERENCES IN SURVEY METHODOLOGY *continued*

Due to the practical difficulties of face to face interviewing and the small numbers involved, persons living in very remote areas of Australia are excluded from the scope of the NHS. However, persons in very remote areas are included in scope for selection in the CATI surveys, provided they meet other requirements (such as having a telephone and, where appropriate, being listed in the EWP).

Telephone interviewing methodology is believed to substantially under-sample Indigenous persons generally, but particularly those in very remote communities. As Aboriginal people in communities make up a large proportion of the population of the NT and are likely to be under represented in the CATI survey, the NT-level estimates from the 2004 *Filling the Gaps* study should not be seen as representative of the entire NT population. In order to obtain representative information for Indigenous persons, a National Aboriginal and Torres Strait Islander Health Survey was conducted concurrently with the 2004-05 NHS, which included Aboriginal and Torres Strait Islander persons in communities and very remote areas.

The CATI surveys used a Primary Approach Letter (PAL) to introduce the survey and promote participation where there was an address in the EWP for that phone number. If required, all surveys made several attempts in order to make contact with households.

All CATI surveys selected one person from the household for interview. NSW, SA and WA surveyed a person of any age. The *Filling the gaps* survey and Vic selected an adult only to participate. For the purposes of creating the pooled unit record data set, only persons 18 and over were included. The NHS randomly selected one adult, and where applicable, one child, from each selected household.

In the CATI surveys, the method of selection for the person within the household differed. In some, respondents were selected from within the household at random, in others on the basis of the most recent birthday in the household, and in others based on who answered the call.

In contrast to the NHS, the CATI surveys were all voluntary.

The different CATI surveys used different methods of calculating response rates, however the response rates reported by each state were:

- NSW - 61%
- Vic - 61%
- SA - 77%
- WA - 76%
- *Filling the gaps* (Qld, Tas, NT, ACT) - 61%

For comparison, the response rate in the 2004-05 NHS was 90%.

WEIGHTING

Weighting is the process of adjusting results from respondents to a sample survey to infer results for the total population. To do this, a 'weight' is allocated to each respondent in the survey. The weight can be considered an indication of how many people are represented by the respondent.

WEIGHTING *continued*

The CATI health data sets supplied to the ABS already had a set of derived weights used for survey estimation purposes. These weights had been calculated to adjust for differences in the probability of selection (due to the number of telephone lines through which the household is accessible, selection of a person in the household and different sampling rates in different geographic strata) and differences in response rates (by age, sex, and geographic location). The unweighted survey samples tended to undersample males in the younger age groups and oversample females in the older age groups.

The 2004 CATI health surveys had been benchmarked by the states to official Estimated Resident Population (ERP) figures for 2004, except for NSW which was benchmarked to 2003 ERP. NSW also adjusted for the exclusion of people in non-private dwellings by removing an estimate of this group from their population benchmark. To ensure consistency between states, all states were re-benchmarked to June 2004 ERP during the pooling process. Weights were benchmarked separately for males and females with age groups for weighting being 18-24 years, then 10 year groups with the upper limit being 75 and over.

Some states had scaled down their weights to sum to the total sample size. The scaling of weights does not affect individual state estimates. However, to produce national estimates from the pooled data set the weights for those states had to be adjusted to reflect their contribution to the national population.

From the analyses undertaken, the impact of different state weighting procedures on the estimates produced from the pooled dataset is thought to be relatively small.

SAMPLE SIZE

The adequacy of the sample size across the states and territories was assessed by examining the following parameters of the pooled CATI state health survey data:

- the Relative Standard Errors (RSE) for selected variables;
- coefficient of variation (CV) of the sample weights; and
- design effects (DE) for selected SNAPS variables.

Where possible, comparisons were made with the NHS as a benchmark.

The proportion of the pooled dataset in each state was compared with the proportion of the June 2004 ERP population in each state, shown in Table 1. Note that the weighting and other analysis in this publication was performed on preliminary ERP figures, which were revised after the analysis was performed, based on the results of the 2006 Census. The impact of this on the relative weights and on the estimates is negligible.

SAMPLE SIZE *continued*

1 PROPORTIONS OF THE SAMPLE AND THE NATIONAL POPULATION AGED 18 AND OVER IN EACH STATE AND TERRITORY, STATE HEALTH SURVEYS AND NHS

	proportion of national population	*proportion of pooled dataset*	*proportion of NHS sample*
	%	%	%
NSW	33.5	29.5	20.5
Vic	24.9	23.1	17.3
Qld	19.1	3.7	16.1
SA	7.8	19.1	17.7
WA	9.8	13.4	10.8
Tas	2.4	3.7	10.0
NT	0.9	3.7	0.6
ACT	1.6	3.7	7.0

As can be seen in Table 1, the proportion of the CATI sample coming from each state is out of proportion to the actual population. Queensland has a lower proportion of the sample than would be expected for its population, while South Australia has a higher proportion. In effect, people in South Australia have a greater chance of selection in the pooled dataset than those in Queensland. While these effects do not invalidate the pooling of the data, they do reduce the efficiency of the pooled dataset. Measures of this are shown in Table 4. The NHS is designed for a level of disproportionality. This supports the production of reliable state level estimates for the smaller states.

Relative standard errors (RSEs)

The adequacy of a given sample size is often assessed in terms of the degree of precision or reliability expected of the estimates. Generally, the larger the sample size, the greater the precision of the estimate. However, there is a cost associated with sample size and so a compromise has to be made between precision and cost. Too large a sample may incur unnecessary costs, and too small can diminish the utility of the results. In practice, the sample size is selected to give a reasonable margin of error around the expected results for key variables.

