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Predicting time trade-off health state valuations of adolescents in four Pacific countries using the AQoL-6D instrument

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ABSTRACT

OPIC (Pacific Obesity Prevention in Communities) is a community-based intervention project which targets adolescent obesity in Australia, New Zealand, Fiji and Tonga. The linked economic studies included the administration of the Assessment of Quality of Life Mark 2 (AQoL-6D previously known as AQoL-2) instrument to 15,481 adolescents to obtain a description of the quality of life associated with adolescent overweight and obesity and a corresponding utility score for use in a cost-utility analysis of the interventions. This paper describes the recalibration of the AQoL-6D utility instrument for adolescents in each country.

The recalibration was based upon country-specific time trade-off (TTO) data for 30 multi attribute health states constructed from the AQoL-6D descriptive system. These health states were grouped into three 'sorts' and groups of senior secondary students in their classrooms provided responses to one sort, ie 10 health state scenarios. These TTO interviews were conducted for thirty-six groups comprising a total of 279 students in the four countries resulting in 2,790 completed TTO scores. An econometric transformation of the TTO scores was carried out by regressing the TTO scores upon predicted scores from the AQoL-6D to produce country-specific algorithms which incorporated country-specific 'corrections' to the Australian adult utility weights in the original AQoL.

This paper reports two methodological elements which, to our knowledge, have not been previously reported. The first is the econometric modification of an extant multi attribute utility instrument to accommodate cultural and other group-specific differences in preferences. The second is the use of the TTO technique with adolescents in a classroom group setting. Significant differences in utility scores were found between the four countries with statistical results indicating that the AQoL-6D can be validly used in the economic evaluation of both the OPIC interventions and other adolescent programs.

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Introduction

The Pacific Obesity Prevention in Communities (OPIC) project is a four-country project funded in Fiji and Tonga by the Wellcome Trust, New Zealand by the Health Research Council and Australia by the National Health and Medical Research Council to expand the capacity of the Pacific region to respond to the obesity crisis. The region is faced with amongst the highest rates of obesity in the world. Prevalence rates for overweight and obesity are around 75% in Tonga (Coyne 2000) and 80% for the Pacific populations living in New Zealand (Russell, Parnell et al. 1997; Parnell, Scragg et al. 2003). The impact of obesity as a risk factor for diseases such as heart disease, stroke, diabetes, selected cancers and osteo-arthritis has been well documented. A World Health Report in 2002 estimated that obesity which was the tenth leading cause of avoidable burden would be the seventh leading cause for 2010 and 2020.

The limited capacity of the Pacific Region to respond to the obesity epidemic and the poor evidence base of what works in terms of obesity prevention were the key factors underpinning the project (Swinburne, Pryor et al. 2007). The OPIC project set out to address these two issues through the development of comprehensive, community-based intervention programs which targeted adolescents (aged 12-18 years) in each of the four countries. A quasi-experimental design was employed with an intervention period of 3 years and a cohort follow-up, and changes in BMI as the primary outcome variable.

The linked economic studies included the administration of a health-related quality of life (HRQoL) measure to both facilitate description of the QoL burden of adolescent overweight and obesity and as an outcome measure in a cost-utility analysis (CUA) of the interventions. The latter will enable a comparison of the efficiency of the obesity interventions implemented against a broader spectrum of health care interventions.

Measuring quality of life for economic evaluation

Before the development of CUA, economic evaluation of health services either ignored QoL or treated QoL as an ‘intangible’ that could be noted and described but not quantified or included as an integral part of the health outcome. CUA has attempted to overcome this deficit by adopting the Quality Adjusted Life Year (QALY) as the unit of output for health benefits in cost effectiveness studies (Drummond, O'Brien et al. 1997). One of two approaches has been adopted.

First, in a ‘holistic’ or scenario based approach to measurement, the health states relevant to the evaluation of a health program are described in a series of scenarios. These are then rated using a scaling device such as the time trade-off (TTO) or standard gamble (SG) to obtain a ‘utility’ index, an index of the strength of a person’s preference for a health state (Drummond, O'Brien et al. 1997). The index is then used to obtain QALYs. The construction of the health scenarios and the rating exercise both require surveys. Normally, patients who have experienced the health states are consulted for scenario construction and a random population sample is used for rating them.

The second ‘decomposed’ approach requires the preliminary construction of a generic multi attribute utility (MAU) QoL instrument which is capable of describing numerous health states and assigning a utility score to each of these. MAU instrument construction requires the creation of a descriptive system describing multiple health states. This involves the decomposition of a health state into multiple dimensions of health which are described by one or more ‘items’; that is a series of questions, each with multiple responses, which describe the dimension and the intensity of the health state. Generic instruments usually purport to include all significant dimensions of health. To convert the descriptive instrument into a MAU instrument, a ‘scaling’ system is created which is capable of assigning utility scores to every combination of the instrument’s health states. This requires the calibration (scaling) of item responses and the decomposition of the dimensions into holistic health states. Literally, the MAU approach decomposes health states, assigns utility scores to the decomposed parts and then recombines the parts using an appropriate model to determine an overall utility score. The attraction of the MAU instrument is, *inter alia*, that it obviates the need for the two surveys required by the holistic approach and it allows for the continuous collection of data in longitudinal studies.

