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A comparison of the five AQoL (Assessment of Quality of Life) multi attribute utility instruments

PLUS

Appendix: Comparison of EQ-5D-5L and AQoL-8D

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Abstract

Multi attribute utility instruments (MAUI) purport to measure utility scores which may be used in economic evaluation studies. However different instruments predict different values and the result of an economic evaluation may depend upon the choice of instrument. Research groups must select instruments which, in their judgement, are most suitable for evaluating the health states they are likely to encounter. This implies the need for information concerning what each instrument measures (content validity) and how responsive the instrument is to the changes which might occur in the context of the services being evaluated.

To assist with this choice the present paper presents a comparison of the properties of the five Assessment of Quality of Life (AQoL) instruments. To place these results in a broader context the paper reports similar results for the five level version of the most commonly used MAU instrument worldwide, the EQ-5D.

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A comparison of the five AQoL (Assessment of Quality of Life) multi attribute utility instruments

1 Introduction

MAU instruments: A multi attribute utility instrument (MAUI) consists of two parts: (i) a health questionnaire; and (ii) a scoring formula based upon people's preferences for different health states. This converts answers to the questionnaire into an overall score. Each set of answers to the health questionnaire defines a 'health state'. The overall score reflects the strength of people's preferences for the state and, consequently, it is a measure of the utility of the state as understood in economics.

Utility scores calculated by MAUI are used for economic evaluation and, in particular, for cost utility analyses (CUA) which compares health program costs with the number of quality adjusted life years (QALYs) obtained. QALYs are calculated by multiplying an index of utility by years of life where the utility index is measured on a scale on which 1.00 is 'best health' (as defined by the instrument) and 0.0 is the 'utility' of death.

Problems arising from multiple instruments: The five AQoL instruments have different dimensions and structures. This raises three questions. First, is it necessary to have additional dimensions and items to achieve sensitivity when multi attribute utility instruments are 'generic' and purport to measure all utility relevant information. Secondly, if they differ, how can scores from different instruments be compared? Thirdly, and most fundamentally, which instrument should be used? These questions are not confined to the AQoL instruments. They apply to all of the instruments currently used to measure what each describes as 'utility'.

The present paper is primarily concerned with providing information to assist with the final question: which instrument should be used. There is a brief discussion of the first two questions below. Section 2 compares the structure and modelling of the AQoL instruments. Section 3 compares their performance using data from the MIC survey described below. The survey did not include AQoL-7D and it is therefore excluded from many of the comparisons. Similar comparisons between other instruments are uncommon. Therefore in the fourth section selected comparisons are reported from the published literature between the AQoL-8D and the most commonly used MAUI, the EQ-5D which therefore allows a valid comparison between AQoL and other instruments.

Problems using generic instruments: The problem facing researchers is that different instruments produce different results and even the correlation between them is not high. This is shown in Table 1. The more commonly used Pearson Correlation Coefficients are given in the upper right hand side of Table 1. They are low for quantities which purport to be identical. Nevertheless they exaggerate the closeness of the association. (GDP and per capita income will correlate very highly despite differing in absolute terms by a factor of about 25 million (the Australian population)). The interclass correlation (ICC) reported in the lower left hand side of Table 1 is a better indication of the absolute agreement between the MAUI. They are sufficiently low that results of an economic evaluation may vary with the choice of instrument. This is confirmed in Box 1.

Table 1 Pearson and ICC Correlation between major MAUI

		Pearson Correlation						Average[2]	
		EQ-5D-5L	**SF-6D**	**HUI 3**	**15D**	**QWB**	**AQoL-8D**	**All**	**Public**
ICC	EQ-5D-5L	1.00	0.75	0.86	0.82	0.65	0.76	0.76	0.57
	SF-6D	0.66	1.00	0.73	0.78	0.61	0.81	0.75	0.53
	HUI 3	0.79	0.59	1.00	0.83	0.66	0.86	0.76	0.56
	15D	0.59	0.50	0.53	1.00	0.73	0.84	0.80	0.62
	QWB	0.54	0.60	0.54	0.34	1.00	0.69	0.68	0.49
	AQoL-8D	0.73	0.71	0.78	0.50	0.62	1.00	0.78	0.58
	Ave All[3]	0.66	0.61	0.65	0.49	0.53	0.67		
	Public	0.47	0.40	0.46	0.32	0.34	0.48		

(1) References: EQ-5D-5L: [1]; SF-6D: [2]; HUI 3: [3] 15D: [4]; QWB: [5];AQoL-8D: [6]

(2) MIC data

(3) All: patients plus public sample; public=public sample

Box 1 Choice of instrument and outcome of an evaluation[1]

If the pairwise linear relationships found in the MIC study apply generally then:

- Replacing HUI 3 with EQ-5D will raise cost/QALY* by 17.6%
- Replacing SF-6D with EQ-5D will reduce cost/QALY by 39.2%
- Replacing SF-6D with HUI 3 will reduce cost/QALY by 48.4%
- Replacing HUI 3 with AQoL-8D will raise cost/QALY by 18.9%
- Replacing SF-6D with AQoL-8D will reduce cost/QALY by 38.7%

*QALY: Quality Adjusted Life Year

(1) Calculation based upon the ratio of the incremental change obtained in GMS regression of one MAUI upon the second MAUI as reported in Richardson et al. using MIC data [7, Table 7]

Why generic instruments differ: MAUI are ‘generic’ in the sense that they were not designed for a single disease and, in principle, they seek to measure the strength of preference for all health states. In practice – and a sub-theme of this paper – is that instruments claiming to be generic differ significantly and the description of the health of a person given by each instrument is unique. Rather than each MAUI measuring ‘health’, each measures a different health related ‘construct’ in which different physical and psycho-social attributes are more or less important. Consequently, different MAUI are more or less suitable for the measurement of people’s preferences for different health states: some measure physical health better than others and will exaggerate the benefit of physical health services when compared with an MAUI which favours mental health. As illustrated below ‘physical health’ and ‘mental health’ are themselves broad categories within which there may be biased measurement: items favouring some aspects of physical health or some aspect of mental health.

The problem of differing measurement has been recognised for some years [2] but has attracted little interest in the literature in terms of an appropriate response. A solution proposed and mandated in the UK by NICE is to use a single MAUI: the choice by NICE has been the EQ-5D. The solution is based upon the argument that consistent results will be achieved by the use of a single MAUI. The argument is wrong. As noted above the sensitivity of an instrument to different health states varies and a single instrument will favour one class of services over another. The EQ-5D is the least sensitive of the major instruments to almost every psycho-social dimension of health [7, 8] and its use discriminates against services for conditions affecting these dimensions.

Scaling and transformations: The chief interest below is the content of the AQoL instruments – what they measure and how sensitive they are to different types of health states. But a second problem arises when MAUI are used to measure change in 'health' – more strictly, the change in utility. Each MAUI has been constructed using a 'model' of how different items and dimensions of health combine to create a single number. (The simplest 'model' would be to average the score on each item and rescale it so the lowest and highest scores were 0.0 and 1.00 respectively). The different models used result in different numbers being attached to the same change in health. As the numbers are treated as representing 'utility' the different numbers alter the apparent improvement in health which has been achieved from a service. This is a second reason why results in Box 1 differ so significantly.

Comparing MAUI: As different instruments have different 'content' and, therefore, 'sensitivity' to different health services they can never be fully reconciled. However differences between MAUI attributable to the modelling (which combines item scores) can be significantly ameliorated. Transformations between instruments can align the pattern of responses. However the term 'transformation' can be misinterpreted. A transformation aligns patterns – the average score will be the same – but a transformation cannot create content where none exists. If hearing is omitted from an MAUI the scores for a deaf person may be inflated to be equal to the scores for other people but the instrument will remain insensitive to variation in hearing acuity.

A caveat is that, in principle, a generic item might indirectly measure the importance of something not directly measured. If hearing was only important because it increased happiness (for example) a generic question about happiness might identify the effects of hearing upon utility. However, the probability of this occurring is in general low and generic questions will generally be imperfect substitutes for more focused questions.

Transformations between all combinations of the EQ-5D-5L, SF-6D, HUI 3, 15D, AQoL-8D and QWB are provided in Chen et al. [9] accessible via the AQoL website. Transformations between AQoL instruments are given in Section 5 below and reproduced and discussed on the AQoL website.

The MIC Survey

To compare AQoL-8D with other MAUI a large Multi Instrument Comparison (MIC) survey was conducted. At the time of writing it remains the largest comparative survey of its type. Its content is summarised in Table 2. Summary statistics are given in Appendix 2. Most of the comparisons presented below use data from this source. The survey did not include the AQoL-7D and it is not included in some comparisons.

MIC data are available free of the charge on the AQoL website [10].

Table 2 Summary of MIC database

Countries	Australia, USA, UK, Norway, Germany, Canada	
Disease areas	Healthy (no disease), asthma, arthritis, cancer, depression, diabetes, hearing loss, heart disease	
Instruments	Subjective wellbeing (happiness)	PWI, IHS, SWLS
	Multi attribute utility (MAU)	EQ-5D-5L, SF-6D, HUI 3, 15D, QWB, AQoL-4D, AQoL-6D, AQoL-8D
	Multi attribute (MA) (non-utility)	SF-36
	Capabilities	ICECAP-A
	Self-Assessment	VAS, Self-TTO,
	Other	Self-TTO, Demographics, SES

2 Structure and Modelling

A Description of AQoL instruments

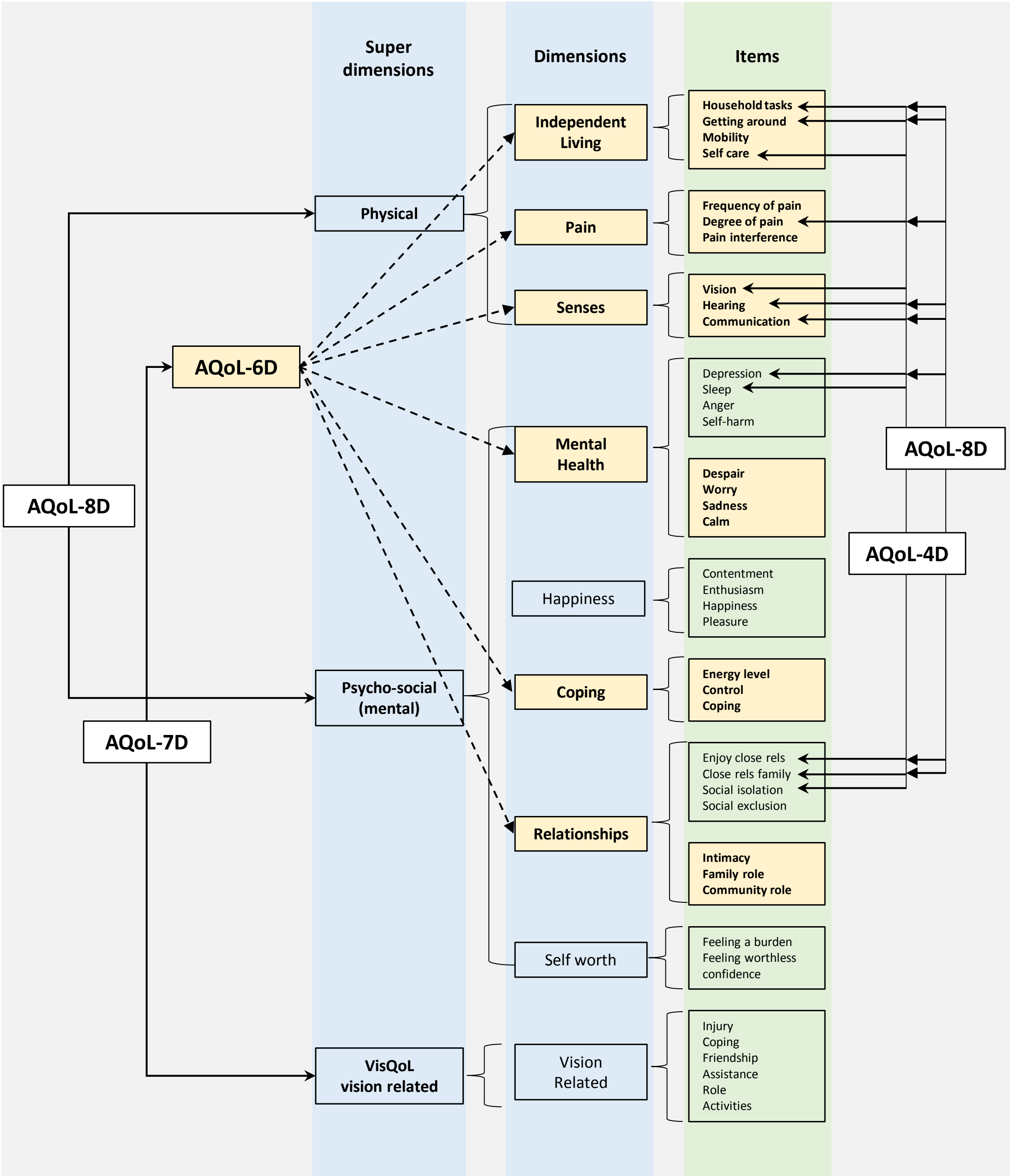
Five AQoL instruments exist. AQoL-4D, 6D, 8D were the result of independent research projects which recreated the descriptive systems and utility algorithms. Items in the descriptive systems represent 4, 6 and 8 psychometrically independent dimensions of the quality of life. An additional non-utility instrument, the VisQoL, was constructed for use with visually impaired patients. It was combined with AQoL-6D to form the AQoL-7D. Utility weights were calculated for the new instrument in a dedicated survey and analysis. AQoL 8 is a ‘brief’ version of AQoL-4D in which a single item from each dimension was removed and its value estimated by interpolation from the remaining two items so that the AQoL-4D algorithm could be used to derive utility weights.

The instruments are summarised in Box 2. Their relationship to each other is shown in Figure 1 and the linear relationship between the instruments given in Box 3. The content of AQoL-4D is largely subsumed by AQoL-6D and AQoL-8D. However wording and items differ. In contrast, AQoL-6D items and dimensions are reproduced identically in AQoL-8D. However dimension scores and utilities differ as they were independently calculated from independent surveys as described below. AQoL-6D is similarly subsumed by AQoL-7D but utilities were also assessed independently. The AQoL-7D utility survey included equal numbers of visually impaired and randomly selected Australians.

Table 3 classifies the AQoL items by dimensions of the quality of life (QoL). The classification of dimensions was drawn eclectically from the MAU literature to facilitate the comparison of instruments. Other major MAUI are included to allow comparison between them and the AQoL group. The table indicates the focus and detail of each instrument.

The AQoL instruments are all available for use without charge on the AQoL website [10] (or Google ‘AQoL’). The website includes user instructions, notes on the instruments, on cost utility analysis, and access to the online self-completion version of the AQoL-8D which may also be accessed by the CHE website (see Box 4).

Figure 1 All AQoL instruments



*AQoL-6D is bold type in (yellow shaded) items and dimensions. It does not map into psychometrically valid 'super dimensions' shown for AQoL-8D.

Box 2 AQoL instruments

AQoL-4D Originally called ‘AQoL’. Initially a 5 dimension 15 item instrument. Dimensions were illness, independent living, social relationships, physical senses, psychological wellbeing. Illness was never part of the scoring algorithm and was subsequently removed from the instrument. Utilities were created from a multi level model using multiplicative models to combine items into dimensions and an overall multiplicative model to combine dimension scores into a single AQoL utility score [11]**.**

AQoL 8: An 8 item ‘Brief’ instrument obtained by removing one item from each AQoL-4D dimension [12].

AQoL-6D: A 6 dimensional 20 item instrument. Pain and coping were added to AQoL-4D as separate dimensions. Mental health and Independent Living items were increased from 3 to 4 items. Utility weights were constructed as for AQoL-4D but with an econometric adjustment to the final algorithm [13].

AQoL-7D: A 7 dimension 26 item instrument which adds an explicit dimension for vision (VisQoL) to the AQoL-6D [14]. Scaling was carried out as for AQoL-6D [15].

AQoL-8D: An 8 dimensional 35 item instrument which adds explicit dimensions for self worth and happiness and expands the items in mental health and relationship. Utility weights were constructed as for AQoL-6D but with an econometric correction to each dimension before their combination to create AQoL-8D [16, 17].