The precision of an estimate can be expressed in terms of its Relative Standard Error (RSE). The results show that the RSEs for each variable by state are within acceptable levels ranging from 0.4-11.7% (RSEs less than 25% are generally considered by the ABS to be sufficiently reliable for most purposes). The RSE for psychological stress is relatively higher compared to the other variables due to the high number of missing/don't know responses, but it is still within the acceptable range.

The RSEs for the eight SNAPS variables are presented in Table 2. Descriptions of the measures used are provided in the Glossary of this publication.

Relative standard errors (RSEs) continued

2 SELECTED RISK FACTORS IN POOLED DATA FROM STATE HEALTH SURVEYS, RELATIVE STANDARD ERRORS

	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Aust
	%	%	%	%	%	%	%	%	%
Smoking(a)	2.69	3.02	7.87	3.31	5.16	6.92	5.38	7.39	1.91
Smokefree household(b)	0.60	0.70	1.31	0.62	0.83	1.20	1.45	1.20	0.38
Fruit(c)	1.44	1.64	3.56	1.35	2.71	3.25	2.78	3.37	0.98
Vegetable(d)	0.38	0.40	1.06	0.43	1.07	1.55	1.02	1.12	0.28
Milk(e)	1.36	1.76	3.61	1.91	2.20	3.70	3.30	3.95	0.98
BMI(f)	1.43	1.63	3.47	1.43	2.44	3.53	3.36	3.52	0.96
Exercise	1.42	1.53	3.23	1.20	2.40	3.51	3.42	3.76	0.92
K10(g)	3.68	4.25	10.05	4.58	7.62	11.69	10.49	10.02	2.70

(a) Current smokers
(b) Living in smoke free household
(c) Inadequate fruit consumption (less than 2 serves/day)
(d) Inadequate vegetable consumption (less than 5 serves/day)
(e) Consuming full cream/other milk (rather than low fat milk)
(f) Body mass index - overweight/obese
(g) Suffering from high/very high stress levels

Further analysis was performed to investigate the reliability of estimates at greater levels of disaggregation. Table 3 shows the RSEs associated with estimates for current smoking prevalence by 5 year age groups by sex for each state and the pooled national dataset.

3 CURRENT SMOKER PREVALENCE IN POOLED STATE HEALTH SURVEYS, RELATIVE STANDARD ERRORS

Age (years)	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Australia
	%	%	%	%	%	%	%	%	%
Males									
18–24	10.5	10.3	39.4	13.2	19.7	33.3	25.0	23.9	7.4
25–29	14.3	10.5	25.7	17.5	21.2	46.6	17.9	38.0	8.1
30–34	9.7	13.0	49.6	14.3	22.6	25.7	26.8	25.3	7.6
35–39	13.8	13.6	37.2	14.1	24.9	30.2	20.8	38.2	9.5
40–44	11.7	12.1	34.0	12.0	18.4	22.3	19.2	29.4	7.4
45–49	11.5	12.9	23.5	12.5	19.3	31.1	20.2	33.8	7.2
50–54	12.3	14.4	31.6	12.4	16.5	28.4	24.1	37.8	7.9
55–59	12.8	20.2	29.4	14.2	23.6	33.2	27.9	34.2	9.7
60–64	13.6	23.6	52.4	14.7	30.2	34.7	24.8	41.5	10.1
65–69	16.7	24.7	51.8	17.3	41.7	59.2	52.4	36.9	13.2
70–74	20.3	33.0	50.9	20.7	34.8	50.9	47.9	102.2	14.0
75+	19.0	42.4	71.0	28.1	44.4	—	71.4	99.2	14.8
Females									
18–24	10.1	10.1	23.2	14.5	19.9	40.5	30.5	26.9	8.2
25–29	11.3	10.9	32.2	15.8	23.1	24.0	18.6	33.7	7.3
30–34	10.0	9.1	25.7	15.1	18.3	31.4	17.5	26.0	6.5
35–39	10.7	10.5	24.8	16.9	21.0	28.2	20.1	22.0	6.8
40–44	10.9	10.6	24.7	11.3	25.6	18.8	17.5	31.1	6.7
45–49	9.4	11.4	41.4	11.8	20.7	20.0	18.0	31.4	7.0
50–54	10.9	16.1	38.4	13.2	21.5	27.4	20.8	30.6	8.1
55–59	10.8	15.4	29.6	14.4	21.3	27.0	28.0	54.6	8.0
60–64	15.2	17.3	38.8	16.5	27.8	34.2	34.9	45.3	10.7
65–69	18.9	22.8	49.8	21.0	35.0	34.8	75.7	60.5	12.8
70–74	20.3	28.6	74.0	23.3	40.6	40.4	65.6	72.8	14.6
75+	17.9	36.3	49.1	21.2	36.3	46.8	98.9	42.2	15.1

— nil or rounded to zero (including null cells)

Coefficient of variation (CV)

The coefficient of variation (CV) measures the degree of variability in a data item. A comparison of the CV of sample weights for each state allowed the distributions of the sample weights to be compared across the states. This is used to measure how closely the sample population matches the population distribution of the state.

Estimates of the CV of the sample weights calculated from the pooled CATI data for each of the states were compared with the figures from the NHS, as shown in Table 4. The CV of the sample weights do not vary significantly across the states and territories, although were relatively higher in WA, and for the pooled dataset. This is due to the unequal probability of selection across the states.

While the CVs of the sample weights in the pooled CATI data are larger and more dispersed than the NHS, the variability in CVs is not that large. This indicates that the quality of the estimates produced by a pooled dataset are not affected by the impact of different survey design and sampling methodology to much extent.