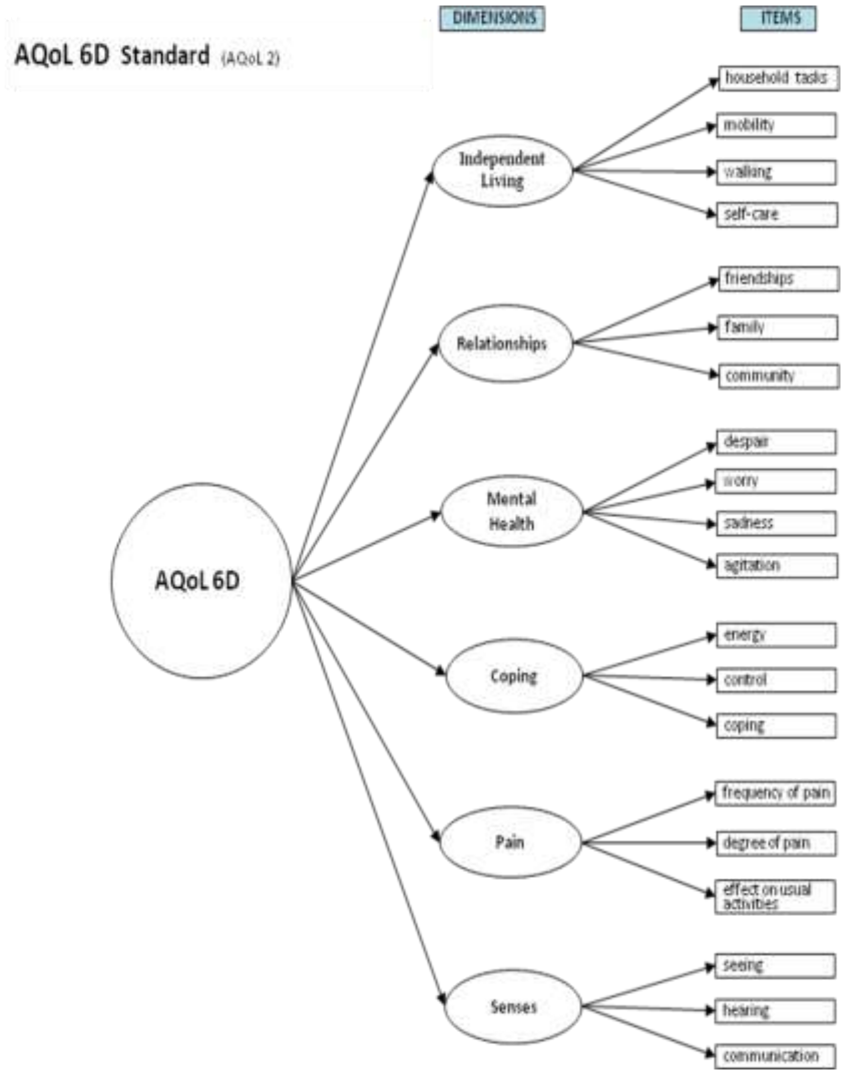
The final MAU instrument is a questionnaire similar in format to a number of disease-specific and psychometric instruments, however, differing in two respects. First, the ‘descriptive system’ – the questionnaire – is generic which purports to cover all health states (a property also claimed by a small number of psychometric instruments including the SF36). Second, the instrument’s scoring system purports to measure ‘utility’, the strength of people’s preferences and in a way which gives the instrument an ‘interval’ property. A numerical increment (eg. 0.2) represents the same improvement in quality of life anywhere on the scale. For example, an increment from 0.3 to 0.5 is the same incremental improvement according to some external criterion as a move from 0.7 to 0.9.

The strength of CUA for economic evaluation is derived from this latter property. In principle, every health state or health state improvement can be described and measured on the same scale and, consequently, disparate health program interventions can be evaluated on a ‘level playing field’. In particular, increments to the quality and quantity of life can be compared. The all important interval property is obtained from the ‘scaling’ instrument. While five such instruments (SG, TTO, Person Trade-Off, Rating Scale and Magnitude Estimation) have been used (Torrance 1986), the first two are the most widely used. The TTO is used in the present study. During a structured interview, respondents (study population or the general public) are asked what proportion of an assumed life expectancy they would be prepared to sacrifice to be in full health rather than in the health state being evaluated. With a zero rate of time preference, an answer of 50 percent, 20 percent and 5 percent respectively therefore indicates a quality of life index of 0.5, 0.8 and 0.95 on a 0-1 scale where 0 and 1 represent death and full health respectively.

In principle, an instrument should only be used in a population for which the instrument has been ‘validated’ – successfully tested, usually by comparison with the results from another instrument which has been independently validated. The greater the difference between the population in which the instrument is to be used and the initial population from which it was created, the greater the likelihood that the instrument will not correctly measure population preferences. For this reason instruments should not be used without independent evidence of validity.

Two Australian MAU instruments have been created, namely the Assessment of Quality of Life (AQoL) (Hawthorne, Richardson et al. 1999; Hawthorne, Richardson et al. 2001) and the Assessment of Quality of Life Mark 2 (AQoL-6D) (Richardson, Day et al. 2004). The AQoL-6D instrument is an adaptation of the AQoL, designed to increase sensitivity to health state variations close to normal health and to extend the coverage of AQoL. Therefore, while AQoL has 4 dimensions, AQoL-6D has six dimensions, viz., independent living, social relationships, physical senses, psychological wellbeing, pain and coping (Figure 1). Both these instruments were scaled using a sample of Australian population representative of the socio-economic profile of adult Australians.

