# **Trend Analysis on Australian Health Status**

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#### Abstract

The general social surveys (GSS) conducted by Australian Bureau of Statistics (ABS) in 2002, 2006 and 2010 contain health status data collected from the participants over the country. ABS only presented a brief summary of Australian health status through simple data analysis, which provided little insight into the trends of general health status of Australians and variations of health status of different age groups over the years. In this paper, these health status data have been analyzed using some existing methods and a newly proposed method of "average residual analysis" (ARA) to identify any hidden trends and variations of health status from 2002 to 2010 in Australia. This trend analysis not only reaffirmed the previous summaries given by ABS, but also found two possible tendencies in the 2010 GSS: people who rated their health status very good or excellent became declining in the extended young-middle age groups (25-64 years old), and people in the middle age groups (35-54) were more likely to rate their health status as good, rather than as very good or excellent, compared with that in the 2002 and 2006 GSSs.

Keywords: Trend Analysis, Average Residual Analysis (ARA), Health Status, General Social Surveys

## **1. Introduction**

Australian Bureau of Statistics (ABS) conducted the general social surveys (GSS) in Australia in 2002, 2006 and 2010 respectively [1-10]. The GSS provides information on a wide range of key areas of concern for Australians. It helps building a picture of the social characteristics of the population and allows for a better understanding of the relationships between different aspects of life and how these affect people, including the exploration of multiple advantage and disadvantage [11-13]. One key area is health status that is based on participant's self assessment on own health status. This information indicates individual's awareness and expectations of own health and well-being and thus provides a picture of overall health status in Australia.

For the collected GSS data, however, ABS only provided a brief summary of results based on its data processing and analysis [11-13]. Results of any detailed analysis on a particular key area were not available although the data are made publicly available on ABS website [14]. These summaries based on simple statistics were generally correct but provided little insight into the trends of general health status of Australians and variations of health status of different age groups from 2002 to 2010.

In this paper, the health status data collected in the GSSs in 2002, 2006 and 2010 are reanalyzed using some existing methods and a newly proposed method called "average residual analysis" (ARA) to identify trends of general health status and variations of health status of different age groups over the period in Australia. This detailed data analysis provides a better understanding of health status of Australians and hence may be useful in health policy making and planning by the governments.

In the following sections, the historical health status data collected from the past three GSSs and ABS' summary on these data are firstly introduced. The methods proposed for furthering the data analysis in this study are then presented. Results of data analysis will be incorporated with discussions, followed by a brief conclusion in the end.

### 2. Historical health status data and previous analysis

The health status data in the GSS conducted in 2002 and 2006 were classified into 7 age groups of 18-24, 25-34, 35-44, 45-54, 55-64, 65-74, and 75 or over [1-9]. The data in 2010 GSS were classified into 8 age groups of 18-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and 85 or over [10]. Response of

self health assessment from each participant fell into one of the three categories: Excellent/Very good (E), Good (G), and Fair/Poor (P) [15-17]. To make the data in one age group comparable to that in other groups, these three categories in a group were normalized by the total number of responses in that group. The normalized health status data in the 2002, 2006 and 2010 GSSs are listed in Table 1. Note that the two age groups of 75-84 and 85 or over in the 2010 GSS are combined and renormalized in the same way as other groups to maintain consistency and comparability among the three GSSs.

GSS	Health status	Age group (years)							
		18-24	25-34	35-44	45-54	55-64	65-74	75 or over	All
		Proportion (%)							
2002	Excellent/Very good	74.0	73.6	66.5	56.7	46.4	34.5	28.5	59.2
	Good	18.5	19.6	23.8	26.9	29.1	32.3	33.3	24.9
	Fair/Poor	7.4	6.8	9.7	16.4	24.5	33.2	38.1	15.9
2006	Excellent/Very good	70.0	71.4	64.2	56.5	48.6	42.0	26.7	58.2
	Good	23.3	21.6	24.4	27.2	27.3	31.5	36.6	25.9
	Fair/Poor	6.7	7.0	11.4	16.3	24.1	26.6	36.7	15.9
2010	Excellent/Very good	69.1	65.6	56.6	47.8	43.6	39.2	27.7	52.6
	Good	22.7	25.1	31.0	35.8	33.9	30.9	36.5	30.5
	Fair/Poor	8.2	9.3	12.4	16.4	22.4	29.9	35.8	16.9