Design effect (DE)

The design effect (DE) is defined as the ratio of the variance of the estimate obtained from a more complex survey design to the variance of the estimate obtained from a simple random sample of the same number of units. It is a measure of the efficiency of the design. It represents the combined effect of a number of components such as stratification, clustering, unequal selection probabilities and weighting adjustments for non-response and non-coverage. A sampling design is said to be as efficient as a simple random sample if the DE is equal to 1, and less efficient if DE is greater than 1. A DE of 2 for example, means that, to obtain the same precision in an estimate, twice as many individuals (sample size) would have to be studied. Therefore the effective sample size (ESS) is defined as the actual sample size divided by the design effect.

Most states use a stratified sample design for their CATI surveys, in order to obtain reliable estimates at the regional level, generally by sampling a roughly equal number of respondents in each state health region (the populations of state health regions may vary considerably). Lower populations in the more regional and remote health services mean that persons in those areas have a higher probability of selection. The design effect will be relatively larger in states that use this kind of sample design. As it was not designed to produce sub-state estimates, the *Filling the gaps* collection had a more straightforward unstratified design, leading to lower design effects in those states.

Estimates of average DE by state are presented in Table 4. The estimates of average DE by state suggests that with the exception of WA, there are no large variations and all are generally comparable with NHS estimates. The relatively larger DE for WA reflects over-sampling for the state health regions in rural areas. The WA design effects are not considered large enough to invalidate data pooling across the states to derive national estimates.

The CV and DE for Australia (ie the pooled data set) are larger than for any individual state. This is due to the unequal probabilities of selection across the states shown in Table 1. In effect, this leads to a more complex survey design at the national level and lowers the efficiency of the design. Thus, although the total sample size of the pooled dataset is 32,474, the estimates will have the same precision of a simple random sample of 11,222.

Design effect (DE) continued

4 COEFFICIENT OF VARIATION OF SAMPLE WEIGHTS, DESIGN EFFECT, AND EFFECTIVE SAMPLE SIZE, BY STATE

	STATE HEALTH SURVEYS				NHS			
State	*CV (Sample weight)*(a)	*Sample size*	*Average design effect*(b)	*ESS*(c)	*CV (Sample Weight)*	*Sample size*	*Average design effect*	*ESS*
NSW	0.9	9 579	2	5 412	0.5	4 004	1.6	2 475
Vic	0.9	7 500	1.8	4 190	0.5	3 367	1.7	1 938
Qld	0.7	1 210	1.5	796	0.4	3 143	1.4	2 256
SA	0.7	6 205	1.5	4 221	0.5	3 458	1.7	2 067
WA	1.3	4 359	2.7	1 639	0.5	2 106	1.7	1 250
Tas	0.7	1 215	1.4	844	0.4	1 949	1.6	1 205
NT	0.6	1 192	1.3	903	0.5	109	2.2	49
ACT	0.6	1 214	1.4	867	0.4	1 365	1.6	869
Aust	1.4	32 474	2.9	11 222	0.8	19 501	1.8	10 715

(a) Coefficient of variation (CV) of the sample weights is calculated by dividing the standard deviation of the sample weights by the mean

(b) The average design effect (DE) is a simple average of the design effects for the eight variables studied

(c) Effective sample size (ESS) is the actual sample size divided by the average design effect

Based on an analysis of a number of parameters of the pooled CATI data we can conclude that the effective sample size (ESS) for each state at least meets the minimum adequacy requirements for pooling the state data to derive national estimates. However there are issues caused by the unequal selection probabilities across the states reducing the power of the pooled dataset.

These effects do not invalidate the pooling of the data, nor do they lead to unreliable national estimates. Despite the larger design effect at the national level, the effective sample size is larger than the effective sample size of the NHS and the pooled dataset is therefore suitable for the production of statistically reliable national estimates. This is supported by the RSEs shown in Tables 2 and 3, which indicate that the pooled national estimates are more statistically reliable than those of any individual state.

IMPACT OF MISSING DATA

One key aspect of the project was to determine if national estimates could be produced if a state does not run a survey in a particular year. The impact on national estimates of selected SNAPS variables for each state were examined by dropping one or a combination of states from the pooled dataset and computing the estimate for the variable and then comparing it with the estimates derived from the full dataset (ie including all states).

The results were inconclusive due to a lack of consistency across variables. No states are consistently above or below national estimates for all of the variables.

A summary measure that captures the overall impact on national estimates for each omitted state was derived using Principal Component Analysis (PCA).

IMPACT OF MISSING DATA *continued*

5 TWO MEASURES OF OVERALL IMPACT OF MISSING STATES ON NATIONAL ESTIMATES

State	*Index*(a) %	*Diff Nat Est*(b) %	*Avg Sqrd Diff*(c) %
Australia	100.0	—	—
excl. NSW	92.0	–8.0	1.8
excl. Vic	95.9	–4.1	1.1
excl. Qld	106.9	6.9	1.8
excl. SA	101.3	1.3	0.5
excl. WA	100.6	0.6	0.5
excl. Tas	100.7	0.7	0.2
excl. NT	100.2	0.2	0.1
excl. ACT	100.2	0.2	0.1

— nil or rounded to zero (including null cells)

(a) Based on weights derived from Principal Component Analysis for the eight variables using the first principal component. Derived overall index for Aust has been rescaled to 100 and other indexes adjusted accordingly.

(b) Difference between index excluding a state and the national (Aust) index.

(c) This is calculated as the square root of the average of the squared difference between the national estimates for each variable and the estimate excluding a state. This is analogous to a standard deviation measure.

The PCA determined index, as might be expected, shows that states with a larger population share tend to have a larger impact than smaller states. As a result, excluding larger states such as NSW, Vic and Qld will have a bigger impact on the national estimates than the exclusion of smaller jurisdictions like Tas, ACT, and NT.