Box 3 GMS Linear regression equations[(1)] n=8,022

AQoL-4D	= -0.27 + 1.23	AQoL-6D	$R^2 = 0.69$
AQoL-4D	= 0.16 + 1.18	AQoL-8D	$R^2 = 0.72$
AQoL-6D	= 0.07 + 0.95	AQoL-8D	$R^2 = 0.95$

(1) GMS (Geometric Mean Squares) regressions give results which are not affected by the choice of dependent and independent variable. Therefore the first result above could be re-written as AQoL-6D = [0.27 + AQoL-4D]/1.23

Table 3 Items per dimension: AQoL and other MAU instruments

Dimensions	AQoL instruments					Other MAUI			
	8	**4D**	**6D**	**7D**	**8D**	**EQ-5D-5L**	**SF-6D**	**HUI 3**	**15D**
Dimensions of physical health									
Physical ability/mobility	2	2	3	5	3	1	1	2	2
Bodily functions/self care		1	1	1	1	1			3
Risk of pain/discomfort	1	1	3	3	3	1	1	1	1
Senses	1	2	2	2	3			2	2
Usual activities/work/role			1	2	1	1	1		1
Communication	1	1	1	1	1			1	1
Dimensions of psycho-social health									
Depression/anxiety/anger/harm	1	1	4	4	4	1	1	1	3
Vitality			3	4	3		1		
Sleeping	1	1			1				1
General satisfaction/contentment					5				
Self esteem/confidence				1	3				
Cognition/memory ability								1	
Social functioning/relationships	1	2	1	2	3		1		
(Family role) Intimacy/sexual relationships	1	1	1	1	4				1
Total number of items	12	12	20	26	35	5	6	8	15

Box 4 AQoL Self-Assessment

> AQoL-8D may be self-completed using the online survey accessed via the homepage of the Monash Centre for Health Economics. Results are given for each dimension relative to population norms. Note that the instrument was constructed primarily for use in large projects. Individual results are subject to significant error. Scores also reflect the valuations of the sample of the Australian public which participated in the AQoL scaling survey and may differ from the values of a particular individual. As an extreme example, loss of hearing reduces AQoL-8D scores. However some members of the deaf community argue that it increases wellbeing (by including the person in a particular community and culture.)
>
> Source: AQoL website [10]

Construction

Table 4 groups instrument content into two broad groups: physical and psycho-social dimensions, and summarises the methods employed to construct the instruments. In principle the descriptive systems were constructed in the same way. *Unique to the MAUI in the literature* these methods were based upon psychometric theory for the construction of instruments with construct validity. Only the SF-6D was psychometrically based but as a reduced form of a psychometrically constructed and validated non-utility instrument, the SF-36. Details of the construction varied as shown in the accompanying references in Table 4.

Each of the AQoL instruments modelled TTO utilities which were obtained during face-to-face interviews. The technique used and visual aids are described in Iezzi et al. [18]. Modelling the utilities differed. AQoL-4D (and therefore AQoL-8) used only the multiplicative modelling recommended by decision analytic theory and used by HUI 1-3. The multiplicative form was adopted as it was indicated by parameter values. For each of the 4 dimensions items were combined with a multiplicative model. The resulting dimension scores were then also combined using a multiplicative model. The TTO was used to estimate values for item levels, item worst, dimension worst and AQoL-4D worst health states. In sum, ‘utilities’ were estimated as multiplicative averages of weighted dimension scores.

Table 4 Modelling the AQoL instruments

AQoL	Dimensions (Items)			Utility	MM= Multiplicative Modelling[(1)] Econ=Econometric Modelling[(1)]	Key Reference [(2)]		
	Total	Physical	Psycho-social			Descriptive system	Utility algorithm	Norms
4D	4 (12)	2 (6)	2 (6)	TTO	MM: Single Items into dimensions MM: Combining dimensions	[11]	[19]	[20]
8	4 (8)	2 (4)	2 (4)	TTO	As for 4D: Interpolation of missing response level	8.1 [12]	8.1 [12]	
6D	6 (20)	3 (10)	3 (10)	TTO	(a) MM: Items into dimensions (b) MM: Combining dimensions (c) Econ[(2)] Correcting, (b)	[21]	[13]	[6]
7D	7 (26)	4 (16)	3 (10)	TTO	As for 6D	N/A	N/A	N/A
8D	8 (35)	3 (10)	5 (25)	TTO	(a) MM: Items into dimensions (b) Econ: Correcting each dimension (c) MM Combining dimensions (d) Econ: Correcting (c)	[16] [22]	[6]	[23]

1. MM: The multiplicative model recommended by decision theory. In effect, this estimates a value, $V = D_1^* \cdot D_2^* \ldots \cdot D_n^*$

   where V is the global value or utility constrained to the range (0.0-1.00) D_i^* are importance weighted dimension scores calculated from importance weighted item scores.

   Econ: an econometric model: The dependent variable is a TTO utility obtained in an interview. Independent variables are the dimension scores (or for the construction of AQoL-8D dimensions, item scores). An exponential model best fitted the data in every case. This had the following form:
   $\text{Log}\,(U) = a + \sum_i b_i \log(Dimension_i) + e$

2. References: See Reference List.

AQoL-6D followed a similar procedure with an important addition. Combinations of health states were constructed from items and directly assessed using the TTO. These were regressed upon the first stage estimate of the AQoL-6D, ie the multiplicative model derived, as described for the AQoL-4D. The second stage is described as a 'correction' which increases model flexibility when compared with a rigid parameter estimates of the multiplicative model. A one stage econometric model was not employed to model the full AQoL-6D as the number of combinations of health states was too great.

AQoL-8D adopted the methods of AQoL-6D and for the same reasons. An important innovation was the use of a second stage econometric correction for each of the 8 dimension scores obtained from the stage 1 multiplicative model. The volume of data for this strategy was very large. Consequently data for the dimension models were collected using a visual analogue scale (VAS). To convert these values to TTO utilities 3,714 observations were collected for 162 health states, an average of 32 observations per state, using both VAS and TTO measurement. The transformation was estimated using these data, viz:

$$U=(1-V)^{1.62}$$

where U and V represent utility and VAS scores respectively.

As with previous AQoL instruments the AQoL-8D descriptive system was derived from an independent population survey and from the application of exploratory and confirmatory factor analyses. With one exception the items in each dimension load upon a single construct; that is each of the dimensions represents an independent, psychometrically valid measure. These are calculated by the program available on the AQoL website.

The items constituting the dimension 'senses' are not related to a single construct. Nevertheless the group of items was retained. Sight, hearing and communication are all important elements for the QoL.

3 Comparison of AQoL utilities

Utility scores: Data from the MIC survey were divided into patient and public samples. Summary statistics for AQoL-4D, 6D and 8D are given for these two groups by age and gender in Table 5. The utilities do not represent population norms as respondents to the MIC survey were self-selected, ie they were people who had joined an online panel company. Scores from these respondents are generally lower than typical utilities. However the table allows comparisons to be made across instruments using the same respondents. No alternative database permit this. The AQoL-6D/8D norms paper [23] provides a comparison of utilities obtained from a web survey with true population norms.

Table 5 Summary statistics AQoL-4D, 6D, 8D: Public and patient MIC data

Public		Mean			SD			Range		
Gender	**Age**	**4D**	**6D**	**8D**	**4D**	**6D**	**8D**	**4D**	**6D**	**8D**
Male	18-24	.82	.88	.83	.18	.13	.14	.87	.69	.63
	25-34	.82	.87	.82	.19	.13	.16	.86	.59	.64
	35-44	.76	.86	.81	.21	.13	.16	.90	.69	.72
	45-54	.81	.88	.84	.18	.11	.13	.88	.53	.56
	55-64	.81	.91	.88	.20	.09	.11	.89	.42	.56
	65+	.83	.91	.88	.16	.09	.11	.89	.59	.53
Female	18-24	.77	.83	.77	.19	.15	.17	.77	.59	.66
	25-34	.80	.83	.77	.17	.14	.15	.85	.67	.66
	35-44	.78	.83	.79	.18	.14	.16	.76	.63	.69
	45-54	.79	.86	.80	.20	.12	.14	.92	.63	.65
	55-64	.79	.86	.81	.19	.12	.14	.78	.54	.62
	65+	.81	.88	.85	.17	.13	.14	1.04	1.00	.88
Total	18-24	.79	.85	.79	.19	.14	.16	.87	.69	.66
	25-34	.81	.85	.80	.18	.14	.16	.86	.67	.66
	35-44	.78	.85	.80	.20	.14	.16	.90	.69	.72
	45-54	.80	.87	.82	.19	.12	.14	.92	.63	.66
	55-64	.80	.89	.85	.19	.11	.13	.89	.54	.62
	65+	.82	.90	.86	.17	.11	.12	1.04	1.00	.88
Patient		**Mean**			**SD**			**Range**		
Gender	**Age**	**4D**	**6D**	**8D**	**4D**	**6D**	**8D**	**4D**	**6D**	**8D**
Male	18-24	.66	.74	.68	.25	.19	.20	.92	.72	.72
	25-34	.61	.69	.62	.26	.21	.22	1.04	.96	.89
	35-44	.56	.67	.60	.28	.23	.23	1.04	.89	.86
	45-54	.53	.65	.59	.28	.24	.24	1.04	.97	.89
	55-64	.58	.70	.65	.27	.22	.23	1.04	.96	.89
	65+	.65	.78	.73	.24	.18	.20	1.04	.93	.86
Female	18-24	.62	.67	.61	.27	.22	.23	1.04	.96	.89
	25-34	.59	.65	.59	.27	.21	.22	1.04	.95	.89
	35-44	.54	.63	.57	.27	.22	.22	1.04	.95	.89
	45-54	.54	.64	.58	.27	.23	.23	1.04	.95	.89
	55-64	.56	.67	.62	.27	.21	.22	1.04	.93	.84
	65+	.63	.74	.70	.24	.19	.20	1.04	.91	.86
Total	18-24	.63	.69	.63	.26	.22	.22	1.04	.96	.89
	25-34	.60	.66	.60	.27	.21	.22	1.04	.96	.89
	35-44	.55	.64	.58	.27	.22	.23	1.04	.95	.89
	45-54	.53	.64	.58	.27	.23	.23	1.04	.97	.89
	55-64	.57	.69	.63	.27	.22	.23	1.04	.96	.89
	65+	.64	.76	.72	.24	.18	.20	1.04	.93	.86

Figure 2 plots the average utilities for public respondents. Results differ for the same two reasons which explain differences between all MAUI. First, the content of the instruments differs. Broadening the instrument to include greater psycho-social content may be responsible for an overall reduction in the scores of AQoL-8D. AQoL-4D declines monotonically with age: a result found in all other MAUI. In contrast, AQoL-6D and AQoL-8D are U-shaped. Psycho-social health improves with age and this more than offsets the effect of declining physical health. These results are detailed in the norms paper for the AQoL-6D/8D [23].

Secondly the three instruments were modelled differently (see Table 4). AQoL-4D had no final econometric correction and its multiplicative model may have magnified low scores: multiplying dimension scores, each less than 1.0, results in a total score which declines as the number of dimensions rise if dimension weight are imperfect. HUI 3, another MAUI which employs only multiplicative modelling was the single instrument to produce lower utilities than AQoL-4D in the MIC survey [7].

Figure 2 AQoL utilities by age (Public sample n=1,760)

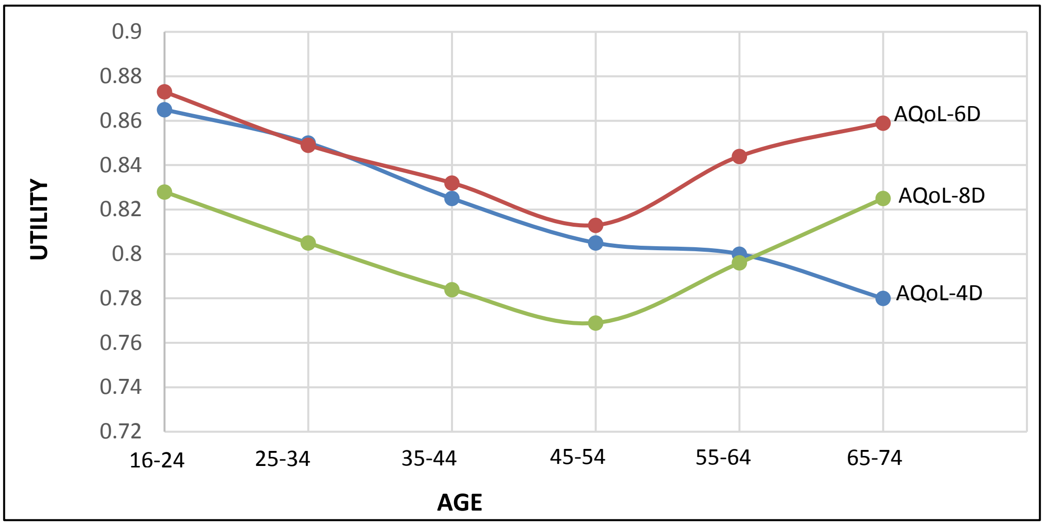


Figure 3 presents an alternative summary. All individuals were ranked according to the score on a particular instrument and grouped into percentiles. The figure plots the average value of each percentile ranked from highest to lowest. Figure 4 presents a similar summary of other major instruments.

Reliability: A sample of 385 individuals were included in a test-retest analysis of the AQoL instruments and each of the dimensions of each instrument. Full results are reported online in Richardson et al. [24]. The results for the AQoL instruments are summarised in Table 6 which indicate very high reliability for each of the instruments.

Figure 3 Mean utility by ranked percentile: All data n=8,022

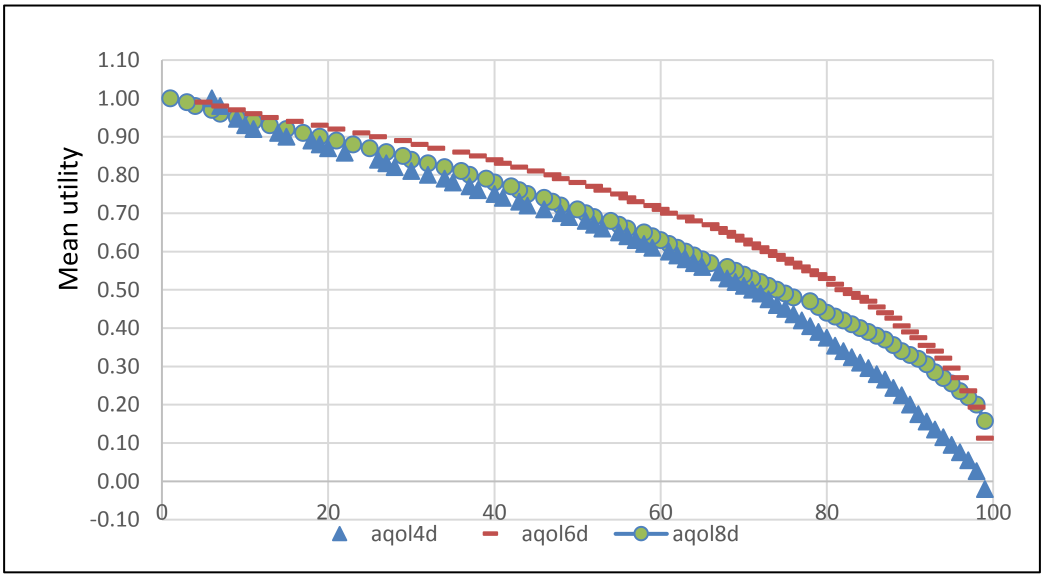
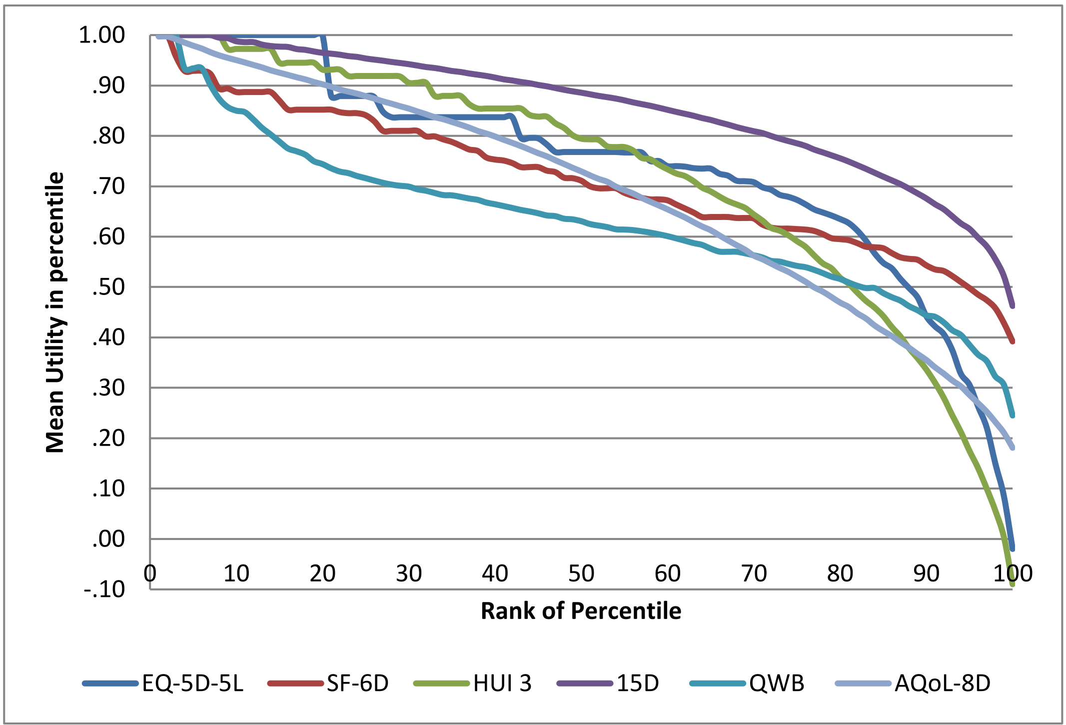


Table 6 Test re-test reliability of AQoL

Intra class correlation between baseline, 2 week and 1 month scores		
	2 week	**1 month**
AQoL-4D	0.83	0.85
AQoL-6D	0.88	0.85
AQoL-7D	0.81	0.83
AQoL-8D	0.91	0.89

Source: Richardson et al. [24]

Figure 4 Mean utility by ranked percentile: All data



Source: Richardson et al. [25]

4 Content and sensitivity

Content: Content of an instrument refers to the dimensions of health which are measured by the instrument. Sensitivity is the extent to which the instrument responds to changes in these dimensions. Both may be subjectively assessed by comparison of the number and type of items in each instrument. These are summarised in Table 3. The full questionnaire for each AQoL may be obtained from the AQoL website (or ‘Google’ AQoL: see ‘instruments’).