Figure 1. Structure of AQoL-6D



In contrast with some instruments, both the AQoL and AQoL-6D were conceptualised in terms of handicap: poor health is described in terms of its impact upon people's capacity to carry out normal activities rather than the effect upon a person's impairment or disability (so called 'within the skin' descriptive systems).

The use of the AQoL-6D (or any other existing MAU instrument) in the OPIC project was considered problematical, as its utility weights were calculated from the health state preferences of Australian adults. In contrast, the target population of the OPIC study was adolescents in Australia, New Zealand, Fiji and Tonga, and it was deemed unlikely that their utility values would be the same as those of Australian adults. A review of the published literature suggests significant cultural variations in health state preferences (James and Foster 1999; Jelsma and Chivaura 2000; Badia, Roset et al. 2001; Tsuchiya, Ikeda et al. 2002; Jelsma, Hansen et al. 2003; Johnson, Luo et al. 2005). Adolescents are also likely to value their health differently to adults, given their social values, support structures, lifestyles and experience. It was therefore important to use adolescent rather than adult values and, more specifically, country-specific adolescent values in the OPIC study. Therefore the utility weights were recalculated and validated for each of the 4 countries using the adolescents' survey results from each site.

Methods

Due to the diversity of health states which were likely to be encountered and high cost of using the scenario-based, holistic method of utility measurement, the OPIC protocol employed the decomposed MAU methodology. Because of the need for instrument sensitivity to near normal health state and a handicap-based conceptualisation of health, the AQoL-6D was adopted as the 'base instrument' (Richardson, Day et al. 2004). It consists of 20 items grouped into 6 dimensions, each of which is separately modelled and then combined to obtain a single AQoL-6D utility score.

The AQoL-6D was created with a three-part calibration which allows a relatively easy recalibration of the instrument. As described below, in the first two parts, multiplicative models were used to determine, respectively, algorithms for the dimension scores and for a total multi-dimensional – MA – score using the TTO values obtained for item responses and dimensions. In the third part, the latter score was adjusted econometrically to offset the potential effects of 'structural preference dependence' which could result in 'double counting' of the disutility of some dimensions. To achieve this, multi attribute (MA) scenarios were independently constructed, evaluated using the TTO methodology, and used as the dependent variables in a regression in which total AQoL scores and country specific demographic factors were the independent variables. Results were used as the stage 3 adjustment. In the present study, this third stage was replicated using site-specific TTO scores for MA scenarios which were constructed to be of most relevance for obese youth.

The process of adaptation involved six stages. These were: (1) adaptation of the AQoL descriptive system; (2) preparation of 30 MA scenarios for assessment using the TTO scores; (3) development of a protocol and proforma for the classroom-based use of the TTO; (4) administration of the TTO and 'debriefing' – qualitative assessment of the understanding and difficulty of the TTO task; (5) data collection and editing; (6) the econometric adaptation of the AQoL-6D. Results were used in a description of the full OPIC project populations using the utility scores produced from the adapted four country-specific AQoL-6D scoring algorithms.

Adaptation of the AQoL-6D instrument

In each country, focus groups of adolescents were conducted to determine semantic and cultural equivalence of the instrument; that is, to determine whether phrases, examples or words used in the descriptive system had clear and equivalent meaning in the different study groups and, when appropriate, to determine replacements from the local idiom. In Tonga, the AQoL descriptive system was double translated into the Tongan language.

Generation of the health state scenarios

The AQoL-6D questionnaire asks 20 questions about a person's health, which are categorised into 6 dimensions of health. Stage 2 of the methodology used combinations of potential responses to these 20 questions to make 30 health state scenarios which participants were asked to value in comparison with instrument-best health. In principle, these would have been constructed using an experimental design to achieve efficiency. In practice, this resulted in absurd combinations of health states – bedridden, depressed but always full of energy – reflecting the fact that structural independence is not achievable with a handicapped base descriptive system. Consequently, an ad hoc approach was adopted which ensured that, while maximising simplicity of the health states, all relevant combinations of dimensions were included in one or more of the scenarios. An example of a scenario is given in Figure 2.

Figure 2. Example of TTO proforma

Example 2

Example 2

Health State **A**

Physical ability	Excellent
Social and family relationships	My **close friendships** make me **generally unhappy**. There are **some group activities** I am **not involved in** because of my health.
Mental health	I **usually** feel **sad** I **often** feel **worried** I am **sometimes calm** and **sometimes agitated**
Coping	Excellent
Pain	I suffer from **severe pain**. Pain **often interferes with my usual activities**.
Vision, hearing & communication	Excellent

OR

Health State **B**

Physical ability	Excellent
Social and family relationships	Excellent
Mental health	Excellent
Coping	Excellent
Pain	Excellent
Vision, hearing & communication	Excellent

Imagine that you are in Health State **A** and that you have 10 years left to live.

We are interested to know whether you would be prepared to live for less than 10 years if your health could be excellent as in **B**.

Please mark on the line the shortest time you would accept in **B** instead of 10 years in **A**.

This is the amount you have chosen to live in excellent health. You are giving up the rest of the 10 years.

0 1 2 3 4 5 6 7 8 9 10 years

Development of the TTO proforma

The materials used during the conduct of the TTOs in the classroom were developed using a collaborative process of design, evaluation, testing, critique and discussion. A sample of the final graphics is attached as Figure 2. Input was sought from a psychologist, health economists and graphic designers. Difference designs for the materials were piloted with both adults and adolescents unfamiliar with the TTO process. The result was a clear, simple and easy-to-use design with a modern, clean format adapted from the materials used during the construction of the original AQoL-6D. The materials and process was pilot tested with Australian secondary students.