The impact of a missing state on an estimate for an individual variable is a function of both the population share of that state and of the difference between the estimate for that state and the national average. For example, the estimate for smoking in the NT is much higher than the other states, and therefore the effect of omitting NT data on the national estimate for smoking is actually greater than excluding WA, despite WA having a much larger population. WA and SA tended to not differ very much from the national average in 2004 so their exclusion has minimal effect. However, the impact of each state on the national estimate may vary from year to year.

6 IMPACT OF MISSING STATES ON NATIONAL ESTIMATES, STATE BY SELECTED RISK FACTORS

	Smoking(a)	*Smokefree*(b)	*Fruit*(c)	*Vegetable*(d)	*Milk*(e)	*BMI*(f)	*Exercise*(g)	*K10*(h)
State	%	%	%	%	%	%	%	%
Australia	21.1	85.5	49.6	90.9	48.3	51.0	52.0	11.8
excl. NSW	20.7	86.4	49.5	90.4	47.0	51.3	53.4	11.2
excl. Vic	20.7	86.1	50.2	90.1	49.6	51.5	52.1	11.6
excl. Qld	21.6	85.0	49.8	91.1	48.3	50.8	51.5	11.8
excl. SA	21.2	85.5	49.0	90.8	49.0	50.6	51.1	11.9
excl. WA	21.1	85.2	50.0	91.5	47.4	50.9	51.9	12.0
excl. Tas	21.1	85.5	49.6	91.0	48.4	51.0	52.0	11.9
excl. NT	21.0	85.5	49.5	90.9	48.3	51.0	52.0	11.8
excl. ACT	21.1	85.5	49.6	90.9	48.4	51.1	52.1	11.8
excl. NT and Tas	21.0	85.5	49.5	91.0	48.3	51.0	52.1	11.9
excl. ACT, NT and Tas	21.1	85.4	49.5	91.0	48.5	51.1	52.2	11.9

(a) Current smokers
(b) Living in smoke free household
(c) Inadequate fruit consumption (less than 2 serves/day)
(d) Inadequate vegetable consumption (less than 5 serves/day)
(e) Consuming full cream/other milk (rather than low fat milk)
(f) Body mass index - overweight/obese
(g) Insufficient exercise level (less than 150 minutes per week)
(h) Suffering from high/very high stress levels

IMPACT OF MISSING DATA *continued*

There is not enough data available at this stage to propose a methodology for imputing estimates for missing states. Given the uncertainty over the effect of missing states, ideally data should be pooled from all states to create a truly national estimate.

SEASONALITY

To assess seasonality and the potential implications of seasonality on national estimates and interstate comparisons, monthly estimates were examined across the states for selected variables. Estimates from those states with continuous data collection were used to see if there was any trend over the year and to compare these estimates against the states with surveys conducted over a few months only (point-in-time).

Although questions are generally framed in terms of what respondents usually do, in practice seasonal effects may impact on certain health behaviours and on recall. As a result national estimates derived from pooling across states may partly reflect the season in which data was collected in some states. In addition, any apparent differences between states may not reflect real underlying differences and instead may be an artefact of differences in the period in which the data was collected.

Table 7 shows the months for which data are collected in each state and territory. As can be seen from the table the CATI surveys are conducted at different times of the year for different jurisdictions. The survey for NSW is generally conducted between February to December each year. In 2004, the survey started at the end of January, and due to the change in the number of area health services during the year no surveys were conducted during the three months between July-September. For Vic the survey was conducted over four months from August to November. For Qld/Tas/ACT/NT the survey for 2004 was carried out in December only as part of the *Filling the gaps* survey.

SEASONALITY *continued*

7 MONTHS OVER WHICH CATI DATA WAS COLLECTED FOR EACH STATE AND TERRITORY, 2004

	NSW	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Jan	x			x	x			
Feb	x			x	x			
Mar	x			x	x			
Apr	x			x	x			
May	x			x	x			
Jun	x			x	x			
Jul				x	x			
Aug		x		x	x			
Sep		x		x				
Oct	x	x		x				
Nov	x	x		x	x			
Dec	x		x	x	x	x	x	x

Unfortunately information on the month that each interview was conducted was not uniformly available on each dataset. Therefore it was not possible to derive precise quarterly estimates across the states to examine the extent of seasonality, if any, in the data.

The monthly rates for each variable for the three states with data collected throughout the year (NSW, WA, SA) were examined to see if there was any trend in seasonality.

There is volatility in the monthly data across variables and states but there does not appear to be any consistent pattern in the data. While some monthly estimates for some variables appear to be different from the average these estimates do not appear to be contiguous to show any seasonal pattern in the data. However, this lack of seasonality may reflect the small monthly sample size for the variables across states, missing monthly data series and the small span (only 12 months) of the time series data. The data showed some evidence of seasonality for inadequate fruit consumption, although it was difficult to draw any firm conclusions.

To further explore potential seasonality effects, data from the 2004-05 National Health Survey (NHS) was examined. Collection in the NHS is spread across the whole year across each state and territory, and therefore gives a good indication of potential seasonality effects in the state CATI health surveys.

In the NHS there was evidence for seasonal effects of only a few health behaviours. The proportion of people reporting inadequate fruit intake was 41.7% in January to March, compared with 48.5% in the other months of the year. The proportion of people assessed as overweight or obese was 56.5% in January, compared with an average of 53.2% in the other months. These findings are consistent with anecdotal evidence from NSW, which also showed seasonality only in BMI and fruit intake based on an analysis of three years of NSW data.

In conjunction with findings from the pooled CATI dataset, we can conclude that seasonality may have a small effect on the estimates.

Further analysis could be undertaken to better understand seasonality. A minimum of three years of monthly/quarterly data is generally required to check for seasonality. A greater evidence base would be needed to be able to recommend any adjustment to raw data to account for seasonality effects.

PRODUCING NATIONAL ESTIMATES

The main purpose of this project was to trial the methodology and assess the quality of different techniques of combining data from the state CATI health surveys.