Content may also be assessed by determining which dimensions of health statistically explain variation in the utilities. This requires the measurement of the dimensions. There is no agreement with respect to the number or definition of the dimensions which should be included in the measurement of the ‘quality of life’. AQoL instruments have been analysed using two classifications for which data are available from the MIC survey. The first of these is the classification used by the SF-36, the most widely used non-utility instrument worldwide. The second is the classification used by the AQoL-8D itself. As noted earlier, each of the dimensions, with the exception of ‘senses’ is a psychometrically valid sub-scale; that is, the items can be shown to be related to a single 'construct'. The dimensions of the SF-36 and AQoL-8D are listed and defined in Table 7. Both classifications divide dimensions into physical and psycho-social groupings. SF-36 is divided into the physical component score (PCS) and mental component score (MCS); AQoL-8D is divided into the physical super dimension (PSD) and the mental super dimension (MSD). All four indices represent coherent sub-scales, ie each is related to a common construct associated, respectively, with physical and psycho-social quality of life.

Table 7 Dimensions of AQoL-8D, SF-36 used in Table 6

SF-36(1)	AQoL-8D(2)
Physical QoL	**Physical QoL**
Physical function (Phys) 10 items(3)(4): ⬩ vigorous/moderate activities; ⬩ lifting; ⬩ climbing stairs; ⬩ bending; ⬩ walking; ⬩ bathing **Role physical** (Role P) 4 Items: ⬩ time spent on work; ⬩ difficulty at work **Bodily pain** (B Pain) 2 items: ⬩ degree of pain; ⬩ interference with work **General health** (Gen H) 6 items: ⬩ perceptions of general health rating **Vitality** (Vital) 4 items: ⬩ energy/tiredness	**Independent living** (Ind Liv) 4 items: ⬩ household tasks; ⬩ mobility; ⬩ walking and self-care **Senses** (Sense) 3 items: ⬩ vision/hearing/communication **Pain** (Pain) 3 items: ⬩frequency; ⬩ degree; ⬩ interference with activities
Psycho-social	**Psycho-social**
Mental health (MH) 5 items: ⬩ nervousness; ⬩ feel down; ⬩ calm/happiness	**Mental health** (Mental) 8 items: ⬩ depression/ sleep; ⬩ anger; ⬩ self-harm; ⬩ despair; ⬩ worry; ⬩ sadness; ⬩ tranquility
Social functioning (Social) 2 items: ⬩ interference with activities **Role limit emotional** (Role E) 3 items: ⬩ work time; ⬩ work accomplished; ⬩ work less carefully	**Happiness** (Happy) 4 items: ⬩ contentment; ⬩ enthusiasm; ⬩ happiness, pleasure **Coping** (Cope) 3 items: ⬩ energy; ⬩ control; ⬩ coping **Self-Worth** (Worth) 3 items: ⬩ worthlessness/ confidence **Relationships** (Relation) 7 items: ⬩ family, friends; ⬩ isolation; ⬩ intimacy; ⬩ community role

(1) Ware and Sherbourne [26].
(2) Richardson and colleagues [6].
(3) Some dot points contain more than one item.
(4) Levels refers to the number of separate states used by at least one respondent. The number is less than the number theoretically possible when none of the 8,022 respondents used a health state.
(5) Diener and colleagues [27].

Both sets of dimensions were used as the independent variables in regressions in which the AQoL instruments were the dependent variables. Regression of AQoL-8D upon its constituent dimensions produces a biased (and largely meaningless) R^2 statistic. Nevertheless the regression coefficients indicate the relative importance of dimensions in explaining variation in total utilities. The results are reported in Tables 8 and 9. Table 8 reports beta coefficients. These give the number of standard deviations change in the dependent variable which occurs when the independent variable changes by 1 standard deviation. For example, the first entry for AQoL-4D (0.291) indicates that a change in the dimension ‘independent living’ by 1 standard deviation will change AQoL-4D by 0.291 standard deviations. In Table 9 the beta coefficients are ‘standardised’ so that they sum to 1.00. The standardised entries give one definition of the content of the instrument. For example the first entry for AQoL-4D (0.189) indicates that ‘independent living’ represents 18.9 percent of the content of the instrument, ie given comparable change in the constituent dimensions the change in independent living would account for 18.9 percent of the total change in AQoL-4D.

Table 8 Regression of AQoL upon dimension of the SF-36 and AQoL-8D(1)

Beta coefficients							
	Dependent variables				Dependent variables		
Independent variables	AQoL regressions			Independent variables	SF-36 regressions		
	4D	6D	8D		4D	6D	8D
1. Physical				1. Physical			
Independent living	0.291	0.119	0.112	General	0.001	0.001	0.001
Senses	0.394	0.203	0.167	Physical function	0.002	0.001	0.001
Pain	0.246	0.162	0.175	Role physical		0	
				Pain	0.002	0.001	0.001
2. Psycho-social				2. Psycho-social			
Happiness	0.199	0.094	0.17	Vitality	0.001	0.002	0.002
Mental health	0.077	0.243	0.28	Social Function	0.002	0.001	0.001
Coping	0.05	0.507	0.203	Role Limit		0	0
Relationships	0.443	0.068	0.256	Mental health	0.003	0.004	0.004
Self Worth	0.075	0.117	0.242				
R^2	0.774	0.961	0.99	R^2	0.643	0.809	0.808

(1) All reported coefficient are significant at 1% level

Figure 5 depicts the adjusted beta values for EQ-5D and AQoL-8D. There is no standard measure of content and these data therefore are indicative of the importance of dimensions as assessed using data from the MIC database. The measurement is also unreliable. Dimensions are (sometimes highly) correlated and multicollinearity may result in unstable coefficients.

The problem of multi-collinearity is largely overcome by collapsing dimensions into their summary physical and psycho-social groupings MCS, PCS; PSD, MSD. Each of the AQoL instruments is regressed upon these summary scores in Table 10. While providing less information the summary categories are orthogonal and results more reliable. The results are plotted in Figure 6.

Table 9 Standardised Beta coefficients(1)(2)

Independent variables	Dependent variables			Independent variables			
	AQoL regressions				SF-36 regressions		
	4D	6D	8D		4D	6D	8D
1. Physical				1. Physical			
Independent living	0.189	0.096	0.086	General	0.113	0.118	0.136
Senses	0.187	0.119	0.094	Physical function	0.203	0.126	0.094
Pain	0.234	0.19	0.197	Role physical	0.005	0.029	0.017
				Pain	0.177	0.159	0.161
2. Psycho-social				2. Psycho-social			
Happiness	0.133	0.078	0.134	Vitality	0.089	0.21	0.236
Mental health	0.046	0.182	0.2	Social Function	0.158	0.09	0.067
Coping	0.032	0.405	0.154	Role Limit	0.005	0.042	0.055
Relationships	0.28	0.053	0.19	Mental health	0.264	0.399	0.38
Self Worth	0.051	0.099	0.194				
Sum	1.00	1.00	1.00		1.00	1.00	1.00

(1) All reported coefficients are significant at 1% level

(2) Beta coefficients from Table 8 scaled to sum to 1.00

Table 10 OLS regressions: Regression of AQoL on summary physical and psycho-social scores of SF-36 and AQoL-8D (beta coefficients)

9(a) Beta coefficients							
	AQoL regressions			SF-36 Regressions			
Independent variables	4D	6D	8D	Independent variable	4D	6D	8D
AQoL super dimensions				SF-36 Summary variables			
PSD(1)	0.52	0.40	0.35	PCS(3)	0.54	0.49	0.49
MSD(2)	0.44	0.85	0.94	MCS(4)	0.54	0.70	0.70
R^2	0.719	0.85	0.94	R^2	0.61	0.76	0.76

9(b) Standardised beta coefficients							
	AQoL regressions				SF-36 regressions		
Independent variables	4D	6D	8D	Independent variable	4D	6D	7D
PSD(1)	0.54	0.33	0.27	PCS(3)	0.50	0.41	0.41
MSD(2)	0.46	0.67	0.73	MCS(4)	0.50	0.59	0.59
Sum	1.00	1.00	1.00	Sum	1.00	1.00	1.00

(1) Physical super dimensions

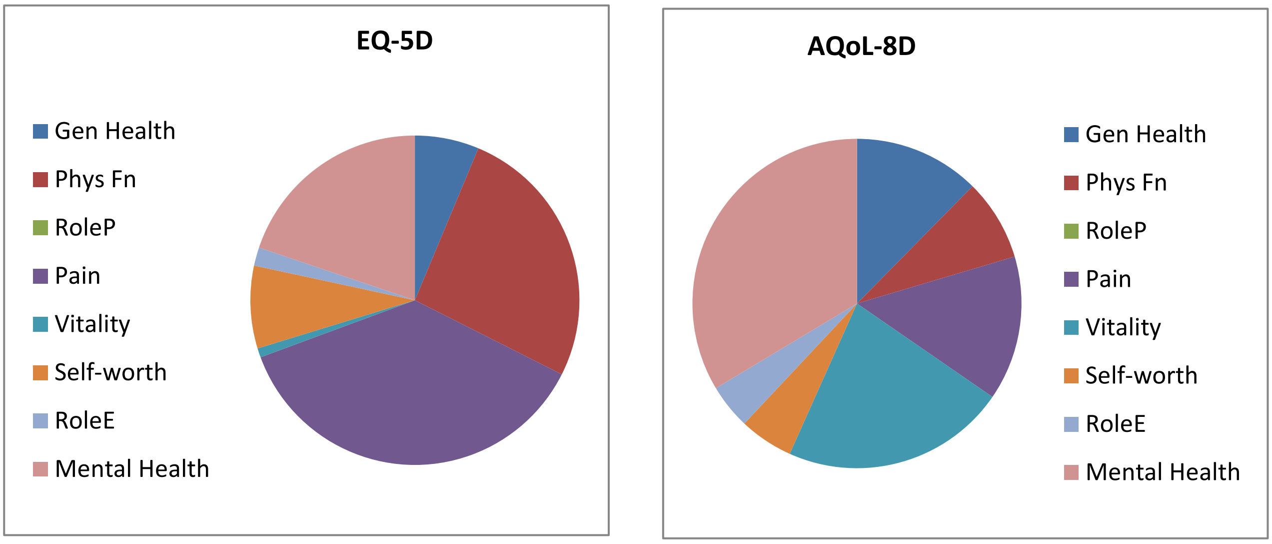
(2) Mental (psycho-social) super dimension

(3) Physical component score

(4) Mental component score

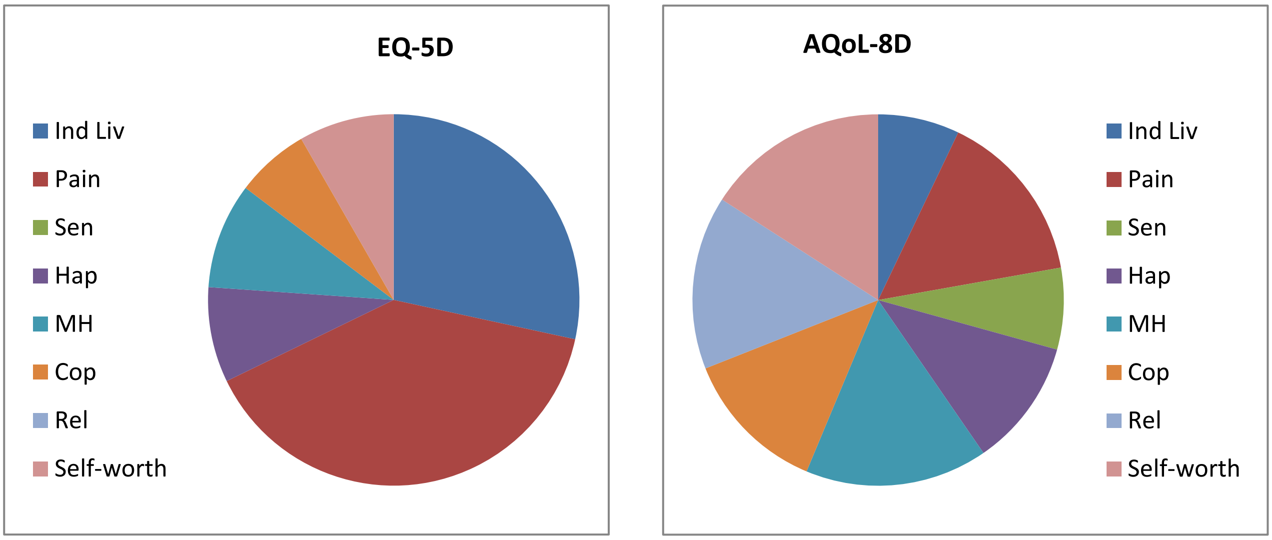
Figure 5 Content of EQ-5D, AQoL-8D measured as standardised beta scores

SF-36 Classification



(a) Relative increase in utility with a 1 standard deviation increase in each dimension of the AQoL-8D

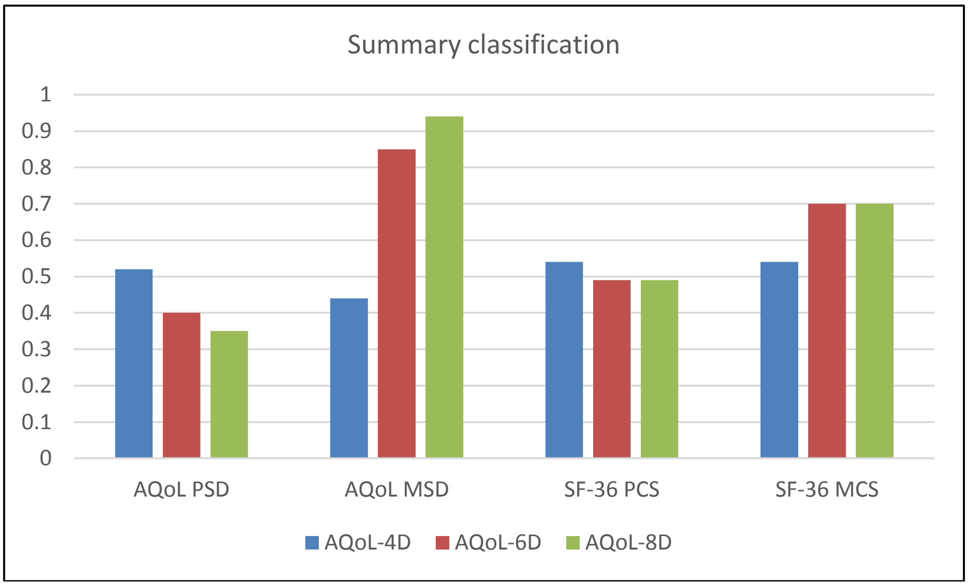
AQoL-8D Classification



(b) Relative increase in utility with a 1 standard deviation increase in each dimension of the SF-36

Source: Richardson et al. [7]

Figure 6 Physical and psycho-social content of AQoL instruments(1)



(1) Beta coefficients from the regression of AQoL on AQoL super dimensions (PSD, MSD) and SF-36 summary component scores PCS, MCS

Source: Table 10

Sensitivity: The content of an instrument will determine the size of the correlation between dimensions and the utility measured by the instrument. A higher correlation is indicative of greater instrument sensitivity. The main caveat is that sensitivity is primarily important as a measure of change through time whereas present results are cross-sectional. Correlation between the four AQoL dimensions and dimensions of the SF-36 are given in Table 11 and the correlation with the dimensions of the AQoL-8D in Table 12. Both tables also include the EQ-5D-5L for comparison.