Conduct of TTO interviews

A sample of 60 students was required from each of the four OPIC sites. Based on the completion of ten scenarios per student, this would result in a total of 600 scenarios per site, sufficient responses to facilitate prediction of the new utility weights with 95% confidence.

TTOs are normally completed by an interviewer with a single respondent. For cost and logistical reasons, this was not practical in the OPIC project. The interviews were administered by two trained facilitators in a class setting to groups of 10-15 students, all of whom gave individual responses. The exercise was completed only by senior students due to the cognitive complexity of the task. The timeframe was generally one classroom period.

The students were told to imagine that the health state described in a scenario ('health state A') would continue for ten years followed by death. Having 'immersed' themselves in the health state, they were then asked whether they would be prepared to live for less time if they could move to health state B – excellent health where all the dimensions were at their best possible level. They were required to specify the amount of time in excellent health they considered equal in value or desirability to spending the rest of their life (10 years) in health state A. In the example (Figure 2), if the respondent marked 4 years on the bar, this would suggest that they were prepared to trade-off 6 years of their remaining life of 10 years to enjoy 4 years in full health.

Each of the scenarios was read aloud by the facilitator, and students were then given time to consider their response before moving onto the next scenario. Assistance was provided to individual students who had difficulty understanding the instructions. Two facilitators moved amongst the students checking responses, and asked for explanations where students had given extreme responses (trading off all or no time) to ensure that they understood the meaning of their answer. In Tonga, the sessions were conducted in English as it is the primary language of instruction. However, a Tongan speaking member of the research team was in attendance to provide clarification in Tongan where necessary.

Recalibration of the utility weights

The competed health state utility scores were then used to recalibrate the AQoL-6D scaling system. This used the three-stage procedure described in more detail below. TTO data from the OPIC study were used to replace the original data used in Stage 3.

As noted, Stages 1 and 2 of the AQoL-6D procedure uses multiplicative models to obtains scores for, firstly, the AQoL-6D's six dimensions and, secondly, a single score for all dimensions. The model is very similar to the simplified model in equation 1 in which U* is the final instrument utility which is the product of the utility scores for each of the 6 dimension scores, Ui. In this simplified equation when any item utility is zero, U* is zero. With all item utilities equal to 1.00, U* is also equal to 1.00. That is, utility is measured on a 0-1 scale. A given percentage reduction in any dimension utility will cause the same percentage reduction in overall utility, U*, at any level.

$$U^* = U_1 * U_2 * U_3 * U_4 * U_5 * U_6 \qquad \text{. . . Equation 1}$$

Equation 1, however, is too simple: each of the utilities has equal importance and if any item is zero the quality of life of other aspects of health is unimportant. For this reason, the multiplicative model recommended by Decision Theory was used (von Winterfeldt and Edwards 1986). This takes the following form:

$$DU = \frac{1}{k}\left[\prod_{i=1}^{n}\left[1 + kw_i DU_i\right] - 1\right] \qquad \text{. . . Equation 2}$$

where *DU* is instrument disutility, DU_i is the measured disutility from dimension i,w_i is the importance weight of dimension *i* and *k* is the scaling constant described as:

$$k = \prod_{i=1}^{n}(1 + kw_i) - 1 \qquad \text{. . . Equation 3}$$

Despite its apparent complexity, Equation 2 is essentially the same as Equation 1 except that each of the dimensions has an unique importance weight, w_i attached to it. The model is also more easily expressed using *DU* as the metric (where *DU* = 1.00 – *U*), as this avoids the complication of using negative scores for states worse than death). From Equation 2, *DU* also varies from 0 to 1.00 which can be seen by setting all $DU_i = 0$ and all $DU_t = 1$ respectively.

In a simple additive model ($DU = w_1D + \ldots + w_6D_6$), items weights must sum to unity ($\Sigma_i w_i = 1$). The analogous requirement for the multiplicative model is given in Equation 3 from which the scaling constant, *k*, may be derived.

Decision Theory requires that, *inter alia*, dimensions be structurally independent (orthogonal): a single 'element' of a poor health state should not contribute to the disutility score of two or more items (von Winterfeldt and Edwards 1986). For example, pain associated with an illness which is independently measured by a pain item or dimension should not affect the score for mobility, social relationships and psychological wellbeing. If this occurs (as it commonly does), then the impact of pain upon final utility will be exaggerated (double counting). This type of structural dependence is virtually unavoidable in all but the most simplistic models of health.

For this reason, the AQoL-6D used an econometric ‘correction’ or adjustment. A number of MA health state scenarios were included in the TTO survey. These were used to calibrate an econometric model in which the MA health state was ‘explained’ by the AQoL-6D scores. In this final model, ‘double counting’ of elements will not result in an exaggerated utility score as the scores are constrained by the left-hand side MA values. In the present project, the MA – TTO values used in this third stage were replaced with the MA – TTO values obtained in each of the four countries as described above. The econometric model used to make the correction is given as:

$$TTO\_DU_{ij} = DUAQoL6D_{ij}^{\alpha} + \varepsilon_i \qquad \text{. . . Equation 4}$$

where TTO_DU is the disutility computed from the TTO scores for health states and DUAQoL-6D is the disutility of the overall AQoL-6D score. This equation is used to get the new utility weights for the four countries. In the above equation α and β’s are coefficients to be estimated for j^{th} individual in i^{th} health state for country *C* (ie Australia, New Zealand, Fiji and Tonga).