Table 1. The normalized health status data in the 2002, 2006 and 2010 GSSs in Australia

In all GSSs, the percentage in Category E declines gradually whereas the percentage in Category P increases steadily with increase in age (Figure 1). The percentage in Category G exhibits small variations with increase in age among the three GSSs. In the 2010 GSS summary on health status, ABS only stated that "just over half (53%) of people aged 18 years and over rated their health as excellent or very good, a further 31% rated their health as good, with only 17% rating their health as only fair or poor. Between 2006 and 2010, the overall proportion of people who rated their health as good or better did not change significantly (84% and 83% respectively). Differences in health status occur across age groups, with younger people more likely to rate their health as excellent or very good compared to people in older age groups." [13]

The report did not make comparison with the health status data in the 2002 GSS. This may be due to the fact that the overall proportion of people who rated their health as good or better did not change at all between 2002 and 2006 (84.1% identical).

#### 3. Methods used in this data analysis

Since the aim of this study is to identify any health status trends hidden in the past three GSSs that have not been found before, the methods chosen and proposed for this data analysis are both comparative and diagnostic.

As the data are categorized in age groups, qualitative comparison methods based on the average figures are the most appropriate choice for this study. Such semi-quantitative comparison can be displayed intuitively using bar charts and radar graphs. Bar charts are most suitable in showing the general trends of the data whereas radar graphs are the best for identifying the overall patterns contained in the data. Radar graphs are also useful in depicting differences in patterns of the same category data.

In addition to the general trends and overall patterns that can be identified through bar charts and radar graphs, other characteristic changes over the period of eight years may also hide in the health status data collected in the past three GSSs. Diagnostic approaches are required to indentify these hidden characteristic changes if they exist. In this study, a new method named "average residual analysis (ARA)" is proposed for achieving this goal.

Trend Analysis on Australian Health Status William W. Guo



Figure 1. Bar charts of Australian health status from the 2002, 2006 and 2010 GSSs

ARA is to locate the intersected points in the horizontal axis (age projection this time) where the vertical variant (residual percentage of health status this time) crosses the horizontal axis. The residual percentage of health status is actually the difference between the category percentage in an age group

in a particular GSS and the overall average category percentage of the whole population in that GSS, i.e.,

$$R_{ij} = A_{ij} - A_i, \tag{1}$$

where  $R_{ij}$  is the residual of Category *i* (E, G, and P) in the *j*th age group in the same GSS;  $A_{ij}$  is the average percentage of Category *i* in the *j*th age group in the same GSS;  $A_i$  is the average percentage of Category *i* over all the age groups in the same GSS.

The two important intersected points (called the crossing points) of  $R_{ij}$  in this data analysis are:

Crossing point 1 (CP1): the intersected age at  $R_{Ej} = 0$ , and Crossing point 2 (CP2): the intersected age at  $R_{Pj} = 0$ .

CP1 indicates the age around which health status rated by people as very good or excellent is at the same level as the national average in Category E. People younger than this age have a higher possibility to rate their health status higher than the national average in Category E whereas those older than this age have a higher possibility to rate their health status lower than the national average in this category. In other words, CP1 is the turning point at which the average of self rated health status in Category E becomes lower than the national average.

Similarly CP2 signifies the age around which health status rated by people as fair or poor is at the same level as the national average in Category P. People younger than this age have a lower possibility to rate their health status as fair or poor with respect to the national average whereas those older than this age have a higher possibility to rate their health status as fair or poor in relation to the national average in this category. CP2 is the turning point at which the average of self rated health status as fair or poor becomes higher than the national average.

Similar crossing point can be defined for Category G. Since Category G lies between Categories E & P and has a general trend similar to Category P (Figure 1), such a point seems less important than both CP1 and CP2 in this trend analysis.

As the percentage in any age group is averaged over that age span, the age indicated by either CP1 or CP2 is a rough linear projection in that age span. Therefore, it is more indicative rather than quantitative in the trend analysis on health status.