Relative sensitivity: A 'head to head' comparison may be made between two instruments to determine which has the greater relative sensitivity to a dimension. In the regression Y=a+bX+Res, the residual, Res, is positive when Y exceeds the predicted value from X. A positive correlation between Res and a dimension Dim_i – ie Res and Dim_i rise and fall together – therefore implies that Y is more sensitive to movement in Dim_i than X. A negative correlation implies the opposite: X is more sensitive to Dim_i therefore (a+bX) moves more than X and Res must have the opposite sign to Y-(a+bX).

In sum, for the regression $AQoL_i$=a+b $AQoL_j$ + Res

- If ρ (Res, Dim_k)>0 then $AQoL_i$ is more sensitive to Dim_k than $AQoL_j$
  If ρ (Res, Dim_k)<0 then $AQoL_i$ is less sensitive than to Dim_k than $AQoL_j$.

Results from this analysis are reported in Tables 13 and 14 and Figure 7.

The results give (only) 'relative sensitivity' as the regressions from which they are derived lineally transform one variable. This adjusts for linear scale effects due to modelling but prevents results from being interpreted as unadjusted sensitivities.

Sensitivity to disease specific instruments (DSI): A further measure of sensitivity is the correlation between an instrument and a disease specific instrument. Selected results are reported in Table 15. An important caveat is that the DSI is not a gold standard and a low correlation may, in part, be attributable to an insensitivity in the DSI.

Table 11 Correlations of AQoL instruments and dimensions of SF-36 n=8,022

	aqol8	4D	6D	8D	EQ-5D-5L	GH	PF	RP	BP	VT	SF	RE	MH	PCS	MCS
aqol8	1														
4D	0.95	1													
6D	0.85	0.83	1												
8D	0.86	0.85	0.97	1											
EQ-5D-5L	0.79	0.76	0.77	0.75	1										
GH	0.65	0.64	0.69	0.70	0.63	1									
PF	0.63	0.61	0.58	0.57	0.70	0.62	1								
RP	0.56	0.54	0.54	0.54	0.55	0.56	0.63	1							
BP	0.65	0.63	0.63	0.63	0.75	0.60	0.67	0.62	1						
VT	0.68	0.66	0.79	0.80	0.62	0.68	0.51	0.50	0.54	1					
SF	0.69	0.67	0.72	0.72	0.64	0.56	0.53	0.54	0.57	0.64	1				
RE	0.52	0.50	0.58	0.59	0.47	0.42	0.37	0.54	0.39	0.51	0.62	1			
MH	0.64	0.63	0.79	0.78	0.55	0.52	0.31	0.36	0.39	0.72	0.67	0.60	1		
PCS	0.59	0.57	0.52	0.52	0.67	0.70	0.88	0.78	0.80	0.48	0.46	0.24	0.17	1	
MCS	0.58	0.57	0.72	0.72	0.47	0.45	0.19	0.34	0.30	0.71	0.74	0.81	0.90	0.04	1

Table 12 Correlations of 4 AQoL instruments and dimensions of AQoL-8D n=8,022

	aqol8	4D	6D	8D	EQ-5D-5L	IL	HAP	MH	COP	REL	SW	PA	SEN	MSD	PSD
aqol8	1														
4D	0.95	1													
6D	0.85	0.83	1												
8D	0.86	0.85	0.97	1											
EQ-5D-5L	0.79	0.76	0.77	0.75	1										
IL	0.72	0.70	0.69	0.69	0.76	1									
HAP	0.68	0.69	0.83	0.86	0.57	0.46	1								
MH	0.67	0.66	0.82	0.85	0.56	0.41	0.77	1							
COP	0.73	0.71	0.91	0.89	0.65	0.58	0.82	0.74	1						
REL	0.75	0.75	0.79	0.85	0.56	0.53	0.74	0.72	0.72	1					
SW	0.69	0.67	0.82	0.87	0.58	0.49	0.80	0.76	0.79	0.72	1				
PA	0.68	0.66	0.67	0.67	0.78	0.71	0.41	0.43	0.50	0.45	0.40	1			
SEN	0.50	0.52	0.50	0.49	0.35	0.38	0.33	0.34	0.36	0.37	0.35	0.31	1		
MSD	0.75	0.73	0.86	0.92	0.59	0.52	0.85	0.90	0.84	0.89	0.83	0.47	0.37	1	
PSD	0.78	0.77	0.76	0.76	0.80	0.84	0.48	0.49	0.58	0.55	0.48	0.92	0.57	0.56	1

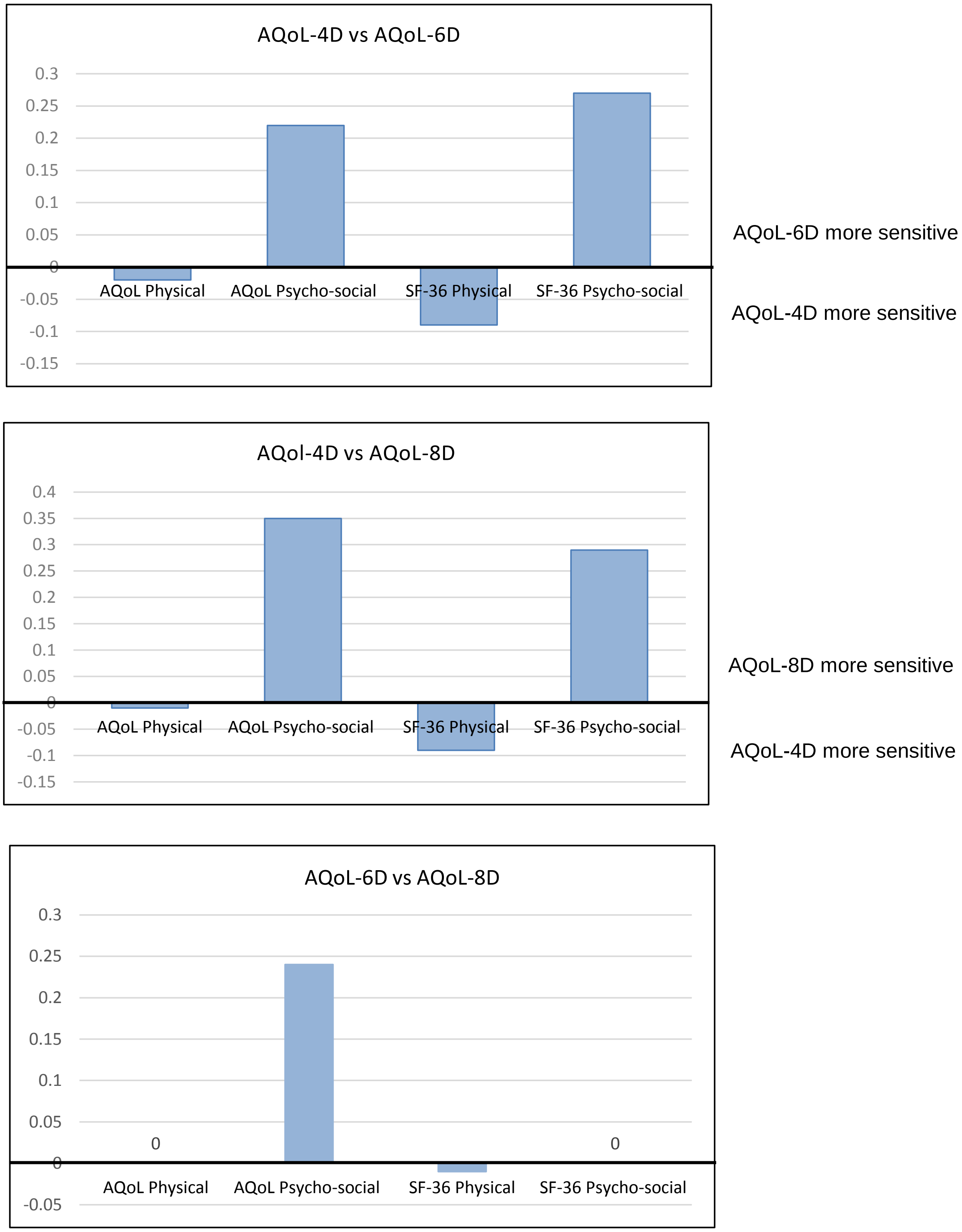
Table 13 Relative sensitivity: Correlation between residual from pairwise regressions and dimensions of SF-36(1) n=8,022

Equation	Gen Health	Phys fn	Role Phys	B Pain	Vital	Social	Role E	MH	PCS	MCS
AQoL-4D = a_1 +b_1 AQoL-6D + Res(48) Res(46)	-0.09	0.05	0.00	0.00	-0.22	-0.09	-0.14	-0.26	0.09	-0.27
AQoL-4D = a_2 + b_2 AQoL-8D + Res(48) Res(48)	-0.12	0.07	0.00	0.01	-0.25	-0.08	-0.16	-0.28	0.09	-0.29
AQoL-6D = a_3 + b_3 AQoL-8D + Res(68) Res(68)	-0.03	0.05	-0.02	0.01	-0.03	0.04	-0.01	0.02	0.01	0.00

(1) ρ (Res_{ij}), (Dim_k)>0 implies ($AQoL_i$) is more sensitive to Dim_k than $AQoL_j$

ρ (Res_{ij}), (Dim_k)>0 implies ($AQoL_i$) is less sensitive than to Dim_k than $AQoL_j$.

Figure 7 Relative sensitivity summary classification[(1)]



(1) Correlation between summary scores SF-36 (PCS, MCS) and AQoL-8D (PDS, MSD) and the residual of the GMS regression of one instrument utilities upon the second instrument utilities.

Source: Tables 13, 14

5 AQoL-7D

A single database contained responses to the AQoL-7D, 4D and 6D. It is described in Richardson et al. [28] and available on the AQoL website. A total of 357 individual cases were employed in the analysis. Comparisons are therefore limited as only the dimensions of the AQoL-6D were available for the analysis of the content and sensitivity. The analysis of content and sensitivity described above was repeated with these data.

Each of the three instruments were regressed upon the 6 dimensions of the AQoL-6D. Unadjusted beta coefficients are reported in Figure 8. By comparison with AQoL-4D and 6D the importance of independent living rises with the use of AQoL-7D but the significance of coping is reduced.

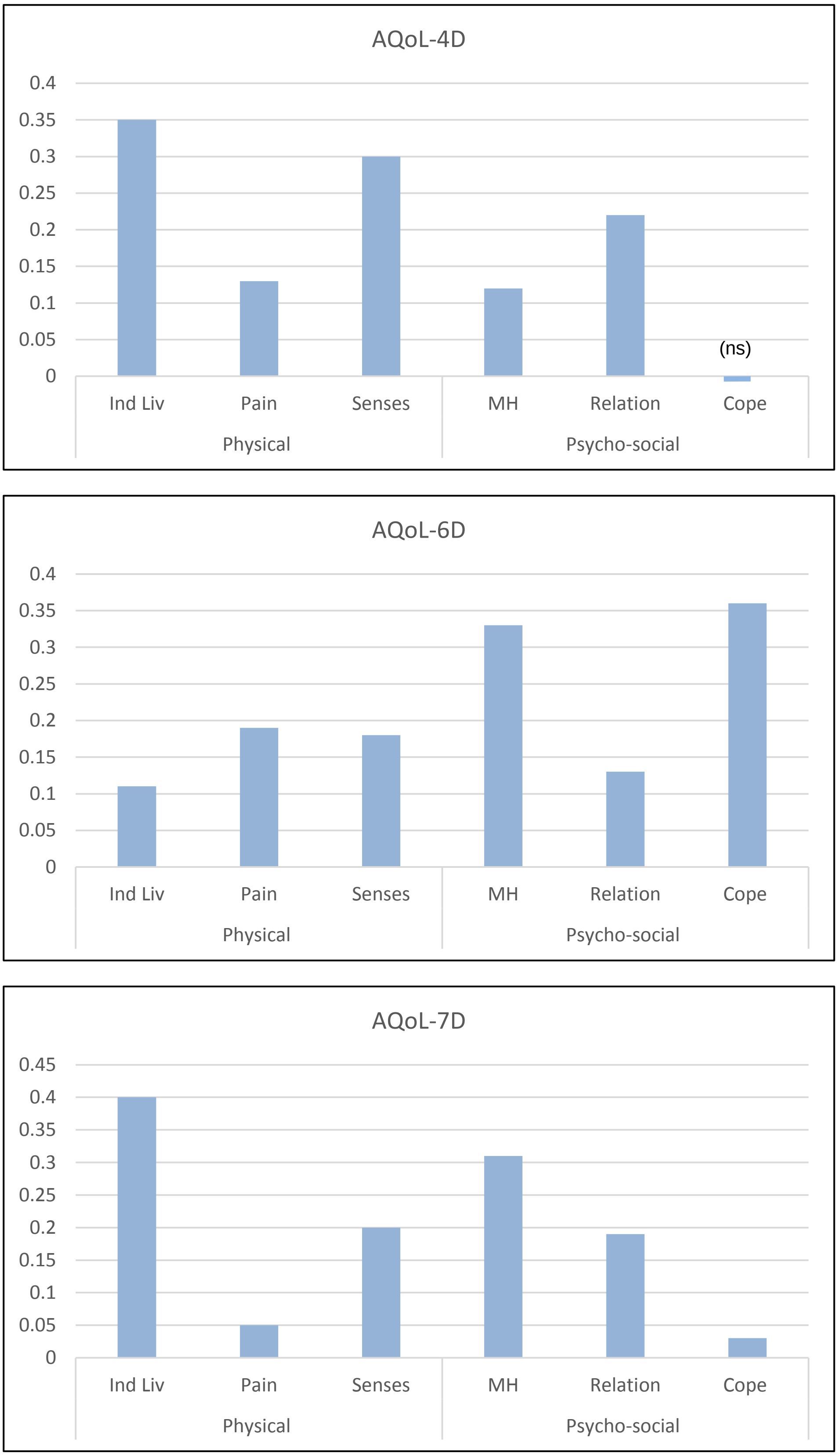
The analysis of relative sensitivity was carried out as described at the end of Section 4 above. Residuals calculated from the regression of AQoL-7D on AQoL-4D and AQoL-6D – Res(7D/4D) and Res(7D/6D) were correlated with the available dimensions and included in Table 16 which also reports the correlation between AQoL-4D, AQoL-6D and AQoL-7D with the dimensions of the SF-36. A positive correlation indicates a relatively greater sensitivity of AQoL-7D to the comparator dimension. Consistent with item content, the AQoL-7D is more sensitive to individual living than the other two AQoL instruments and more sensitive to senses than AQoL-6D. It is less sensitive with respect to mental health and coping whose effects are ‘diluted’ in the expanded instrument.

Table 14 Relative sensitivity: Correlation between residual from pairwise regressions and dimensions of AQoL-8D(1) n=8,022

Equation	Ind Living	Pain	Senses	Happy	Mental	Cope	Relation	Worth	PSD	MSD
AQoL-4D = a_4 +b_4 AQoL-6D + Res (4, 6, 8) Res(46)	0.01	-0.01	0.04	-0.24	-0.27	-0.34	-0.06	-0.25	0.02	-0.22
AQoL-4D = a_5 + b_5 AQoL-8D + Res(48) Res(48)	0.01	-0.01	0.05	-0.31	-0.36	-0.32	-0.19	-0.35	0.01	-0.35
AQoL-6D = a_6 + b_6 AQoL-8D + Res(68) Res(6, 8)	0.03	0.01	0.04	-0.12	-0.13	0.12	-0.27	-0.16	0.00	-0.24

(1) ρ (Res_{ij}), (Dim_k)>0 implies ($AQoL_i$) is more sensitive to Dim_k than $AQoL_j$
ρ (Res_{ij}), (Dim_k)>0 implies ($AQoL_i$) is less sensitive than to Dim_k than $AQoL_j$

Figure 8 Content of AQoL-4D, 6D, 7D by AQoL-6D dimension n=363[1]



(1) All coefficients are significant at the 1% significance level.