Therefore, to compute the QoL scores first, individual item responses from the 15,481 survey population were converted into item scores which were then converted into dimension scores which were further combined into an overall stage 2 AQoL-6D disutility score. The model in equation 4 was estimated using panel data estimation techniques where 30 health state scenarios (groups) comprising of students were analysed. These were used to estimate utility scores for all of the individuals in the OPIC survey.

Results

Results from the TTO interviews are summarised in Table 1. Thirty-six groups and 279 students were interviewed, which resulted in a total of 2,790 scenario evaluations or ‘observations’. Because interviews were conducted in schools and during school hours, there was a 100 percent response rate. Few students found the task taxing and only 6 responses were rated as invalid (generally because the point marked on the scale was not decipherable or enclosed a range of values). The target number of 20 completed responses for each of the 30 scenarios was achieved and exceeded, particularly in Tonga where 81 students (rather than the targeted 60) participated in the interviews.

There was significant variation in the scores for each of the MA states which is normal in value elicitation surveys. This commonly reflects a misunderstanding of a particular question or difficulty with the framing of the question, although assessment of comprehension suggested that this was high in all of our groups. This did not, however, have a large effect.

Despite this the average scores per MA state in each country were less varied. As shown in Table 3 most of the mean utility values were in the range 0.5 – 0.8. At the lower end of the range this result is plausible. A utility of 0.5 indicates that a person will give up 50 percent of their life to avoid the health state and it is unsurprising that few states had values less than this. In the upper range there are few health states close to normal health. This reflects the design of the MA – scenarios which included multi-dimensional, poor health which were sufficiently severe to attract attention and consideration.

Tables 4 to 7 report results of the econometric analyses for the four countries using the functional form of equation 4. In each of these tables, the model in equation 4 was used to analyse individual level data and the mean level data for the 30 MA-TTO health states.

The model estimates for individual data and mean data for each country reveal that the structure of health states valuations differ in the four geographical locations. Results for both the individual and mean analysis are statistically significant. As most of the variation in these models is around the mean of the 30 MA variables, the single predicted score from the model for the 30 MA health states is considered to provide a better estimate. Thus, while individual data also produce significant parameter estimates, they cannot explain variation in individual scores around a single health state. The explanatory power of the equation for the between health state variation is therefore better indicated by the analysis of mean not individual data. It is also the more relevant result, as the economic evaluations which will use the instruments are generally based upon mean, not individual, estimates of the QoL.

Table 1 Time Trade-offs: Participation and Responses

	Australia	Fiji	Tonga	New Zealand	Total
No. groups conducted	6	6	6	6	24
No. students participating	68	70	81	60	
No. students completing					
Sort 1 (10 Scenarios)	21	24	28	24	97
Sort 2 (10 Scenario)	26	22	26	12	86
Sort 3 (10 Scenario)	21	24	27	24	96
Total responses completed	680	700	810	600	2790
No. responses invalid	3	2	1	0	6
Total valid responses	677	698	809	600	2784

Table 2 Responses with extreme values by site

No. responses with extreme values	Aust	Fiji	Tonga	NZ
Value of 0 (would rather die)	0	0	9	5
Value of 10 (not prepared to trade off any time)	7	11	10	13
No. valid responses less values of 0 or 10	670	687	790	582

Table 3 Frequency of average MA utility scores (adjusted[a]) within specified ranges

Range	Australia		Fiji		New Zealand		Tonga	
	No.	%	No.	%	No.	%	No.	%
≥8.0	0	0.0	2	6.7	1	3.3	0	0.0
7.0 - 7.9	9	30.0	2	6.7	1	3.3	1	3.3
6.0 - 6.9	10	33.3	12	40.0	3	10.0	8	26.7
5.0 - 5.9	10	33.3	0	33.3	10	33.3	9	30.0
4.0 - 4.9	1	3.3	4	13.3	4	13.3	7	23.3
3.0 - 3.9	0	0.0	0	0.0	9	30.0	4	13.3
<3.0	0	0.0	0	0.0	2	6.7	1	3.3
Total	**30**	**100.0**	**30**	**100.0**	**30**	**100.00**	**3**	**100.0**

Table 4. Australia: Dependent variable: MA-TTO disutility scores

	Individual Data(1)(2)		Mean Data(1)(3)	
Regression DUAQoL6D	Model 1.44 (13.16) wald chi^2 173 Log like -798 N = 677		Model 1.19 (13.0) wald chi^2 168 Log like -15.3 N = 30	

(1) Regression coefficient, Z score
(2) Individual E-type data
(3) Mean data for E-type health states

Table 5. Fiji: Dependent variable: MA-TTO disutility scores

	Individual Data(1)(2)		Mean Data(1)(3)	
Regression(1) DUAQoL6D	Model 1.31 (13.18) wald chi^2 173 log like -668 n = 698		Model 1.57(18.46) wald chi^2 174 log like -13.7 n = 30	

(1) Regression coefficient, Z score
(2) Individual E-type data
(3) Mean data for E-type health states

Table 6. New Zealand: Dependent variable: Log(MA-TTO) disutility scores

	Individual Data(2)		Mean Data(3)	
Regression(1) DUAQoL6D	Model 1.01 (14.3) wald chi^2 203 log like -591 n = 600		Model 0.87 (13.5) wald chi^2 183 log like -4.4 n = 30	

(1) Regression coefficient, Z score
(2) Individual E-type data
(3) Mean data for E-type health states