A pooled national dataset was created using the unit record data from the *Filling the Gaps* collection and the state CATI health surveys. This enabled national estimates to be produced directly from a single dataset. An assessment of quality of other methods of producing national estimates could also then be made by comparing these estimates to those produced using alternative methods.

If a pooled national dataset was unavailable, the only available method of producing national estimates from state CATI health surveys would be to appropriately weight and aggregate state estimates. Estimates created in this fashion are referred to below as "aggregated national estimates".

Using this method, the overall national estimate, $\hat{Y}$, is calculated from the state estimates using the following formula:

$$\hat{Y}=\sum_{s} \frac{N_s}{N}\hat{Y}_s$$

where N is the national population, N_s is the population of a state and $\hat{Y}_s$ is the state estimate.

Table 8 shows state estimates for smoking prevalence, weighted using this formula. Each state's contribution to the national total is the state estimate multiplied by the state weight, where the weighting is the state's share of the national population aged 18 years and over. Therefore the sum of each state's contribution is the national estimate.

8 SMOKING PREVALENCE, CURRENT SMOKER, BY STATE (POOLED DATA)

	State estimate	*Weighting*	*Percentage point contribution*
State	%	%	% pts
NSW	21.9	33.53	7.34307
Vic	22.3	24.90	5.55270
Qld	18.8	19.13	3.59644
SA	19.5	7.76	1.51320
WA	20.6	9.77	2.01262
Tas	21.3	2.38	0.50694
NT	28.8	0.92	0.26496
ACT	17.8	1.62	0.28836
Total	na	na	21.07802

In the example above, 21.9% of the adult population in NSW were current smokers. As NSW made up 33.53% of the Australian population, NSW made a contribution of 7.34307 percentage points to the total national smoking rate (21.9% x 33.53% = 7.34307%). Repeating this process for each state and territory, and summing each contribution to the total, the national estimate for current smoking is therefore 21.07802% (rounded to 21.1%).

One disadvantage of this approach is that if the variable of interest was at a different level of disaggregation, the weighting adjustments and calculations could be extremely complex. For example, if the estimate of interest was smoking rates in capital cities and

PRODUCING NATIONAL ESTIMATES *continued*

the rest of Australia, each state level smoking estimate for the capital city and the rest of the state would need to be multiplied by a different weighting factor to take into account the proportion of the population living in the capital city in that state.

In addition, to produce a national estimate, data would need to be published for the relevant data item for all states and territories. For certain levels of disaggregation for individual states and territories, this may not be available.

Another issue with this approach is that there are differences in the way individual states calculate and report their published estimates. For example, there was different treatment of "not stated" responses for the purposes of calculating percentages. This effect can be particularly significant for topics that have higher levels of non-response, such as body mass index (BMI), psychological distress, and physical activity.

To ensure that all state estimates were calculated on a consistent basis, the ABS also re-produced the state estimates using the data provided and with identical standards for reporting (eg treating "not stated" responses the same for each state). This removed the effect of the different reporting standards and allowed a true assessment of the quality of the methodology.

The aggregated national estimates from published state estimates were compared with the aggregated national estimates from re-derived state estimates and with the estimates produced from the pooled national dataset, as shown in Table 9 on page 14.

EXPERIMENTAL NATIONAL ESTIMATES

There were a number of metadata inconsistencies in the various state datasets, such as field labelling and different response categories. These had to be resolved before the data could be successfully pooled. For example, for individual smoking status, some states provided the data in five categories (daily smoker, occasional smoker, etc), while others provided the data in three categories (non smoker, ex smoker, current smoker). For milk consumption, the codes associated with each type of milk varied, so the same numerical code referred to different types of milk in different datasets. For example the code 1 referred to low fat milk in one dataset, and whole milk in another, while the code 4 referred to soya milk in one dataset and evaporated or sweetened in another dataset.

For most of the indicators, these inconsistencies were able to be resolved and the datasets were able to be successfully pooled. National estimates were therefore able to be produced for most of the SNAPS topics. Notably, estimates for alcohol risk were not able to be produced due to differences between some of the states in the way the data was collected and presented.

Table 9 shows the results of producing national estimates using different approaches. As might be expected, the national estimates created by weighting and aggregating the re-derived state level estimates were almost identical to those created directly from the pooled unit record data. As noted by Yang (2007), estimates produced from pooled unit record data will be the same as "meta prevalence" estimates produced from weighting and aggregating estimates from separate surveys. These results show that the methodology of weighting and combining state level estimates to produce a national level estimate is sound in principle.

In practice, there were large discrepancies between the estimates compiled from the pooled data and the national estimates created by weighting and aggregating published state estimates. This is due to inconsistencies in the reporting of particular estimates across the states. For example, calculation of estimates is affected by whether non-response for that question is included in the denominator. Depending on the topic (and the level of non-response), this can make a significant difference. For fruit intake, vegetable intake and physical activity, some jurisdictions reported the proportion with "sufficient" levels, while others reported the proportion with "insufficient" levels. There were also some small differences in weighting and rounding that explains some of the difference between published estimates and those generated from unit record data. Published estimates for some variables for some states were unavailable or unable to be located. In these cases, this is noted in the table and the estimate produced with that state missing.

The differences in reporting standards and methodology between the different states mean that weighting and combining currently published state estimates will not produce a high quality national estimate.

For comparison purposes, data from the 2004-05 National Health Survey is also presented. While CATI surveys offer greater frequency than is feasible from large, face-to-face household surveys, for ongoing reporting or use in any health performance indicator framework, estimates produced from pooled state CATI health surveys would need to be of high quality and be consistent with equivalent estimates from key national data sources like the NHS.