Table 15 Sensitivity: Correlation with disease specific instruments: EQ-5D-5L included as comparator

Disease	Instrument	AQoL-8	AQoL-4D	AQoL-6D	AQoL-8D	EQ-5D-5L
Arthritis	AIMS SF	0.74	0.75	0.77	0.78	0.74
Asthma	AQLQ	0.45	0.45	0.45	0.46	0.46
Cancer	QLQ	0.39	0.37	0.35	0.35	0.35
Depression	DASS	0.57	0.57	0.73	0.72	0.58
Diabetes	Diabetes 39	0.58	0.56	0.61	0.63	0.49
Heart disease	McNew	0.78	0.75	0.84	0.85	0.73

Table 16 Correlation of AQoL-7D with dimensions of the AQoL-6D and residuals Res7D/4D and Res7D/6D

	AQoL-4D	AQoL-7D	AQoL-6D	Ind Liv	Rel	MH	Cope	Pain	Sense
AQoL-4D	1								
AQoL-7D	0.87	1							
AQoL-6D	0.81	0.88	1						
Ind Liv	0.84	0.85	0.76	1					
Rel	0.75	0.78	0.76	0.74	1				
MH	0.55	0.69	0.82	0.45	0.49	1			
Cope	0.55	0.62	0.84	0.49	0.58	0.62	1		
Pain	0.57	0.57	0.69	0.54	0.42	0.45	0.46	1	
Sense	0.75	0.71	0.64	0.68	0.53	0.36	0.35	0.36	1
Res7D/4D				0.03	0.05	0.27	0.15	-0.01	-0.07
Res7D/6D				0.19	0.04	-0.26	-046	-0.24	0.14

(1) AQoL(7D) =a+b AQoL(4D) + Res 7D/4D: ρ (Res, Dimi) > 0 implies AQoL-7D is more sensitive

(2) AQoL(7D) = a+b AQoL(6D) + Res 7D/6D

6 Transformations between AQoL instruments: Methods

Transformations between all combinations of the AQoL instruments are described in detail in Richardson et al. [24]. Two variants of two methods were used to predict the score which would be obtained with instrument A from the results obtained from instrument B. Both employed econometric methods to obtain a relationship between instrument scores from an existing data set and results are assumed to apply more generally.

Model 1A: This method involved two stages.

(i) Each dimension score, Dim_i (A), of instrument A is predicted from a regression upon the dimensions of instrument B, Dim_i B.

$$Dim_i\ (A) = f(Dim_1(B)) \ldots Dim_n(B))$$

The predicted score for instrument A is obtained by inserting the predicted dimensions Dim_i (A) into the algorithm for instrument A.

Model 1B: As a variant of this method the square of the dimension scores are entered into stage 1.

Model 2A: The utility score of instrument A is predicted directly from the scores obtained from instrument B and its dimensions.

Model 2B: The square of the dimension terms is entered into the regression.

In the present context, the task is to obtain a best estimate of the dependent instrument given information with respect to the independent instrument. A measurement error in the independent variable cannot be altered and, given this, the task is to minimise additional error arising from the estimation procedure. This suggests the use of OLS estimation.

Selection criteria: Four criteria were used for choosing between the results. These were:

(i) The value of the average error between actual and predicted values;

(ii) The intra-class correlation between predicted and actual values. (The intra-class correlation is a measure of the absolute agreement between scores which may be large despite a high correlation and low average error);

(iii) Visual inspection of the predicted and actual frequencies and, particularly, their correspondence at the ceiling and floor, and at peaks and troughs in the frequency;

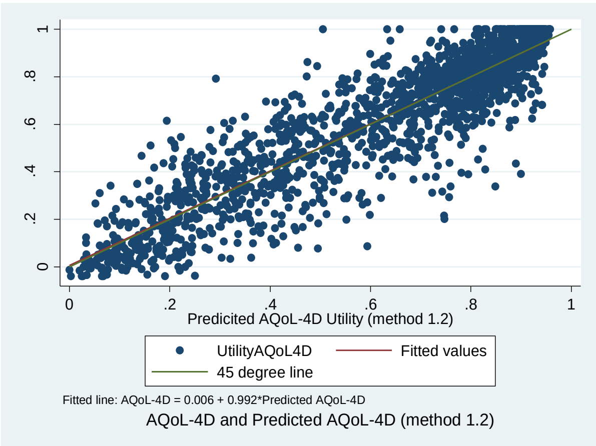
(iv) Systematic bias in the predicted score. This was determined by regressing scores for instrument A upon the predicted score using each of the four methods. Perfect prediction would result in a linear regression of the form score A = 0.00 + 1.00 score (A/B). The fourth criterion was the extent of the deviation from this gold standard.

Data: For the purposes of obtaining a transformation the important feature of the sample is the breadth of observations, not the representativeness of the individuals. Consequently, the largest available database for each set of transformations was employed. At the time of the analysis, May 2011, 2,617 observations were available for AQoL-8D, 3,417 for AQoL-6D, 1,898 for AQoL-4D and 378 for AQoL-7D. They are described in Richardson et al. [24].

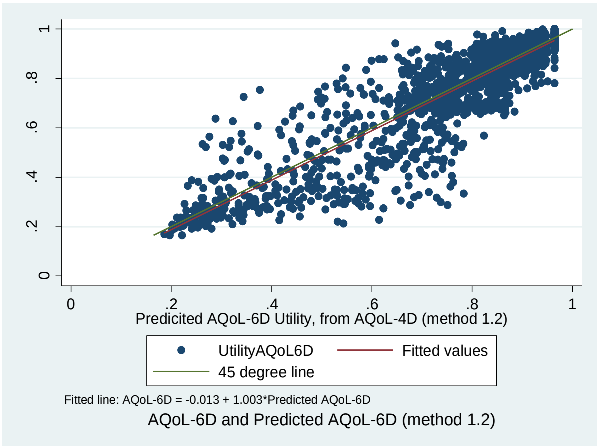
Results: Regression equations for the selected transformations are reproduced in Appendix 3 and scattergrams of the relationship between actual and transformed data are shown in Figures 9(a) to 9(f).

Figure 9 Transformations between AQoL instruments

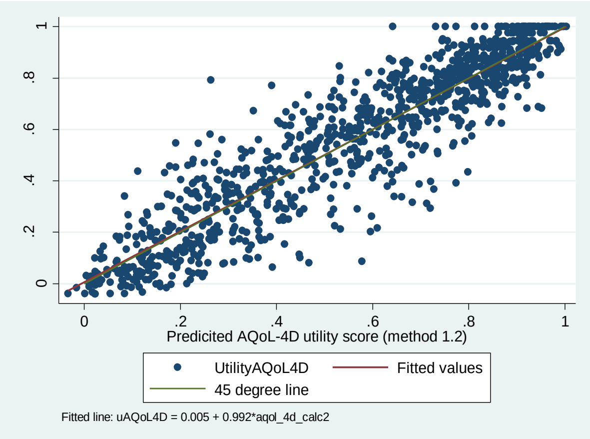
9(a) AQoL-4D predicted from AQoL-6D Model 1B



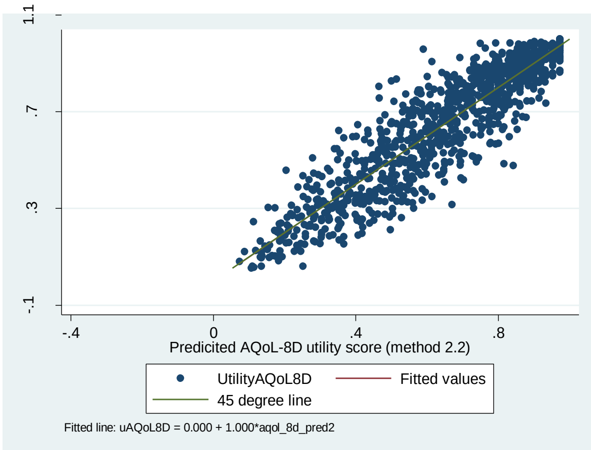
9(b) AQoL-6D predicted from AQoL-4D Model 1B



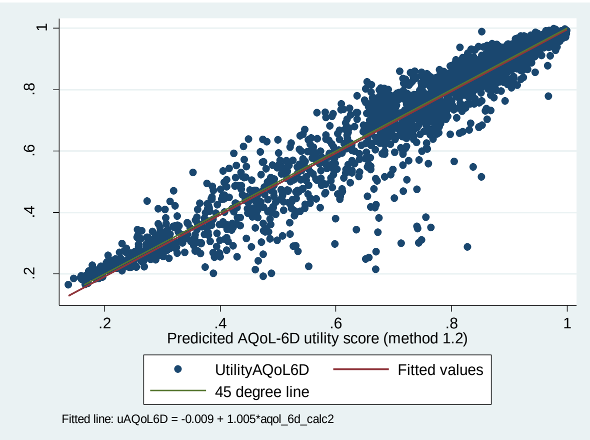
9(c) AQoL-4D predicted from AQoL-8D Model 1B



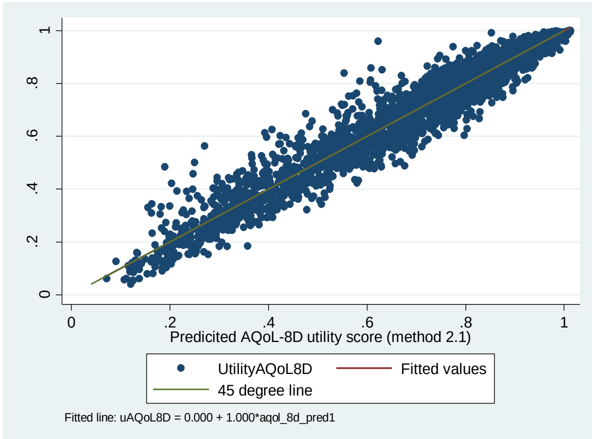
9(d) AQoL-8D predicted from AQoL-4D Model 2B



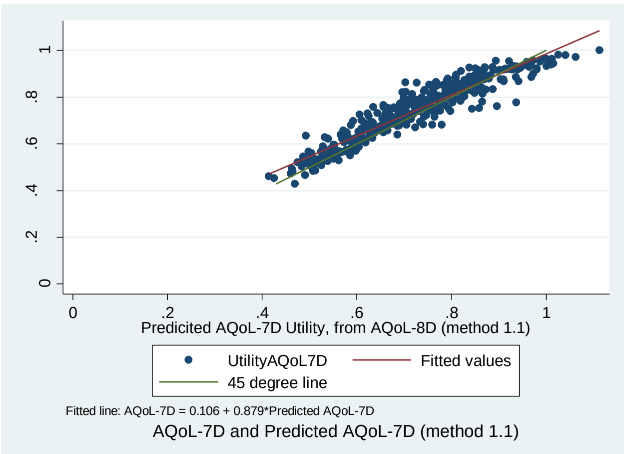
9(e) AQoL-6D predicted from AQoL-8D Model 1B



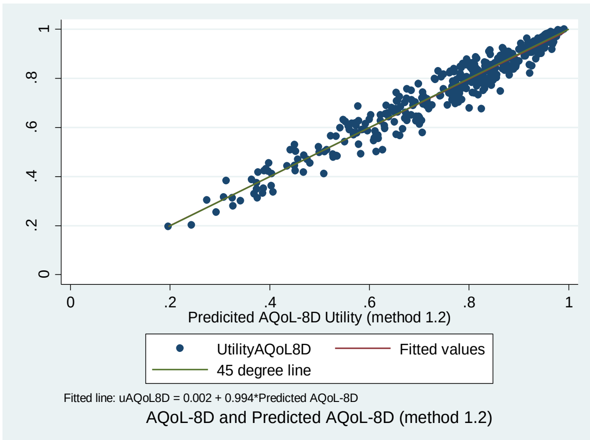
9(f) AQoL-8D predicted from AQoL-6D Model 2A



9(g) AQoL-7D predicted from AQoL-8D Model 1B



9(h) AQoL-8D predicted from AQoL-7D Model 1B



7 Recommendations

The criteria which should be used to select an appropriate MAUI are not unique to the AQoL instruments. The same considerations apply when the choice is within the AQoL group of instruments or between them and one of the alternative MAUI.

The overriding consideration in the choice of an instrument should be whether its descriptive system is sensitive to the health states which will be relevant in a particular study. However this criteria is inconclusive. A deterioration in any dimension of health affecting the QoL is likely to reduce the utility measured by every MAUI and a very large literature has used this observation to claim that a particular MAUI has been ‘validated’ in the context of a particular disease.

However the observation of the expected change in utility does not distinguish between MAUI. ‘Validation’ is not equivalent to a ‘right-wrong’ decision. It is a process of building confidence that the properties of an instrument achieve what the instrument purports to measure. MAUI purport to measure ‘utility’ which is the strength of preference for a health state measured on a cardinal scale. This means that the magnitude of the change is of significance. However interpretation of the magnitude is also problematic. As illustrated in Figure 4 the change measured by different instruments varies significantly and this is largely attributable to the modelling of the instruments as distinct from their sensitivity. This is examined in detail in Richardson et al. [8, 29]. In the domain of physical health the most sensitive instrument – the MAUI which correlates most highly with dimensions of physical health – is generally the 15D. But its modelling compressed numerical values. In the psycho-social domain the least sensitive of the common instruments with respect to virtually every dimension is the EQ-5D. However its modelling – embodied in the MIC data – has the opposite effect as the 15D: change in EQ-5D utilities are significantly greater than changes in 15D utilities despite the discrepancy in sensitivity.

One solution to this problem is to conduct head-to-head comparisons of instruments as summarised in Table 13 and to determine which of two competing instruments has the greatest sensitivity with respect to the dimensions which are of interest. This analysis is conducted for the main non-AQoL instruments in Richardson et al. [7].

Results in Table 13 are consistent with the analysis of instrument content. When physical dimensions of health are of primary concern and psycho-social dimensions are either irrelevant or of no interest the AQoL-4D and its brief version, AQoL-8 provide sensitive measurement. When psycho-social dimensions are important AQoL-6D and AQoL-8D are to be preferred. As judged by the dimensions of the SF-36 the two instruments cannot be separated. However the AQoL-8D with its 25 dedicated items provides a more sensitive description of psycho-social health than either the AQoL-6D or SF-36 (SF-36: 14 items; AQoL-6D: 10 items). When the corresponding dimensions are of importance (happiness/satisfaction, self worth and some elements of mental health) the AQoL-8D is the preferred instrument.

An additional advantage of the AQoL-8D is that it provides a profile of 8 health dimensions, 7 of which are validated sub-scales. A disadvantage is its greater length. However the average completion time of the 8,022 participants in the MIC survey was 5.5 minutes. There is little evidence that questionnaires of this length reduce completion rates of well presented questionnaires to motivated respondents. It is not recommended that the validity of a large and expensive clinical or epidemiological study should be jeopardised by economising on the measurement of QoL.

The scales adopted by all instruments – AQoL and non-AQoL – differ (see Figure 4). When comparisons are to be made using results from different instruments the scales should be aligned by transforming scores of one of the instruments to a common scale. Transformations between instruments are given in the previous section of this paper and between the major MAUI in Chen et al. [9].

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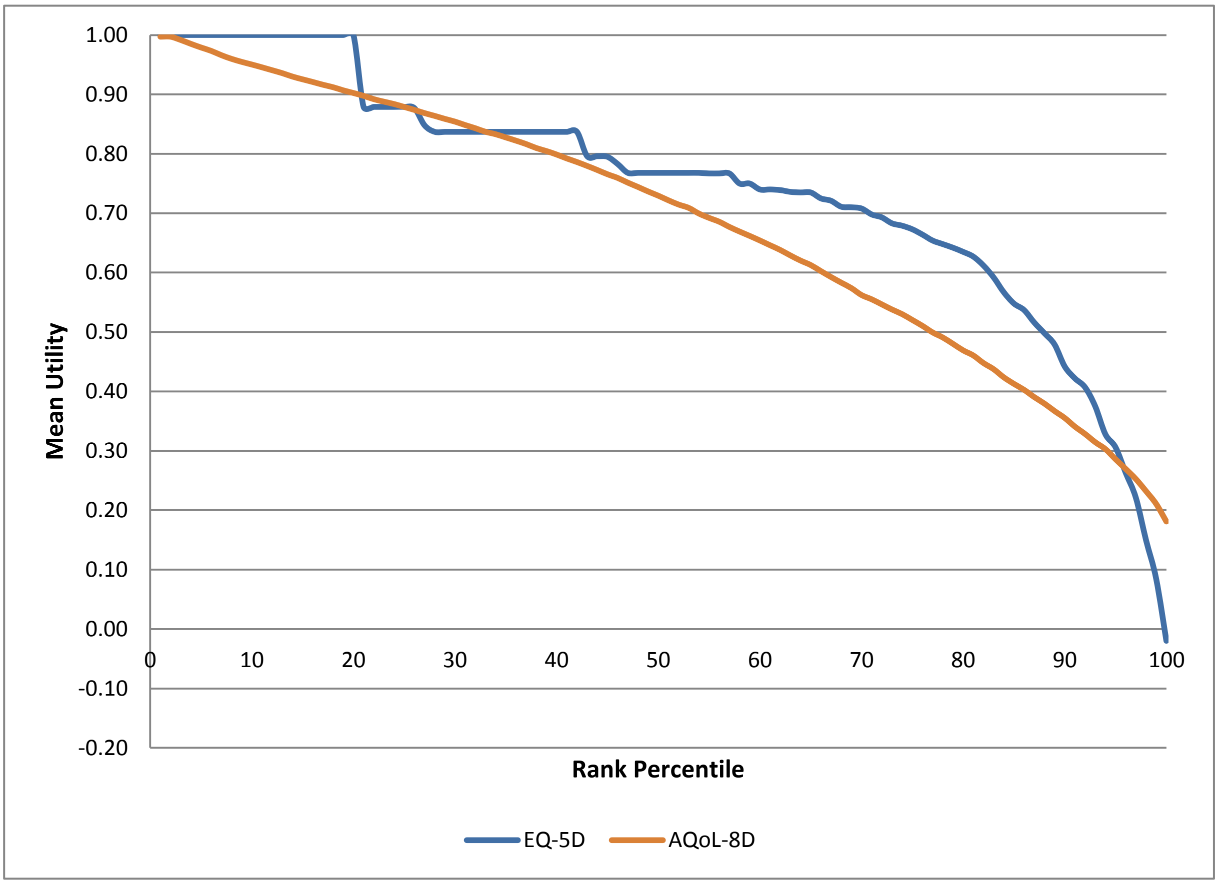
Appendix 1 AQoL-8D and EQ-5D-5L

MIC data were used to compare sensitivity and content of the major MAUI. The main results are published in Richardson et al. [7, 8]. Extracts of these are reproduced below.