Table 7.Tonga: Dependent variable: MA-TTO disutility scores

	Individual Data(2)		Mean Data(3)	
Regression(1) DUAQoL6D	Model 1.38(13.52) wald chi^2 182.91 log like -790 n = 809		Model 1.13(14.60) wald chi^2 213.02 log like -2.15 n = 30	

Figures 3-6 plot the MA-TTO mean scores for each health state against the average of the MA-TTO scores predicted from the econometric model for each country. In each of these graphs, the scatter plot for the observations and the corresponding regression fit is displayed. For all four countries the regression fit coincides with the 45 degree line passing through origin, which suggests that the TTO scores predicted from the model in equation 4 provides a good predictor of the actual TTO scores. Table 8 reports the results for regression of actual TTO scores on predicted scores from estimating the model in equation 4 for the mean analyses. The coefficient of the TTO score is statistically significant for all the four countries and the coefficient of the constant term is not statistically significant. The R^2 coefficient in the final column of indicates that, considering the various possible sources of error in the procedures described above and the limited range of the MA states, the regression's explanatory power is very good.

Figure 3. Mean Analysis for 30 Health States: Australia

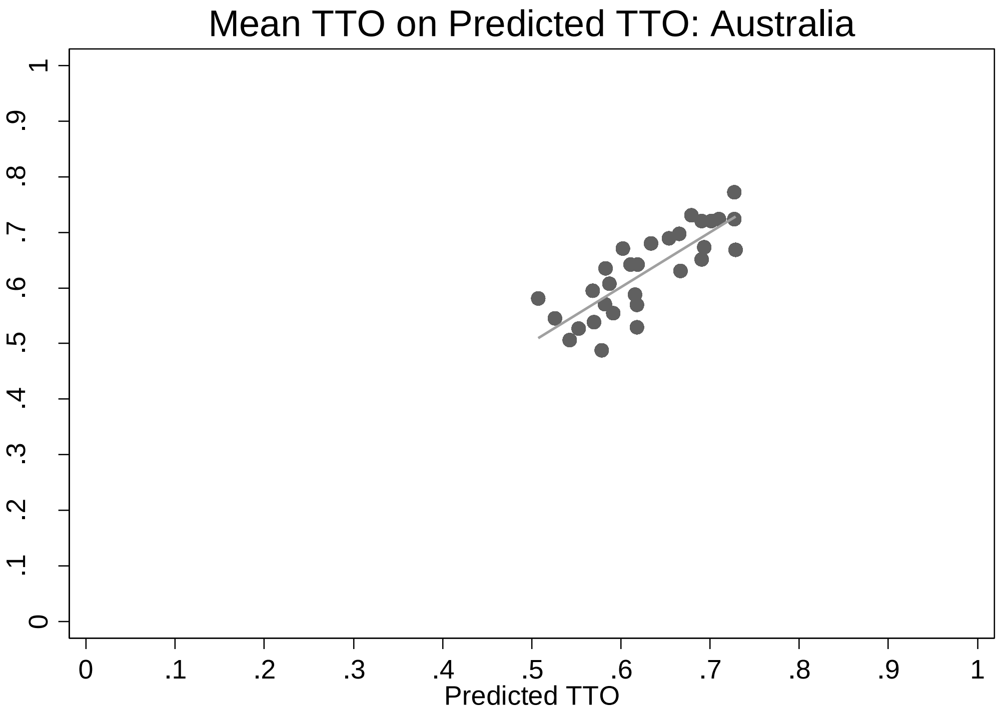


Figure 4. Mean Analysis for 30 Health States: New Zealand