EXPERIMENTAL NATIONAL ESTIMATES *continued*

9 COMPARISON OF NATIONAL ESTIMATES USING DIFFERENT METHODS

Indicator	*Aggregated national estimate based on published state estimates* %	*Aggregated national estimate based on re-derived state estimates* %	*Pooled national estimate* %	*NHS* %
Current smokers	20.8	21.1	21.1	23.2
Smoke-free household	-	-	85.5	87.3
(excluding SA & WA)	85.2	85.1	85.1	87.1
Inadequate fruit consumption	50.2	49.6	49.6	46.2
Inadequate vegetable consumption	87.3	90.9	90.9	85.6
Usually consumer regular/full cream milk	-	-	48.3	43.2
(excluding WA)	45.2	47.4	47.4	43.5
Overweight or obese	49.9	51.0	51.0	53.6
Sufficient exercise	53.1	52.0	52.0	24.0
High/very high psychological distress	12.0	11.8	11.8	13.0

Significance testing shows that for all the variables, there is a significant difference between the estimates derived from the CATI dataset and those from the NHS.

These differences are likely to be due to differences in response rates and collection methodology. There is some evidence that people without telephone connections are more likely to be smokers and less likely to be overweight or obese, even after accounting for the effects of age and sex (PHIDU, 2009). In addition, there are modal differences between telephone surveys and face to face interviewing that may account for some of the observed differences. For example, the NHS uses visual prompt cards for respondents to assist in working out how many serves of vegetables they consumed, while telephone interviewing does not allow for this. In addition, the nature of telephone interviewing means that people may be more likely to under-report their weight or over-report their height than they would if they were undergoing a face to face interview.

Given the statistically significant differences between the NHS and the pooled dataset, caution should be exercised in comparing the two. While CATI estimates could potentially be reported in the interim years between National Health Surveys, any differences between a set of national estimates produced from CATI surveys in the year after an NHS and estimates from the NHS the previous year should not be construed as representing any actual change in risk factor prevalence over that year. Rather, for any meaningful comparisons over time, results from CATI surveys should be compared with results from previous CATI surveys, and results from National Health Surveys compared with results from previous National Health Surveys. Further harmonisation is required to improve comparability between CATI surveys and the NHS.

The appendix to this publication contains the estimates published by each jurisdiction, along with state-level estimates that were produced as part of the data pooling process, and equivalent estimates from the NHS. Comparison between state CATI estimates and state estimates from the NHS tends to show the same pattern of results observed at the national level.

CHAPTER 4 CONCLUSIONS

CONCLUSIONS

The results of this exercise show that ongoing pooling of state health survey data is feasible. While CATI surveys are unlikely to be able to produce data of the same quality as a large, national household survey such as the NHS, they could potentially provide an alternative source of national estimates on a more regular basis than the three-yearly NHS. However, further harmonisation of standards, question modules, and data set specifications would be required to streamline the compilation process, improve confidence in the findings, and improve comparability with the NHS.

Questions on alcohol consumption may need to be better harmonised to ensure that national estimates for alcohol risk are able to be produced from state health surveys. Further investigation may also need to be undertaken to better understand the significantly different estimates for physical activity between CATI and the NHS.

In addition, data from all states and territories would need to be available to produce national estimates. Currently, some states and territories do not have an ongoing health survey program. Introduction of regular data collection from these jurisdictions would be required to produce regular national estimates.

Theoretically, estimates produced from pooled unit record data will be the same as estimates produced by aggregating and weighting data from each state and territory. However, as shown in the results, creating national aggregated estimates from published estimates is problematic without further harmonisation and consistency of reporting standards. In many cases, the inconsistencies in standards between the states led to estimates generated by aggregating published estimates that were quite different to the estimates produced using the unit record data. The data quality of national estimates created from published state estimates is therefore limited and this method could not be recommended.

There are also clear benefits to data pooling beyond constructing regular national level prevalence estimates. The potential for improved opportunity for analysis at a more disaggregated level is one of the key benefits of a pooled dataset. A national dataset of CATI data would allow a greater range of analyses to be undertaken: the greater sample size in a national dataset means that more detailed analysis of particular risk factors or relatively low-prevalence conditions could be performed, along with additional cross-tabulations that would be impossible to perform on any individual state dataset. Rather than relying on published estimates already being available for each and every jurisdiction, any national or sub-group estimates and cross-tabulations could easily be generated.

STATE ESTIMATES

Published state estimates, equivalent estimates from the NHS, and state level estimates re-produced from the pooled data set are presented below.

A1 SMOKING PREVALENCE, PERSONS CURRENTLY SMOKING, AGED 18 YEARS AND OVER(a)(b)

	NSW	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*(c)	*ACT*	*Aust*
	%	%	%	%	%	%	%	%	%
Published data	21.1	22.3	18.8	20.2	(d)19.9	21.3	28.8	17.8	20.8
Data pooling	21.9	22.3	18.8	19.5	20.6	21.3	28.8	17.8	21.1
2004–05 NHS	22.4	23.3	24.6	22.5	21.6	25.4	na	17.6	23.2

(a) Estimates adjusted for missing values.
(b) Includes current daily smokers and other current smokers.
(c) CATI surveys in NT are believed to under sample Indigenous persons, particularly those in very remote areas.
(d) Calculated by equal weighting of males and females.

A2 SMOKEFREE HOUSEHOLDS, PERSONS AGED 18 YEARS AND OVER(a)(b)

	NSW	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*(c)	*ACT*	*Aust*
	%	%	%	%	%	%	%	%	%
Published data	84.3	83.8	87.9	na	na	88.5	84.8	89.7	(d)85.2
Data pooling	83.9	83.8	87.9	86.3	88.9	88.4	84.8	89.7	85.5
2004–05 NHS	86.8	87.4	87.5	88.3	88.6	84.3	na	91.5	87.3

(a) Estimates adjusted for missing values.
(b) Persons in households in which no current daily smokers smoke indoors.
(c) CATI surveys in NT are believed to under sample Indigenous persons, particularly those in very remote areas.
(d) Not a complete national estimate as SA and WA CATI estimates not published. Australian estimate is the population weighting of NSW, Vic, Qld, Tas, NT and ACT.