Distribution of utilities

Figure A1.1 extracts the EQ-5D and AQoL data from Figure 4. It indicates significant correspondence between the broad magnitudes of the instruments but significant differences at best and worst health.

Figure A1.1 Mean instrument utility by ranked percentile EQ-5D-5L and AQoL-8D

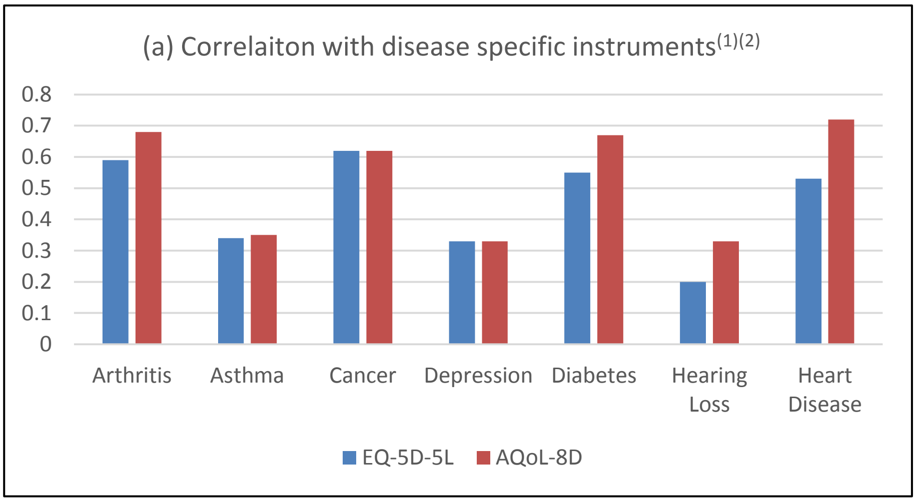


Correlation

Figure A1.2 compares the correlation between the two MAUI and DSI. Note that DSI are not a gold standard. Their sensitivity also varies and they commonly omit some dimensions included in MAUI but considered peripheral for the particular disease. Figure A1.2(b) depicts the correlation between the MAUI and other indices of wellbeing.

Figure A1.2 Selected correlations with EQ-5D-5L and AQoL-8D

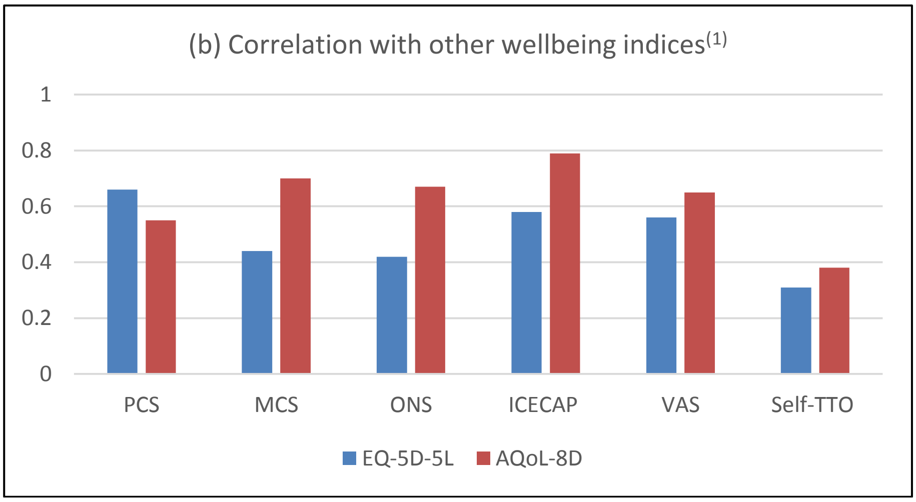
(a) Disease specific instruments(1)(2)



(1) Source: Richardson et al. [8, Appendix 4]

(2) Disease specific instruments

(b) Other wellbeing indices(1)



PCS/MCS: Physical/Mental component scores of SF-36; ONS: Subjective Well-Being; ICECAP: Capabilities; Preferences VAS: Self Assessed Health on a Visual Analogue Scale Preferences; Self-TTO; A Self-TTO, described in appendices of Richardson et al. [8]

(1) Source Richardson et al. [8, Appendix 1]

Instrument Content

Table A1.1 reports Beta coefficients from the regression of EQ-5D-5L and AQoL-8D on: (i) dimensions of the SF-36; and (ii) dimensions of AQoL-8D, as reported in Box 3. The coefficients are plotted in Figure A1.3.

Table A1.1 Beta coefficients from regressing AQoL-8D, EQ-5D on SF-36, AQoL-8D dimensions

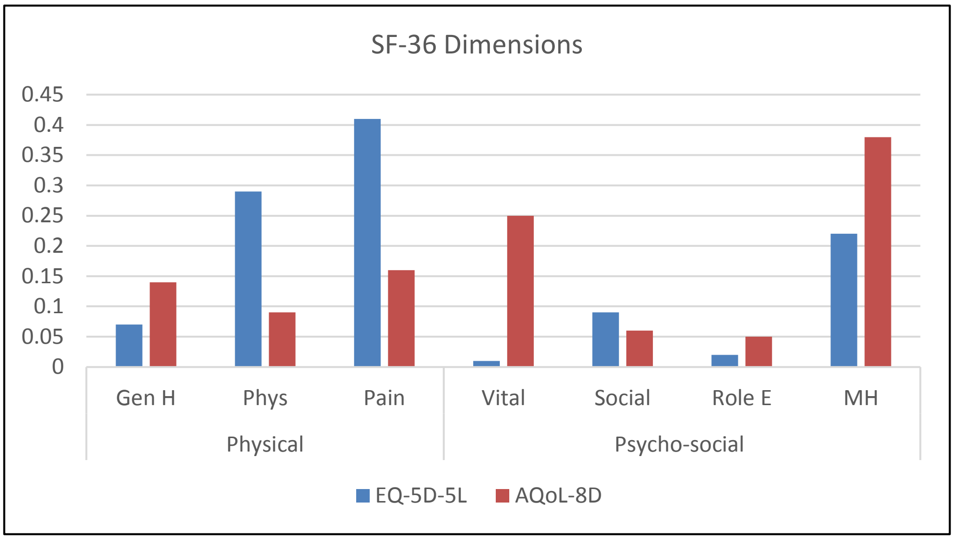
	Independent: SF-36 dimension(1)									
	Physical				**Psycho-social**				**R^2**	**F**
Dependent	Gen H	Phys	Role P	Pain	Vital	Social	Role E	MH		
EQ-5D-5L	0.07	0.29	0	0.41	0.01*	0.09	0.02	0.22	0.70	1652
AQoL-8D	0.14	0.09	0	0.16	0.25	0.06	0.05	0.38	0.81	2971
	Independent: AQoL-8D dimension(1)									
	Physical			**Psycho-social**					**R^2**	**F**
Dependent	Ind Liv	Pain	Senses	Happy	Mental	Cope	Relation	Worth		
EQ-5D-5L	0.31	0.43	0	0.09	0.10	0.07	0.0	0.09	0.74	2026
AQoL-8D	0.09	0.19	0.09	0.14	0.20	0.16	0.19	0.20	0.99	-

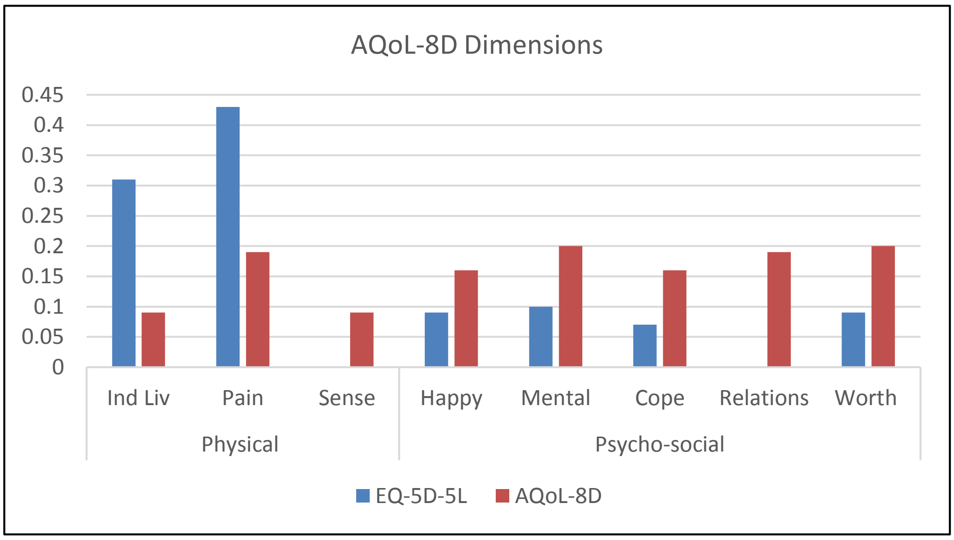
(1) Dimensions defined in Richardson et al. [7, Table 7]

Source Richardson et al. [7, Supplementary Table S.4]

Figure A1.3 Content of EQ-5D-5L and AQoL-8D

Beta coefficients from regression on dimension scores





Source: Richardson et al. Supplementary Table S.4 [7]

Sensitivity

Table A1.2 reports the GMS regression of EQ-5D-5L on AQoL-8D. The correlation of the residual with the dimensions of the SF-36 are reported in Figure A1.4.

Geometric Mean Square Regression EQ-5D-5L = 0.05 + AQoL-8D + Res

$R^2 = 0.69$

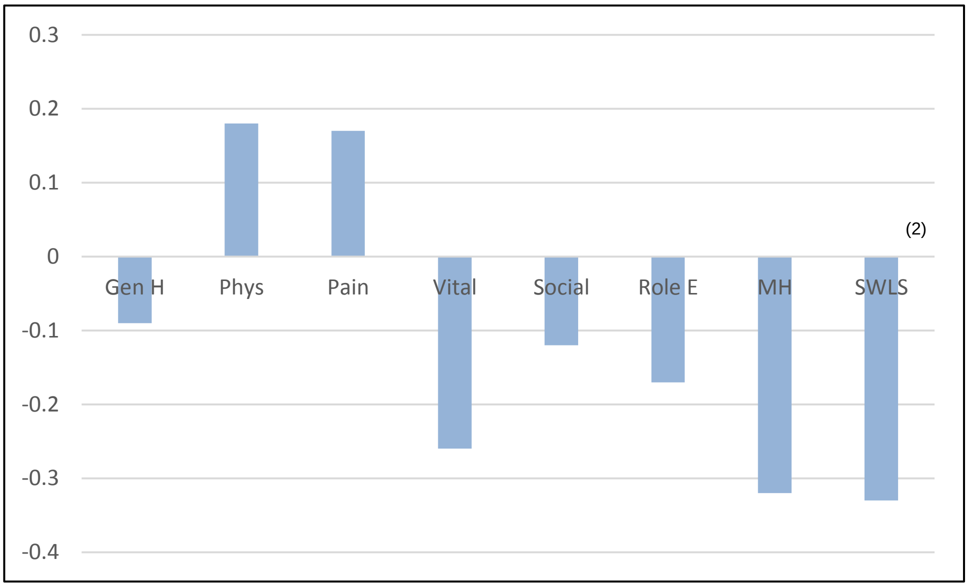
Table A1.2 Correlation RES and Dimensions of the SF-36 and AQoL-8D(1)

	SF-36							
	Physical			Psycho-social				
Correlation	**Gen H**	**Phys**	**B Pain**	**Vital**	**Social**	**Role E**	**MH**	**SWLS(1)**
(RES,Dim_1)	-0.09	0.18	0.17	-0.26	-0.12	-0.17	-0.32	-0.33

(1) Greater sensitivity AQoL-8D (ρ<0); EQ-5D-5L (ρ>0)

Figure A1.4 Relative sensitivity of EQ-5D-5L and AQoL-8D(1)

Correlation of residual with dimensions of the SF-36



Greater sensitivity

EQ-5D-5L … positive

AQoL-8D … negative

(1) Correlation res, dimension

(2) Satisfaction with life/social (subjective wellbeing/happiness)

Source: Richardson et al. [7]

Appendix 2 Summary statistics from the MIC survey

Table A2.1 MIC survey respondents by age, gender and disease category(1)

	Male			Female			Total		
	High school	Diploma/ trade	Uni	Total	High school	Diploma/ trade	Uni	Total	
Arthritis	105	149	83	337	198	250	144	592	929
Asthma	77	123	122	322	165	213	156	534	856
Cancer	91	136	128	355	137	147	133	417	772
Depression	100	127	86	313	212	241	151	604	917
Diabetes	146	235	161	542	128	164	90	382	924
Hearing loss	127	186	165	478	123	137	94	354	832
Heart disease	160	267	178	605	121	150	67	338	943
	806	1223	923	2952	1084	1302	835	3221	6173
Public	286	333	222	841	306	350	263	919	1760
	1092	1556	1145	**3793**	1390	1652	1098	**4140**	7933

(1) Excludes 89 patients with COPD included in some MIC analyses

Source: Richardson et al. [25]

Table A2.2 MIC survey respondents by age

Country	Excluded (%)		Composition of Final Sample														Education			Total (n)
			Public (%) n=1,760							Patient (%) n=6,262										
	Pub	Pat	18-24	25-34	35-44	45-54	55-64	65+	Male	18-24	25-34	35-44	45-54	55-64	65+	Male	High school	Diploma or certificate or	University	
Australia	36.5	15.3	11.3	18.1	18.9	18.5	14.7	18.5	46.4	2.1	8.0	10.3	19.5	32.6	27.5	50.4	35.8	35.1	29.1	1430
USA	17.1	11.2	10.3	17.8	18.1	20.2	16.2	17.4	45.2	4.8	8.8	13.1	25.0	25.5	22.8	36.4	36.1	29.3	34.6	1460
UK	18.8	13.2	11.4	15.4	20.1	18.1	14.4	20.5	47.7	7.1	12.7	9.7	16.4	29.0	25.1	51.4	38.1	30.2	31.7	1356
Canada	9.4	19.2	12.8	18.3	16.2	20.1	16.8	15.9	47.3	5.8	15.1	18.0	19.1	27.3	14.8	34.8	29.2	47.6	23.2	1330
Norway	19.1	19.1	12.8	16.0	16.7	18.4	15.6	20.5	50.3	6.2	8.2	10.2	16.8	26.0	32.6	63.6	28.0	48.5	23.5	1177
Germany	24.4	17	6.5	20.0	18.5	23.1	17.7	14.2	50.4	5.2	8.3	17.5	31.4	24.4	13.2	54.2	19.6	55.0	25.4	1269
Total	21.2	15.7	11.0	17.6	18.0	19.7	15.9	17.8	47.8	5.1	10.1	13.1	21.4	27.6	22.6	48.0	31.4	40.4	28.2	8022

Source: Richardson et al. [7]

Appendix 3 Transformations between AQoL instruments

Predicting AQoL-4D from AQoL-6D

Model 1B (1) Predict AQoL-4D dimensions from the 4 regressions below
(2) Insert predicted dimension scores in AQoL-6D formula.
See AQoL website www.aqol.com.au