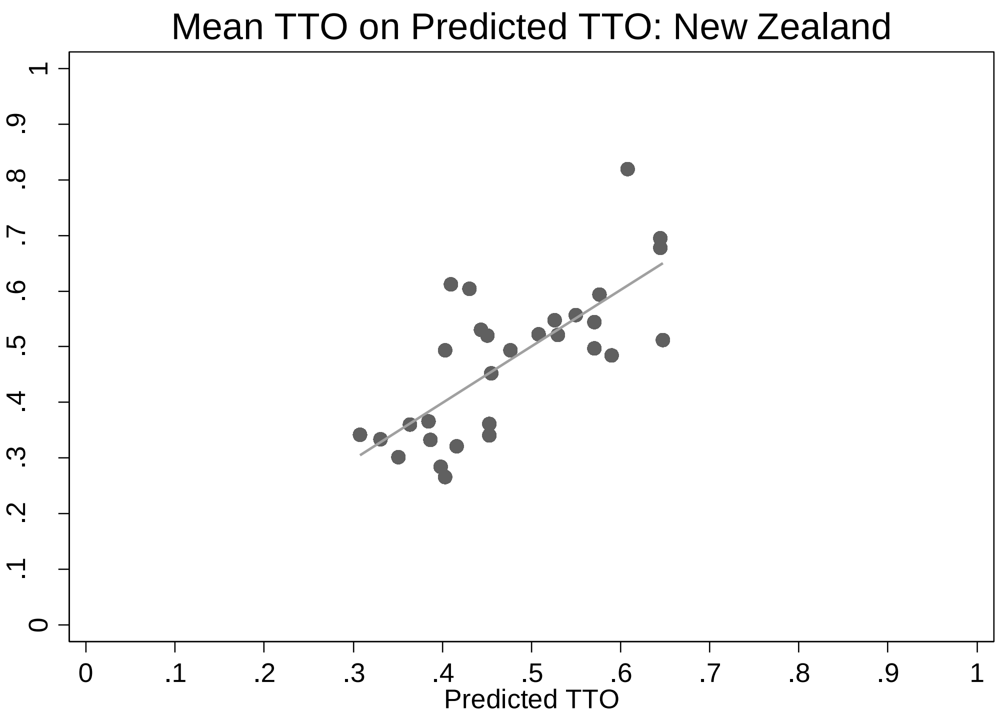


Figure 5. Mean Analysis for 30 Health States: Fiji

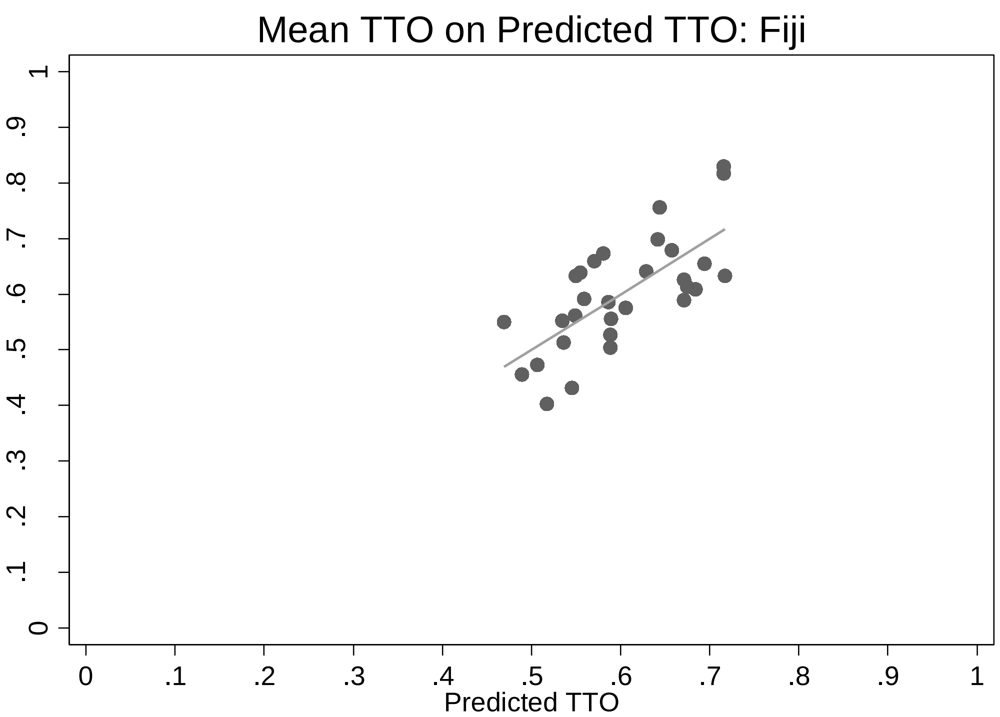


Figure 6. Tonga Mean Analysis: 30 Health States

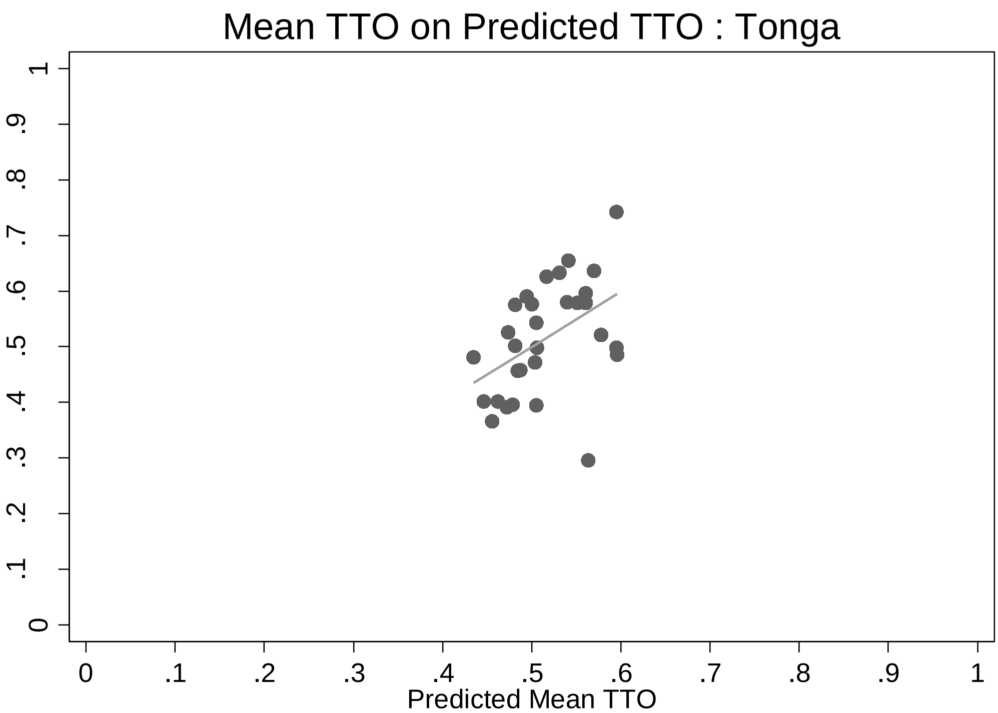


Table 8. Mean Analysis: Linear Regression Results: $TTO\ on\ T\hat{T}O$

	β	t-stat	Constant	t-stat	R2
Australia	0.98	7.35	0.003	0.07	0.68
New Zealand	1.20	5.65	-0.10	-0.12	0.53
Fiji	1.00	5.22	-0.011	-0.01	0.49
Tonga	0.99	2.90	0.003	0.02	0.23

Discussion

Contrary to expectation, few of the students appeared to have difficulty with the notion of trading quantity and quality of life. This is indicated in Table 2 by the very small number of students who opted for extreme (no trade) options. Tonga and New Zealand were the only sites where respondents opted for death rather than time in a morbid health state. However, the numbers involved – 9 and 5 – represented only 1.1 and 0.6 percent of responses in the two sites respectively. Adolescents were able to provide considered and reasoned responses when questioned about their choice of extreme values. Those who gave scores of 10 would typically respond that life was too precious, and they were not prepared to trade regardless of the severity of the health state. The results obtained were plausible and the variations between countries seem logical. To that extent, we are confident that they represent real differences in health state preferences between adolescents in the four sites.