#### 4. Results and discussion

The health status data collected in the 2002, 2006 and 2010 GSSs are presented in Table 1 and Figure 1. As summarized in the ABS report [13], there was no significant change in the overall proportion of people who rated their health as good or better because the combined average of both Categories E & G was around 83-84% in the past three GSSs. These data also showed a general trend that younger people were more likely to rate their health as excellent or very good compared to people in older age groups.

By plotting the same category data from the three GSSs in the same radar graph (Figure 2), some noticeable changes can be easily seen. For Category E, the areas enclosed by both the 2002 and 2006 data almost cover the entire area enclosed by the 2010 data. More importantly, the shrunk portions in the 2010 data point to the extended young-middle age groups (25-64 years old). Compared with health status in the first two GSSs, there may be a tendency that people rated their health status very good or excellent became declining in the young-middle age groups in the 2010 GSS.

In contrast, in Category G, the area enclosed by the 2010 data almost covers the areas enclosed by both the 2002 and 2006 data (Figure 2b). The fully covered portions point to the extended young-middle age groups (25-64 years old). This means that more people rated their health status as good in the young-middle age groups in the 2010 GSS, partly as a result of the declined percentage in the young-middle age groups in Category E in the 2010 GSS.

In Category P, the 2010 data lies between the 2002 and 2006 data with a slight increase in the 25-44 age groups. However, it has no statistical significance.

The ASA data of the three GSSs are given in Table 2. The CP1 and CP2 in both the 2002 and 2006 data are almost identical (CP1 = 47 and CP2 = 49) but that of 2010 data are different (CP1 = 43 and

CP2 = 51). The increased gap between CP1 and CP2 in the 2010 data may deliver a mixed message in Australian health status, i.e., there may be a tendency that people in the middle age groups (35-54) are more likely to rate their health status as good, rather than as very good or excellent (Figure 3).



Figure 2. Categorized radar graphs of Australian health status from the 2002, 2006 and 2010 GSSs

Trend Analysis on Australian Health Status William W. Guo



Figure 3. ARA graphs of Australian health status from the 2002, 2006 and 2010 GSSs

		Age group (years)								
GSS	Health status	18-24	25-34	35-44	45-54	55-64	65-74	75 or over		
		Proportion (%)								
2002	Excellent/Very good	14.8	14.4	7.3	-2.5	-12.8	-24.7	-30.7		
	Good	-6.4	-5.3	-1.1	2.0	4.2	7.4	8.4		
	Fair/Poor	-8.5	-9.1	-6.2	0.5	8.6	17.3	22.2		
2006	Excellent/Very good	11.8	13.2	6.0	-1.7	-9.6	-16.2	-31.5		
	Good	-2.6	-4.3	-1.5	1.3	1.4	5.6	10.7		
	Fair/Poor	-9.2	-8.9	-4.5	0.4	8.2	10.7	20.8		
2010	Excellent/Very good	16.5	13.0	4.0	-4.8	-9.0	-13.4	-24.9		
	Good	-7.8	-5.4	0.5	5.3	3.4	0.4	6.0		
	Fair/Poor	-8.7	-7.6	-4.5	-0.5	5.5	13.0	18.9		

Table 2. Data of ARA on the health status data from the 2002, 2006 and 2010 GSSs in Australia

## **5.** Conclusion

This trend analysis on the health status data collected in the 2002, 2006 and 2010 GSSs reaffirmed the previous summaries made by ABS, i.e., the overall proportion of people who rated their health as good or better did not show significant change from 2002 to 2010, and younger people were more likely to rate their health as excellent or very good compared to people in older age groups. Additionally, through analyzing radar graphs, a noticeable change in health status has also been identified among the three, i.e., there may be a tendency that people rated their health status very good or excellent became declining in the extended young-middle age groups (25-64 years old) in the 2010 GSS, compared with that in the 2002 and 2006 GSSs. The ASA also found that there may be another tendency that people in the middle age groups (35-54) are more likely to rate their health status as good, rather than as very good or excellent in the 2010 GSS, compared with that in the 2006 GSSs. This information may be useful in health policy making and planning by the governments.

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