Table A3.1 Predicting dimension 1 of AQoL-4D from AQoL-6D

	Coef.	t	P>|t|
dud1_6d	0.1896	4.86	0.00
dud2_6d	0.0470	1.30	0.20
dud3_6d	0.1203	2.77	0.01
dud4_6d	-0.1184	-2.86	0.00
dud5_6d	-0.0236	-0.79	0.43
dud6_6d	0.0545	1.18	0.24
dud1_6dsq	0.3211	7.10	0.00
dud2_6dsq	0.0403	0.98	0.33
dud3_6dsq	-0.1156	-2.67	0.01
dud4_6dsq	0.1585	3.56	0.00
dud5_6dsq	0.0331	1.02	0.31
dud6_6dsq	0.1442	1.87	0.06
constant	-0.0066	-0.75	0.46
R^2	0.68		

Table A3.2 Predicting dimension 2 of AQoL-4D from AQoL-6D

	Coef.	t	P>|t|
dud1_6d	0.1178	2.21	0.03
dud2_6d	0.2664	5.39	0.00
dud3_6d	-0.0002	0.00	1.00
dud4_6d	0.0481	0.85	0.39
dud5_6d	-0.0421	-1.04	0.30
dud6_6d	0.1036	1.65	0.10
dud1_6dsq	-0.1594	-2.58	0.01
dud2_6dsq	0.1754	3.14	0.00
dud3_6dsq	0.1036	1.75	0.08
dud4_6dsq	0.1025	1.68	0.09
dud5_6dsq	0.0272	0.62	0.54
dud6_6dsq	0.0419	0.40	0.69
constant	0.0132	1.09	0.27
R^2	0.63		

Table A3.3 Predicting dimension 3 of AQoL-4D from AQoL-6D

	Coef.	t	P>|t|
dud1_6d	0.0115	0.51	0.61
dud2_6d	0.0240	1.15	0.25
dud3_6d	0.0363	1.46	0.15
dud4_6d	-0.0454	-1.91	0.06
dud5_6d	0.0212	1.24	0.21
dud6_6d	0.5749	21.77	0.00
dud1_6dsq	-0.0011	-0.04	0.97
dud2_6dsq	-0.0131	-0.56	0.58
dud3_6dsq	-0.0518	-2.08	0.04
dud4_6dsq	0.0885	3.46	0.00
dud5_6dsq	-0.0151	-0.81	0.42
dud6_6dsq	-0.1205	-2.73	0.01
constant	-0.0075	-1.48	0.14
R^2	0.69		

Table A3.4 Predicting dimension 4 of AQoL-4D from AQoL-6D

	Coef.	t	P>|t|
dud1_6d	0.0325	0.87	0.38
dud2_6d	-0.0733	-2.13	0.03
dud3_6d	-0.0116	-0.28	0.78
dud4_6d	-0.0810	-2.06	0.04
dud5_6d	0.0584	2.06	0.04
dud6_6d	-0.0209	-0.48	0.63
dud1_6dsq	0.0180	0.42	0.68
dud2_6dsq	0.1134	2.91	0.00
dud3_6dsq	0.1500	3.63	0.00
dud4_6dsq	0.1605	3.78	0.00
dud5_6dsq	0.2143	6.96	0.00
dud6_6dsq	0.0491	0.67	0.50
constant	0.0429	5.10	0.00
R^2	0.63		

Predicting AQoL-6D from AQoL-4D

Model 1B (1) Predict AQoL-4D dimensions from the 4 regressions below
(2) Insert predicted dimension scores in AQoL-6D formula.
See AQoL website www.aqol.com.au

Table A3.1 Predicting dimension 1 of AQoL-6D from AQoL-4D

	Coef.	t	P>|t|
dud1_4d	1.1493	21.44	0.00
dud2_4d	0.2069	4.21	0.00
dud3_4d	0.1332	1.67	0.09
dud4_4d	0.5974	10.28	0.00
dud1_4dsq	-0.5172	-6.31	0.00
dud2_4dsq	-0.1154	-2.15	0.03
dud3_4dsq	0.2737	1.45	0.15
dud4_4dsq	-0.4734	-6.35	0.00
constant	-0.0051	-0.79	0.43
R^2	0.71		

Table A3.2 Predicting dimension 2 of AQoL-6D from AQoL-4D

	Coef.	t	P>|t|
dud1_4d	0.4803	8.02	0.00
dud2_4d	1.2151	22.11	0.00
dud3_4d	-0.0444	-0.50	0.62
dud4_4d	0.5114	7.87	0.00
dud1_4dsq	-0.1894	-2.07	0.04
dud2_4dsq	-0.6709	-11.18	0.00
dud3_4dsq	0.2087	0.99	0.32
dud4_4dsq	-0.3587	-4.31	0.00
constant	-0.0201	-2.81	0.01
R^2	0.71		

Table A3.3 Predicting dimension 3 of AQoL-6D from AQoL-4D

	Coef.	t	P>|t|
dud1_4d	0.1013	1.42	0.16
dud2_4d	0.9934	15.20	0.00
dud3_4d	-0.0234	-0.22	0.83
dud4_4d	1.2367	16.01	0.00
dud1_4dsq	-0.0684	-0.63	0.53
dud2_4dsq	-0.6858	-9.61	0.00
dud3_4dsq	-0.0890	-0.35	0.72
dud4_4dsq	-0.9046	-9.13	0.00
constant	0.2020	23.68	0.00
R^2	0.55		

Table A3.4 Predicting dimension 4 of AQoL-6D from AQoL-4D

	Coef.	T	P>|t|
dud1_4d	0.1222	1.76	0.08
dud2_4d	1.0985	17.21	0.00
dud3_4d	-0.0365	-0.35	0.72
dud4_4d	0.8348	11.06	0.00
dud1_4dsq	0.0178	0.17	0.87
dud2_4dsq	-0.6566	-9.42	0.00
dud3_4dsq	0.1174	0.48	0.63
dud4_4dsq	-0.5091	-5.26	0.00
constant	0.0524	6.29	0.00
R^2	0.59		

Table A3.5 Predicting dimension 5 of AQoL-6D from AQoL-4D

	Coef.	t	P>|t|
dud1_4d	0.4177	5.47	0.00
dud2_4d	-0.0103	-0.15	0.88
dud3_4d	0.3487	3.07	0.00
dud4_4d	1.9812	23.90	0.00
dud1_4dsq	-0.3469	-2.97	0.00
dud2_4dsq	-0.0641	-0.84	0.40
dud3_4dsq	-0.3957	-1.47	0.14
dud4_4dsq	-1.3223	-12.45	0.00
constant	0.0189	2.07	0.04
R^2	0.55		

Table A3.6 Predicting dimension 6 of AQoL-6D from AQoL-4D

	Coef.	t	P>|t|
dud1_4d	0.0815	2.47	0.01
dud2_4d	-0.0615	-2.03	0.04
dud3_4d	1.3987	28.52	0.00
dud4_4d	-0.0057	-0.16	0.87
dud1_4dsq	0.0806	1.60	0.11
dud2_4dsq	0.0919	2.78	0.01
dud3_4dsq	-0.7901	-6.79	0.00
dud4_4dsq	0.0269	0.59	0.56
constant	0.0330	8.36	0.00
R^2	0.70		

Predicting AQoL-4D from AQoL-8D

Model 1B (1) Predict AQoL-4D dimensions from the 4 regressions below
(2) Insert predicted dimension scores in AQoL-6D formula.
See AQoL website www.aqol.com.au

Table A3.7 Predicting dimension 1 of AQoL-4D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-2.0767	-9.24	0.00
dud2_8d	-0.2258	-1.36	0.18
dud3_8d	0.1840	1.09	0.28
dud4_8d	-0.5201	-2.55	0.01
dud5_8d	0.2627	1.28	0.20
dud6_8d	-0.2064	-1.25	0.21
dud7_8d	-0.2340	-1.42	0.16
dud8_8d	-0.6772	-3.22	0.00
dud1_8dsq	0.9370	6.24	0.00
dud2_8dsq	0.2819	2.18	0.03
dud3_8dsq	-0.2143	-1.58	0.11
dud4_8dsq	0.3559	2.38	0.02
dud5_8dsq	-0.2270	-1.54	0.13
dud6_8dsq	0.0842	0.71	0.48
dud7_8dsq	0.1425	1.27	0.20
dud8_8dsq	0.3615	2.60	0.01
constant	1.7621	14.82	0.00
R^2	0.64		

Table A3.8 Predicting dimension 2 of AQoL-4D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.2458	-0.81	0.42
dud2_8d	-1.2954	-5.78	0.00
dud3_8d	-0.1848	-0.81	0.42
dud4_8d	0.1118	0.41	0.69
dud5_8d	-1.2183	-4.41	0.00
dud6_8d	-0.3635	-1.63	0.10
dud7_8d	-0.1237	-0.56	0.58
dud8_8d	-0.3340	-1.18	0.24
dud1_8dsq	-0.0291	-0.14	0.89
dud2_8dsq	0.7659	4.39	0.00
dud3_8dsq	0.1426	0.78	0.44
dud4_8dsq	-0.0632	-0.31	0.75
dud5_8dsq	0.5222	2.62	0.01
dud6_8dsq	0.1541	0.96	0.34
dud7_8dsq	0.0934	0.62	0.54
dud8_8dsq	0.1282	0.68	0.49
constant	1.9475	12.17	0.00
R^2	0.65		

Table A3.9 Predicting dimension 3 of AQoL-4D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.1877	-1.65	0.10
dud2_8d	0.1222	1.45	0.15
dud3_8d	-0.1238	-1.45	0.15
dud4_8d	-0.2618	-2.53	0.01
dud5_8d	-0.0492	-0.47	0.64
dud6_8d	0.0013	0.02	0.99
dud7_8d	-0.0047	-0.06	0.96
dud8_8d	-0.4149	-3.90	0.00
dud1_8dsq	0.1033	1.36	0.18
dud2_8dsq	-0.0473	-0.72	0.47
dud3_8dsq	0.0855	1.25	0.21
dud4_8dsq	0.1933	2.55	0.01
dud5_8dsq	0.0057	0.08	0.94
dud6_8dsq	-0.0209	-0.35	0.73
dud7_8dsq	-0.0113	-0.20	0.84
dud8_8dsq	-0.0941	-1.34	0.18
constant	0.6969	11.58	0.00
R^2	0.71		

Table A3.10 Predicting dimension 4 of AQoL-4D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.3489	-1.76	0.08
dud2_8d	-0.6952	-4.73	0.00
dud3_8d	-0.6896	-4.62	0.00
dud4_8d	-0.0059	-0.03	0.97
dud5_8d	0.0418	0.23	0.82
dud6_8d	-0.2746	-1.88	0.06
dud7_8d	-1.5171	-10.40	0.00
dud8_8d	-0.1914	-1.03	0.30
dud1_8dsq	0.1952	1.47	0.14
dud2_8dsq	0.4681	4.09	0.00
dud3_8dsq	0.3322	2.78	0.01
dud4_8dsq	0.0029	0.02	0.98
dud5_8dsq	-0.0367	-0.28	0.78
dud6_8dsq	0.2013	1.91	0.06
dud7_8dsq	0.7334	7.43	0.00
dud8_8dsq	0.1406	1.14	0.25
constant	1.6889	16.09	0.00
R^2	0.69		

Table A3.11 Predicting AQoL-8D from AQoL-4D (Model 2B)

	Coef.	Std. Err.	t	P>|t|
dud1_4d	-0.2614	0.05	-5.22	0.00
dud2_4d	-0.8947	0.05	-19.61	0.00
dud3_4d	-0.3552	0.07	-4.90	0.00
dud4_4d	-0.8900	0.05	-16.72	0.00
dud1_4dsq	0.1816	0.08	2.37	0.02
dud2_4dsq	0.5890	0.05	12.64	0.00
dud3_4dsq	0.0615	0.18	0.34	0.74
dud4_4dsq	0.5819	0.07	8.85	0.00
constant	0.9738	0.01	147.66	0.00
R^2	0.83			

Predicting AQoL-6D from AQoL-8D

Model 1B (1) Predict AQoL-4D dimensions from the 4 regressions below
(2) Insert predicted dimension scores in AQoL-6D formula.
See AQoL website www.aqol.com.au

Table A3.12 Predicting dimension 1 of AQoL-6D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-3.3744	-37.31	0.00
dud2_8d	-0.1940	-2.93	0.00
dud3_8d	-0.1248	-1.96	0.05
dud4_8d	0.1479	1.83	0.07
dud5_8d	-0.2388	-3.28	0.00
dud6_8d	-0.0670	-1.06	0.29
dud7_8d	-0.1781	-2.86	0.00
dud8_8d	-0.2096	-2.52	0.01
dud1_8dsq	1.2961	21.88	0.00
dud2_8dsq	0.1540	3.10	0.00
dud3_8dsq	0.0617	1.20	0.23
dud4_8dsq	-0.1018	-1.77	0.08
dud5_8dsq	0.1417	2.71	0.01
dud6_8dsq	0.0344	0.77	0.44
dud7_8dsq	0.1180	2.83	0.01
dud8_8dsq	0.1489	2.76	0.01
constant	2.3943	53.31	0.00
R^2	0.92		

Table A3.13 Predicting dimension 2 of AQoL-6D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-1.0132	-4.43	0.00
dud2_8d	-0.7148	-4.26	0.00
dud3_8d	-0.6568	-4.08	0.00
dud4_8d	-0.6403	-3.14	0.00
dud5_8d	-0.6456	-3.51	0.00
dud6_8d	-0.4323	-2.69	0.01
dud7_8d	-0.2470	-1.57	0.12
dud8_8d	-0.3007	-1.43	0.15
dud1_8dsq	0.3398	2.27	0.02
dud2_8dsq	0.4084	3.25	0.00
dud3_8dsq	0.4891	3.76	0.00
dud4_8dsq	0.3688	2.53	0.01
dud5_8dsq	0.0522	0.39	0.69
dud6_8dsq	0.2414	2.12	0.03
dud7_8dsq	0.1009	0.96	0.34
dud8_8dsq	0.1351	0.99	0.32
constant	2.5040	22.04	0.00
R^2	0.67		

Table A3.14 Predicting dimension 3 of AQoL-6D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.3481	-2.11	0.04
dud2_8d	-0.0453	-0.37	0.71
dud3_8d	-1.0807	-9.29	0.00
dud4_8d	-0.6353	-4.31	0.00
dud5_8d	-0.1036	-0.78	0.44
dud6_8d	0.2415	2.08	0.04
dud7_8d	-0.0356	-0.31	0.75
dud8_8d	-0.3668	-2.42	0.02
dud1_8dsq	0.2231	2.06	0.04
dud2_8dsq	-0.0425	-0.47	0.64
dud3_8dsq	-0.0611	-0.65	0.52
dud4_8dsq	0.3383	3.22	0.00
dud5_8dsq	0.0309	0.32	0.75
dud6_8dsq	-0.2651	-3.23	0.00
dud7_8dsq	0.0345	0.45	0.65
dud8_8dsq	0.2406	2.44	0.02
constant	1.7635	21.50	0.00
R^2	0.81		

Table A3.15 Predicting dimension 4 of AQoL-6D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.1840	-2.22	0.03
dud2_8d	0.0045	0.07	0.94
dud3_8d	-0.4226	-7.25	0.00
dud4_8d	-1.6861	-22.82	0.00
dud5_8d	-0.4217	-6.33	0.00
dud6_8d	0.0200	0.34	0.73
dud7_8d	-0.0899	-1.58	0.11
dud8_8d	-0.0675	-0.89	0.38
dud1_8dsq	0.1256	2.32	0.02
dud2_8dsq	0.0218	0.48	0.63
dud3_8dsq	0.2891	6.15	0.00
dud4_8dsq	0.1590	3.02	0.00
dud5_8dsq	0.2767	5.77	0.00
dud6_8dsq	-0.0603	-1.47	0.14
dud7_8dsq	0.0789	2.07	0.04
dud8_8dsq	0.0464	0.94	0.35
constant	1.8817	45.76	0.00
R^2	0.95		

Table A3.16 Predicting dimension 5 of AQoL-6D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.1821	-1.64	0.10
dud2_8d	-0.0004	0.00	1.00
dud3_8d	-0.1978	-2.53	0.01
dud4_8d	0.3146	3.18	0.00
dud5_8d	-0.3776	-4.23	0.00
dud6_8d	-0.0135	-0.17	0.86
dud7_8d	-1.0885	-14.27	0.00
dud8_8d	-0.1454	-1.43	0.15
dud1_8dsq	0.1107	1.52	0.13
dud2_8dsq	0.0024	0.04	0.97
dud3_8dsq	0.1302	2.07	0.04
dud4_8dsq	-0.2227	-3.15	0.00
dud5_8dsq	0.2466	3.84	0.00
dud6_8dsq	-0.0122	-0.22	0.83
dud7_8dsq	-0.3587	-7.01	0.00
dud8_8dsq	0.1021	1.54	0.12
constant	1.6920	30.69	0.00
R^2	0.93		