Comments made by the respondents supported the ranking of the results by country. Anecdotally, students of Pacific origin often expressed concern about the burden which a particular health state would place on their families. '*It would not be fair on my family to live like* *that*'. No such comments were forthcoming from Australian students, and this is reflected in their generally higher mean scores. Pacific Island children (including children of Pacific Island origin living in New Zealand) typically live in larger families/households. They are more likely to have experienced living with a chronically ill family member, and know the impact, burden and responsibility it places on the family unit.

The (individual) adjustment models were used in conjunction with AQoL-6D to estimate QoL scores for the full OPIC population of 15,481 by inserting self-completed AQoL-6D scores into the three-part scoring algorithm for each country. Details and other results from the OPIC study are reported elsewhere (Keating and Moodie 2008; Moodie, Keating et al. 2009). However, the summary results provide both a summary of the relative QoL estimates from the four countries and a test of the discriminatory power of the resulting instruments in the context of youth obesity. The numerical values of the scores cannot, however, be compared directly with other TTO results, as the 'best health' used in the TTO assessments were defined as 'AQoL-6D all-best' health states and, in order to achieve sensitivity around ' good health', the AQoL-6D 'best health' scenario is exceptionally good ('all jobs done quickly/efficiently; running very easy; very happy; never worried/sad; always full of energy; completely cope with life's problems, etc.'). This depresses numerical values of other health states.

Subject to these initial caveats, Table 9 suggests Australian youth have significantly higher QoL, followed by New Zealand youth, followed by Fijians and, finally, Tongan youth. The QoL scores for BMI ranges suggests that quality of life score falls with weight in Australia, Fiji and New Zealand. However, in Tonga quality of life scores improve with weight, which can be associated with social, cultural and demographic factors. In the normal weight range, the other three groups fall below the Australian QoL scores by 17.12, 12.7, 30.72% respectively. An interesting result is the contrasting result for Tonga compared with other countries for individuals with low BMI (BMI under 21). While in Australia, Fiji and New Zealand the quality of life score for underweight people (BMI under 21) is highest among the four BMI categories implying that underweight people have a better quality of life in comparison to people with higher BMI, Tonga displays a different behaviour as the BMI score for underweight is the lowest and for obese people is the highest. A complete analysis of the relationship between AQoL-6D based QoL measurement and the BMI of the different ethnic communities is given in Moodie et al. (2009).

Table 9. Table 9 AQoL 6D Utility Scores for Four Countries

AQoL 6D Utility Scores	**Australia**	**Fiji**	**Tonga**	**New Zealand**
Overall Score	0.799	0.638	0.574	0.763
BMI (<21) (Under Wt.)	0.755	0.666	0.459	0.632
BMI(21-25)(Normal Wt.)	0.739	0.646	0.512	0.613
BMI(25-30) (Over Wt.)	0.707	0.641	0.521	0.593
BMI(>30) (Obese)	0.687	0.638	0.531	0.579

Conclusion

The literature suggests that different MA instruments produce very different results (Hawthorne, Richardson et al. 2001). This does not indicate that CUA is an inappropriate methodology for evaluating programs. The alternative is to ignore QoL or use subjective judgements. While comparison between these options has not been reported in the literature, it is generally true that systematic approaches to problem solving outperform ad hockery. Depending upon study objectives, differences between instruments need not indicate invalidity in the measurement of QoL if the same instrument is used consistently. Invalidity will occur only if the evaluation compares the benefits of quality of life with the benefits of life extension with an instrument where this implied ‘exchange rate’ has not been validated.

CUA is evolving and the present study employed new methods. To the authors’ knowledge, this is the first time that time trade-off exercises have been completed by adolescents and in a classroom setting. A study by Essink-Bot et al. (2002) suggested that a group setting could produce acceptable results for much less cost than face-to-face individual interviews. The classroom format was considered appropriate for the OPIC project, as adolescents are accustomed to being in classes, receiving instructions as a group, before completing work on an individual basis. A conscious decision was made not to invite junior secondary students (12-14 years) in the OPIC target group given the cognitive complexity of the task. Qualitative and quantitative results suggest that the process was highly successful.

Estimation of utilities using a two stage procedure is also unique to the AQoL instruments with the econometric correction only used, to date, in AQoL-6D. This latter innovation is particularly important in view of the gross differences between scores obtained with different instruments. It ensures that estimated utilities must be within the range of values obtained independently using the holistic (quasi gold standard) methodology.

The utility weights in the AQoL-6D algorithm have been revised separately for adolescents in each of the four countries. The AQoL6D can now be validly used in the economic evaluation of the OPIC interventions, and also in the field for the evaluation of any other adolescent programs in Australia, New Zealand, Fiji and Tonga.

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