A3 INADEQUATE VEGETABLE CONSUMPTION, PERSONS EATING LESS THAN FIVE SERVES PER DAY, PERSONS AGED 18 YEARS AND OVER(a)

	NSW	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*(b)	*ACT*	*Aust*
	%	%	%	%	%	%	%	%	%
Published data	91.8	93.0	(c)73.3	92.4	(d)86.4	66.4	75.8	90.7	87.3
Data pooling	91.9	93.0	90.0	91.6	84.8	84.3	91.1	89.7	90.9
2004–05 NHS	88.1	84.7	84.7	87.9	80.3	79.4	na	89.7	85.6

(a) Estimates adjusted for missing values.
(b) CATI surveys in NT are believed to under sample Indigenous persons, particularly those in very remote areas.
(c) Less than four serves per day.
(d) Calculated by equal weighting of males and females.

STATE ESTIMATES *continued*

A4 INADEQUATE FRUIT CONSUMPTION, PERSONS EATING LESS THAN TWO SERVES PER DAY, PERSONS AGED 18 YEARS AND OVER(a)

	NSW	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*(b)	*ACT*	*Aust*
	%	%	%	%	%	%	%	%	%
Published data	53.0	48.4	47.4	59.0	(c)42.2	52.8	51.1	59.4	50.2
Data pooling	50.0	48.0	49.0	57.3	46.4	52.8	49.1	59.3	49.6
2004–05 NHS	46.0	44.0	47.3	50.0	44.6	46.3	na	46.5	46.2

(a) Estimates adjusted for missing values.
(b) CATI surveys in NT are believed to under sample Indigenous persons, particularly those in very remote areas.
(c) Calculated by equal weighting of males and females.

A5 TYPE OF MILK CONSUMED, CONSUMPTION OF REGULAR/FULL CREAM MILK, PERSONS AGED 18 YEARS AND OVER(a)

	NSW	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*(b)	*ACT*	*Aust*
	%	%	%	%	%	%	%	%	%
Published data	48.9	38.0	48.5	(c)41.0	na	46.7	51.0	53.2	(d)45.2
Data pooling	51.0	44.4	48.5	40.0	56.6	46.7	51.2	41.7	48.3
2004–05 NHS(e)	45.4	39.7	47.2	37.2	40.3	48.1	na	39.7	43.2

(a) Estimates adjusted for missing values.
(b) CATI surveys in NT are believed to under sample Indigenous persons, particularly those in very remote areas.
(c) Includes evaporated, sweetened condensed milk, all soy milk and any other milk.
(d) Not a complete national estimate as WA estimate was not published. Australian estimate is the population weighting of NSW, Vic, Qld, SA, Tas, NT and ACT.
(e) Includes evaporated and sweetened condensed milk and excludes regular soy milk.

A6 BODY MASS INDEX, PROPORTION OF PERSONS OVERWEIGHT/OBESE, PERSONS AGED 18 YEARS AND OVER(a)

	NSW	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*(b)	*ACT*	*Aust*
	%	%	%	%	%	%	%	%	%
Published data	49.3	46.8	(c)51.9	54.8	(d)52.7	50.6	51.5	48.2	49.9
Data pooling	50.5	49.4	51.7	55.5	52.3	50.6	51.5	48.2	51.0
2004–05 NHS	53.8	53.3	52.9	55.4	52.7	55.6	na	52.8	53.6

(a) Estimates adjusted for missing values.
(b) CATI surveys in NT are believed to under sample Indigenous persons, particularly those in very remote areas.
(c) Estimates are for persons aged 18 to 64 years.
(d) Calculated by equal weighting of males and females.

STATE ESTIMATES *continued*

A7 PERSONS WHO UNDERTOOK SUFFICIENT EXERCISE, PERSONS AGED 18 YEARS AND OVER(a)

	NSW	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*(b)	*ACT*	*Aust*
	%	%	%	%	%	%	%	%	%
Published data	51.7	59.9	(c)46.8	42.9	(d)62.0	50.2	48.6	57.3	53.1
Data pooling 2004–05	49.2	51.5	54.1	62.6	52.4	49.3	49.5	43.1	52.0
NHS	23.0	24.0	24.0	23.0	26.0	25.0	na	27.0	24.0

(a) Estimates adjusted for missing values.
(b) CATI surveys in NT are believed to under sample Indigenous persons, particularly those in very remote areas.
(c) Estimates for persons aged 18 to 64.
(d) Calculated by equal weighting of males and females.

A8 HIGH OR VERY HIGH LEVELS OF PSYCHOLOGICAL DISTRESS, PERSONS AGED 18 YEARS AND OVER(a)

	NSW	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*(b)	*ACT*	*Aust*
	%	%	%	%	%	%	%	%	%
Published data	13.2	12.1	11.7	10.6	(c)9.5	7.3	8.4	10.8	11.8
Data pooling 2004–05	13.0	12.4	11.7	10.1	9.2	7.3	8.9	10.8	11.8
NHS	12.6	13.1	14.3	12.2	11.8	12.6	na	12.1	13.0

(a) Estimates adjusted for missing values.
(b) CATI surveys in NT are believed to under sample Indigenous persons, particularly those in very remote areas.
(c) Calculated by equal weighting of males and females.

GLOSSARY

Benchmark A benchmark is an independent estimate of the population of interest. Weights calibrated against population benchmarks ensure that the survey estimates conform to the independently estimated distributions of the population rather than to the distribution within the sample itself. Calibration to population benchmarks helps to compensate for over or under enumeration of particular categories which may occur due to the random nature of sampling or non-response. This process can reduce the sampling error of estimates and may reduce the level of non-response bias. See *weighting*.