Table A3.17 Predicting dimension 6 of AQoL-6D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.1897	-2.11	0.04
dud2_8d	-0.0049	-0.07	0.94
dud3_8d	-0.1207	-1.91	0.06
dud4_8d	0.1675	2.09	0.04
dud5_8d	-0.3338	-4.61	0.00
dud6_8d	-0.0518	-0.82	0.41
dud7_8d	0.0148	0.24	0.81
dud8_8d	-2.3583	-28.52	0.00
dud1_8dsq	0.1122	1.90	0.06
dud2_8dsq	0.0218	0.44	0.66
dud3_8dsq	0.0803	1.57	0.12
dud4_8dsq	-0.1172	-2.05	0.04
dud5_8dsq	0.2008	3.86	0.00
dud6_8dsq	0.0293	0.66	0.51
dud7_8dsq	0.0096	0.23	0.82
dud8_8dsq	0.8773	16.35	0.00
constant	1.6715	37.41	0.00
R^2	0.83		

Table A3.18 Predicting AQoL-8D from AQoL-6D (Model 2A)

	Coef.	Std. Err.	t	P>|t|
dud1_6d	-0.0788	0.01	-11.14	0.00
dud2_6d	-0.1005	0.01	-16.54	0.00
dud3_6d	-0.2387	0.01	-38.22	0.00
dud4_6d	-0.3017	0.01	-43.55	0.00
dud5_6d	-0.1272	0.00	-27.13	0.00
dud6_6d	-0.1618	0.01	-19.73	0.00
constant	1.0125	0.00	415.16	0.00
R^2	0.94			

Predicting AQoL-7D from AQoL-8D

Model 1B (1) Predict AQoL-4D dimensions from the 4 regressions below
(2) Insert predicted dimension scores in AQoL-6D formula.
See AQoL website www.aqol.com.au

Table A3.19 Predicting dimension 1 of AQoL-7D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-3.6228	-41.64	0.00
dud2_8d	0.1102	1.47	0.14
dud3_8d	-0.2293	-3.27	0.00
dud4_8d	-0.0236	-0.27	0.79
dud5_8d	0.0053	0.08	0.93
dud6_8d	-0.0176	-0.23	0.82
dud7_8d	-0.1225	-2.12	0.03
dud8_8d	-0.1577	-1.54	0.12
dud1_8dsq	1.4324	25.81	0.00
dud2_8dsq	-0.0618	-1.16	0.25
dud3_8dsq	0.1789	3.36	0.00
dud4_8dsq	0.0032	0.06	0.96
dud5_8dsq	-0.0130	-0.29	0.77
dud6_8dsq	0.0220	0.44	0.66
dud7_8dsq	0.0762	2.02	0.04
dud8_8dsq	0.1130	1.79	0.07
constant	2.3244	42.86	0.00
R^2	0.99		

Table A3.20 Predicting dimension 2 of AQoL-7D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-2.1251	-4.07	0.00
dud2_8d	-1.6309	-3.64	0.00
dud3_8d	-0.4212	-1.00	0.32
dud4_8d	1.3711	2.65	0.01
dud5_8d	-1.2868	-3.39	0.00
dud6_8d	-0.9042	-1.98	0.05
dud7_8d	-0.4865	-1.41	0.16
dud8_8d	0.0463	0.08	0.94
dud1_8dsq	0.9955	2.99	0.00
dud2_8dsq	0.9309	2.91	0.00
dud3_8dsq	0.3238	1.02	0.31
dud4_8dsq	-0.8068	-2.31	0.02
dud5_8dsq	0.5111	1.90	0.06
dud6_8dsq	0.5862	1.95	0.05
dud7_8dsq	0.1977	0.87	0.38
dud8_8dsq	-0.0517	-0.14	0.89
constant	2.7471	8.45	0.00
R^2	0.69		

Table A3.21 Predicting dimension 3 of AQoL-7D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.2934	-0.64	0.53
dud2_8d	-0.5912	-1.49	0.14
dud3_8d	-1.4871	-4.00	0.00
dud4_8d	-0.8404	-1.84	0.07
dud5_8d	-0.0931	-0.28	0.78
dud6_8d	0.8356	2.07	0.04
dud7_8d	-0.3274	-1.07	0.29
dud8_8d	-0.9268	-1.71	0.09
dud1_8dsq	0.2484	0.84	0.40
dud2_8dsq	0.2637	0.93	0.35
dud3_8dsq	0.2692	0.95	0.34
dud4_8dsq	0.4307	1.39	0.16
dud5_8dsq	-0.0011	0.00	1.00
dud6_8dsq	-0.5612	-2.11	0.04
dud7_8dsq	0.2125	1.06	0.29
dud8_8dsq	0.5822	1.74	0.08
constant	2.2059	7.66	0.00
R^2	0.80		

Table A3.22 Predicting dimension 4 of AQoL-7D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.2048	-1.04	0.30
dud2_8d	-0.1113	-0.66	0.51
dud3_8d	-0.6530	-4.11	0.00
dud4_8d	-2.0964	-10.74	0.00
dud5_8d	-0.1434	-1.00	0.32
dud6_8d	-0.0288	-0.17	0.87
dud7_8d	0.0413	0.32	0.75
dud8_8d	-0.2350	-1.02	0.31
dud1_8dsq	0.1387	1.10	0.27
dud2_8dsq	0.0402	0.33	0.74
dud3_8dsq	0.4520	3.75	0.00
dud4_8dsq	0.5030	3.81	0.00
dud5_8dsq	0.1131	1.12	0.27
dud6_8dsq	-0.0359	-0.32	0.75
dud7_8dsq	-0.0105	-0.12	0.90
dud8_8dsq	0.1481	1.04	0.30
constant	2.0751	16.89	0.00
R^2	0.96		

Table A3.23 Predicting dimension 5 of AQoL-7D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	0.3832	2.59	0.01
dud2_8d	0.0643	0.51	0.61
dud3_8d	-0.0857	-0.72	0.47
dud4_8d	0.0000	0.00	1.00
dud5_8d	-0.1049	-0.98	0.33
dud6_8d	-0.0035	-0.03	0.98
dud7_8d	-1.5505	-15.81	0.00
dud8_8d	-0.3540	-2.04	0.04
dud1_8dsq	-0.2236	-2.37	0.02
dud2_8dsq	-0.0706	-0.78	0.44
dud3_8dsq	0.0835	0.92	0.36
dud4_8dsq	-0.0069	-0.07	0.94
dud5_8dsq	0.0725	0.95	0.34
dud6_8dsq	0.0174	0.20	0.84
dud7_8dsq	-0.0838	-1.31	0.19
dud8_8dsq	0.1895	1.77	0.08
constant	1.6726	18.15	0.00
R^2	0.99		

Table A3.24 Predicting dimension 6 of AQoL-7D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.0979	-1.55	0.12
dud2_8d	-0.0072	-0.13	0.90
dud3_8d	-0.0777	-1.53	0.13
dud4_8d	0.1095	1.75	0.08
dud5_8d	-0.1315	-2.86	0.00
dud6_8d	-0.0640	-1.16	0.25
dud7_8d	-0.0562	-1.34	0.18
dud8_8d	-2.5546	-34.47	0.00
dud1_8dsq	0.0652	1.62	0.11
dud2_8dsq	0.0178	0.46	0.65
dud3_8dsq	0.0531	1.37	0.17
dud4_8dsq	-0.0732	-1.73	0.08
dud5_8dsq	0.0845	2.60	0.01
dud6_8dsq	0.0406	1.12	0.26
dud7_8dsq	0.0417	1.52	0.13
dud8_8dsq	0.9680	21.13	0.00
constant	1.6819	42.72	0.00
R^2	0.98		

Table A3.25 Predicting dimension 7 of AQoL-7D from AQoL-8D

	Coef.	t	P>|t|
dud1_8d	-0.2715	-1.25	0.21
dud2_8d	0.1244	0.67	0.51
dud3_8d	-0.7757	-4.43	0.00
dud4_8d	-0.1040	-0.48	0.63
dud5_8d	-0.2246	-1.42	0.16
dud6_8d	0.2425	1.27	0.20
dud7_8d	0.1119	0.78	0.44
dud8_8d	0.0628	0.25	0.81
dud1_8dsq	0.0629	0.45	0.65
dud2_8dsq	-0.0103	-0.08	0.94
dud3_8dsq	0.5382	4.05	0.00
dud4_8dsq	0.0691	0.48	0.64
dud5_8dsq	0.1171	1.05	0.30
dud6_8dsq	-0.1562	-1.25	0.21
dud7_8dsq	-0.0619	-0.66	0.51
dud8_8dsq	-0.1123	-0.71	0.48
constant	0.4254	3.14	0.00
R^2	0.33		

Predicting AQoL-8D from AQoL-7D

Model 1B (1) Predict AQoL-4D dimensions from the 4 regressions below
(2) Insert predicted dimension scores in AQoL-6D formula.
See AQoL website www.aqol.com.au

Table A3.26 Predicting dimension 1 of AQoL-8D from AQoL-7D

	Coef.	t	P>|t|
dud1_7d	-0.9253	-49.52	0.00
dud2_7d	-0.0313	-1.93	0.05
dud3_7d	-0.0280	-1.64	0.10
dud4_7d	0.0005	0.03	0.98
dud5_7d	-0.0253	-2.09	0.04
dud6_7d	-0.0655	-2.94	0.00
dud7_7d	-0.0227	-0.59	0.55
dud1_7dsq	0.3749	16.02	0.00
dud2_7dsq	0.0338	1.48	0.14
dud3_7dsq	0.0236	1.25	0.21
dud4_7dsq	0.0002	0.01	0.99
dud5_7dsq	0.0235	1.71	0.09
dud6_7dsq	0.1088	2.28	0.02
dud7_7dsq	-0.0140	-0.17	0.87
constant	1.0013	310.24	0.00
R^2	0.98		

Table A3.27 Predicting dimension 2 of AQoL-8D from AQoL-7D

	Coef.	t	P>|t|
dud1_7d	-0.0595	-0.84	0.40
dud2_7d	-0.1685	-2.75	0.01
dud3_7d	-0.0589	-0.91	0.36
dud4_7d	-0.4031	-6.40	0.00
dud5_7d	-0.0113	-0.25	0.80
dud6_7d	-0.0377	-0.45	0.66
dud7_7d	0.0714	0.49	0.62
dud1_7dsq	0.1864	2.11	0.04
dud2_7dsq	-0.0225	-0.26	0.80
dud3_7dsq	-0.0849	-1.19	0.23
dud4_7dsq	0.0506	0.67	0.50
dud5_7dsq	0.0045	0.09	0.93
dud6_7dsq	0.1618	0.90	0.37
dud7_7dsq	0.4877	1.57	0.12
constant	0.9318	76.45	0.00
R^2	0.78		

Table A3.28 Predicting dimension 3 of AQoL-8D from AQoL-7D

	Coef.	t	P>|t|
dud1_7d	-0.0133	-0.21	0.84
dud2_7d	0.0681	1.21	0.23
dud3_7d	-0.8472	-14.30	0.00
dud4_7d	-0.1060	-1.83	0.07
dud5_7d	-0.0542	-1.29	0.20
dud6_7d	-0.1080	-1.39	0.16
dud7_7d	-0.2427	-1.82	0.07
dud1_7dsq	0.0881	1.08	0.28
dud2_7dsq	-0.1280	-1.61	0.11
dud3_7dsq	0.4749	7.25	0.00
dud4_7dsq	-0.0189	-0.27	0.79
dud5_7dsq	0.0351	0.74	0.46
dud6_7dsq	0.2246	1.36	0.18
dud7_7dsq	0.2879	1.01	0.31
constant	0.9042	80.64	0.00
R^2	0.80		

Table A3.29 Predicting dimension 4 of AQoL-8D from AQoL-7D

	Coef.	t	P>|t|
dud1_7d	-0.0437	-1.40	0.16
dud2_7d	-0.0399	-1.48	0.14
dud3_7d	-0.0348	-1.22	0.22
dud4_7d	-0.7378	-26.53	0.00
dud5_7d	-0.0011	-0.06	0.96
dud6_7d	-0.0578	-1.55	0.12
dud7_7d	0.0215	0.34	0.74
dud1_7dsq	0.0387	0.99	0.32
dud2_7dsq	0.0324	0.85	0.40
dud3_7dsq	0.0339	1.08	0.28
dud4_7dsq	0.1733	5.22	0.00
dud5_7dsq	-0.0080	-0.35	0.73
dud6_7dsq	0.0946	1.19	0.24
dud7_7dsq	0.2918	2.13	0.03
constant	0.9604	178.43	0.00
R^2	0.96		

Table A3.30 Predicting dimension 5 of AQoL-8D from AQoL-7D

	Coef.	t	P>|t|
dud1_7d	-0.0415	-0.46	0.65
dud2_7d	-0.7637	-9.67	0.00
dud3_7d	-0.4513	-5.43	0.00
dud4_7d	-0.1599	-1.97	0.05
dud5_7d	0.0612	1.04	0.30
dud6_7d	0.1340	1.23	0.22
dud7_7d	-0.3768	-2.02	0.04
dud1_7dsq	0.1548	1.36	0.18
dud2_7dsq	0.6864	6.15	0.00
dud3_7dsq	0.3171	3.45	0.00
dud4_7dsq	-0.0503	-0.52	0.60
dud5_7dsq	-0.0306	-0.46	0.65
dud6_7dsq	-0.2406	-1.04	0.30
dud7_7dsq	0.8618	2.16	0.03
constant	0.9313	59.22	0.00
R^2	0.67		

Table A3.31 Predicting dimension 6 of AQoL-8D from AQoL-7D

	Coef.	t	P>|t|
dud1_7d	-0.1303	-1.40	0.16
dud2_7d	-0.0870	-1.08	0.28
dud3_7d	-0.3893	-4.59	0.00
dud4_7d	-0.1988	-2.39	0.02
dud5_7d	0.0349	0.58	0.56
dud6_7d	-0.0179	-0.16	0.87
dud7_7d	0.0129	0.07	0.95
dud1_7dsq	0.1990	1.71	0.09
dud2_7dsq	-0.0342	-0.30	0.77
dud3_7dsq	0.2476	2.64	0.01
dud4_7dsq	-0.1943	-1.96	0.05
dud5_7dsq	0.0102	0.15	0.88
dud6_7dsq	-0.0869	-0.37	0.71
dud7_7dsq	-0.0006	0.00	1.00
constant	1.0076	62.72	0.00
R^2	0.65		

Table A3.32 Predicting dimension 7 of AQoL-8D from AQoL-7D

	Coef.	t	P>|t|
dud1_7d	0.0160	0.77	0.44
dud2_7d	0.0270	1.50	0.14
dud3_7d	-0.0258	-1.36	0.17
dud4_7d	0.0073	0.39	0.69
dud5_7d	-0.6059	-45.11	0.00
dud6_7d	0.0153	0.62	0.54
dud7_7d	-0.0787	-1.85	0.07
dud1_7dsq	-0.0677	-2.60	0.01
dud2_7dsq	-0.0430	-1.69	0.09
dud3_7dsq	0.0175	0.83	0.41
dud4_7dsq	0.0031	0.14	0.89
dud5_7dsq	0.0318	2.08	0.04
dud6_7dsq	0.0502	0.95	0.34
dud7_7dsq	0.1441	1.58	0.12
constant	0.9973	277.95	0.00
R^2	0.99		

Table A3.33 Predicting dimension 8 of AQoL-8D from AQoL-7D

	Coef.	t	P>|t|
dud1_7d	-0.0268	-1.54	0.12
dud2_7d	-0.0012	-0.08	0.94
dud3_7d	-0.0021	-0.13	0.89
dud4_7d	-0.0073	-0.47	0.64
dud5_7d	-0.0295	-2.62	0.01
dud6_7d	-1.2555	-60.52	0.00
dud7_7d	0.0224	0.63	0.53
dud1_7dsq	0.0277	1.28	0.20
dud2_7dsq	0.0044	0.20	0.84
dud3_7dsq	0.0094	0.54	0.59
dud4_7dsq	-0.0004	-0.02	0.98
dud5_7dsq	0.0282	2.20	0.03
dud6_7dsq	0.7248	16.36	0.00
dud7_7dsq	-0.0570	-0.75	0.46
constant	0.9828	327.59	0.00
R^2	0.98		