BMI See overweight and obesity

Coefficient of variation (CV) The coefficient of variation is a statistical measure of the degree of variation in a data item. It is calculated by dividing the standard deviation by the mean.

In this publication, the coefficient of variation was used to measure the degree of variation in the sample weights.

Computer Assisted Telephone Interviewing (CATI) Computer Assisted Telephone Interviewing (CATI) is a survey technique in which respondents are interviewed over the telephone, with interviewers following a script on a computer screen, and recording the responses directly onto the computer. This technique allows particular parts of the survey to be tailored to the respondent based on the responses to previous questions, and allows results to be quickly and easily compiled.

In the health context in Australia, "CATI" is often used as shorthand to describe the various state health surveys that are conducted using this methodology.

Current smoker A current smoker is a person who, at the time of interview, reported that they smoked cigarettes, cigars or pipes at least weekly.

Design effect (DE) The design effect is defined as the ratio of the variance of the estimate obtained from a more complex survey design to the variance of the estimate obtained from a simple random sample of the same number of units. It is a measure of the efficiency of the design. It represents the combined effect of a number of components such as stratification, clustering, unequal selection probabilities and weighting adjustments for non-response and non-coverage. A sampling design is said to be as efficient as a simple random sample if the DE is equal to 1, and less efficient if DE is greater than 1. A DE of 2 for example, means that, to obtain the same precision in an estimate, twice as many individuals (sample size) would have to be studied.

Effective sample size (ESS) The effective sample size is the actual sample size divided by the design effect.

Estimated Resident Population (ERP) The Estimated Resident Population (ERP) is the official estimate of the Australian population.

It is based on the counts from the most recent Census, which are adjusted for undercount, net overseas migration and births and deaths.

Filling the gaps *Filling the gaps* was a telephone health survey funded by the Australian Government department of Health and Ageing, and conducted in Qld, Tas, NT and ACT in December 2004. The survey focussed on the SNAPS health risk factor topics and key demographics. It was designed to provide data for those states and territories that did not have a telephone health survey at that time.

Inadequate fruit consumption Inadequate fruit consumption refers to those people who usually consume less than two serves of fruit per day. A medium piece of fruit (eg an apple), two small pieces of fruit (eg apricots), or one cup of chopped fruit is considered a serve.

Inadequate vegetable consumption Inadequate vegetable consumption refers to those people who usually consume less than fives serves of vegetables per day. Half a cup of cooked vegetables, one medium potato, or one cup of salad is considered a serve.

K10 See psychological distress

Milk consumption

Milk consumption refers to the proportion of people who report consuming full fat or regular milk (as distinct from soy, skim, etc).

National Health Survey (NHS)

This publication presents results from the National Health Survey (NHS), which was conducted throughout Australia from August 2004 to June 2005.

The NHS was conducted in a sample of 19,501 private dwellings. Both urban and rural areas in all states and territories were included, but very remote areas of Australia were excluded. Non private dwellings such as hotels, motels, hospitals, nursing homes and short-stay caravan parks were not included in the survey.

A National Aboriginal and Torres Strait Islander Health Survey was conducted at the same time as the 2004-05 NHS. Information about that survey, together with summary results was published in National Aboriginal and Torres Strait Islander Health Survey 2004-05: Summary of Results, Australia (cat. no. 4715.0)

Overweight and obesity

Overweight and obesity refers to those people who have a Body Mass Index (BMI) score greater than 25.0. BMI is calculated using weight in kilograms, divided by the square of the height in metres. In the state health surveys and in the NHS, this is based on self-assessed height and weight.

Principal Component Analysis (PCA)

Principal Component Analysis is a statistical technique that aims to summarise a large number of correlated variables into a smaller set of transformed variables, called principal components.

Psychological distress

Psychological distress is based on having a "high" or "very high" score on the Kessler Psychological Distress Scale - 10 items (K10). This is a scale of non-specific psychological distress based on 10 questions about negative emotional states in the 4 weeks prior to interview. The K10 is scored from 10 to 50, with higher scores indicating a higher level of distress. A high or very high score is considered to be a score of 22 or over.

Seasonality

Seasonality is the existence of regular and predictable variations in a data item, based on the period in which the data is collected. Seasonality can be due to natural differences, such as weather, administrative procedures, such as school terms, or social and cultural behaviour such as Christmas or Chinese New Year. Seasonal adjustment can be proposed to estimate and attempt to remove the effects of seasonality on particular estimates.

Smokefree household

A smokefree household is where the respondent reports that no-one in that dwelling smokes indoors.

SNAPS

SNAPS is the acronym for a number of health risk factors that are collected in the state health surveys and in the NHS. It stands for Smoking, Nutrition, Alcohol, Physical Activity, and Stress. The Nutrition component includes fruit intake, vegetable intake, milk consumption, and obesity, although the latter is sometimes identified separately.

Sufficient exercise

Sufficient exercise is defined as a total of at least 150 minutes of exercise in the last week, on at least 5 different occasions. In calculating the number of minutes, vigorous activity is weighted at double the number of minutes.

Weighting

Weighting is the process of adjusting results from a sample survey to infer results for the total population. To do this, a weight is allocated to each sample unit. The weight is therefore a value which indicates how many people in the population and represented by each person in the survey.

Weights are initially assigned based on the probability of being selected in the survey. For example, if the probability of a person being selected was 1 in 600, then the person would have an initial weight of 600 (that is, they represent 600 other people).

Weights are then calibrated to align with independent estimates of the population of interest or 'benchmarks', in designated categories of sex, age, and geographic location. See *Benchmarks*

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