EEPRU

Economic Evaluation of Health and Social Care Interventions Policy Research Unit

RESEARCH REPORT

Estimating an exchange rate between the EQ-5D-3L and ASCOT

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RR0041

July 2015

The University Of Sheffield.

University of York

The Policy Research Unit in Economic Evaluation of Health and Care interventions is funded by the Department of Health Policy Research Programme. It is a collaboration between researchers from then University of Sheffield and the University of York.

The Department of Health's Policy Research Unit in Economic Evaluation of Health and Care Interventions is a 5 year programme of work that started in January 2011. The unit is led by Professor John Brazier (Director, University of Sheffield) and Professor Mark Sculpher (Deputy Director, University of York) with the aim of assisting policy makers in the Department of Health to improve the allocation of resources in health and social care.

Abstract

The aim was to estimate an exchange rate between the EQ-5D-3L and ASCOT using a new preference based method.

These measures are useful for examining cost-effectiveness within sectors, but there is a policy need to aggregate benefits across sectors to understand overall benefits and compare across sectors to assess relative value for money. Although these measures are scored on the QALY scale using similar versions of time trade off, the upper anchors differed which may result in differences.

We used a value based mapping approach to estimate the exchange rate. A sample of health states from each measure was valued using TTO by 200 members of the UK adult general population. The generic upper anchor was "the best life imaginable" ensuring the two measures were valued on a common scale.

The relationship between the measures is a linear transformation with an intercept of -0.0404 and gradient of 0.9648 for moving from ASCOT to EQ-5D-3L. This enables the QALY gain generated by ASCOT to be comparable to that for the EQ-5D across different interventions.

This method could be applied to other measures, such as the ICECAP and also provide another method for moving between generic and condition specific measures in health care.

1. Introduction

A problem in comparing the cost-effectiveness of interventions across sectors is the use of different outcome measures. For example, the EQ-5D (Dolan, 1997) has become the most widely used generic measure of patient reported outcome in health care, while in social care there is the increasingly used Adult Social Care Outcome Tool (ASCOT) (Netten, 2012). These measures are useful for examining cost-effectiveness within their sectors but not between.

The EQ-5D measures an individual's health status across five dimensions: mobility, self-care, usual activities, pain or discomfort, and anxiety or depression. The original EQ-5D (EQ-5D-3L) contains three levels for each dimension (no problem, some problems and severe problems). A five level version (EQ-5D-5L) is also now in use (no problem, mild problems, moderate problems, severe problems and extreme problems). The EQ-5D-3L is converted to a preference-weighted index using a value set obtained from a large survey of the general public using a variant of Time Trade-Off (TTO) anchored on full health at one and dead at zero (Dolan, 1997). A more recent study has also been undertaken to provide preference-based values for the EQ-5D-5L (OHE 2014). The index is used to generate quality adjusted life years (QALYs) for use in economic evaluations.

ASCOT is a measure of social-care quality of life that is designed to assess the extent to which an individual's needs and wants are being met (Netten, 2012). It has eight dimensions: accommodation, cleanliness and comfort, safety, food and drink, personal care, control over daily life, social participation and involvement and dignity. Each is assessed across four levels: high unmet needs, some unmet needs, no unmet needs and ideal level achieved. The state 11111111 denotes the best state. There are two methods of scoring

the instrument. One is to use scores developed from a general population survey using Best-Worst Scaling (BWS) (Netten, 2012), but these values are not anchored on the QALY scale. The second is to use the mapping function between BWS and TTO which was developed by valuing a sample of ASCOT states by TTO, then estimating a mapping function between BWS and TTO that generates values for all ASCOT states on the QALY scale (Netten, 2012).

Although both the EQ-5D-3L and ASCOT can be used to generate QALYs, differences in the descriptive systems and valuation methods means they are not measuring the same thing and results are not directly comparable. These instruments are trying to measure different conceptualisations of life. EQ-5D-3L is about 5 key aspects of a person's health, whereas ASCOT is concerned with the way a person's health, combined with their socio-economic status, home circumstances (including availability of informal care) and the social care services they receive impacts on their overall quality of life in terms of the extent to which their needs and wants are being met. While there is a significant degree of correlation between the measures, they are not measuring the same thing.

Although these measures have both been scored and anchored on the QALY scale using similar versions of TTO, the two TTO tasks differed in a crucial way. The upper anchor in the TTO for EQ-5D-3L was EQ-5D-3L state 11111 (no health problems) and for ASCOT was ASCOT state 11111111 (meeting all social care related needs and wants). These upper anchors are not the same and so this may result in important differences in the scales. Furthermore, the UK TTO values obtained in the original valuation by Dolan (Dolan, 1997) have not been replicated in subsequent surveys (Tsuchiya, 2006; Longworth, 2014). This

suggests that values obtained more than 20 years ago may be responsible for further differences with ASCOT.

There are different approaches to enhancing comparability between the measures. One is the conventional mapping approach which involves estimating a statistical relationship between the measures, but this relies on a strong and meaningful statistical relationship, which is unlikely given the differences at the conceptual level. An alternative approach is based on preferences to value the measures on a common scale (Rowen, 2012). The aim of this research was to estimate an exchange rate between the EQ-5D-3L and ASCOT using this new methodology.

2. Methods

2.1 The preference based method

We applied the new preference-based approach (Rowen et al, 2012; Alava et al, 2013) to estimate the exchange rate or relationship between EQ-5D-3L and ASCOT. Rowen and colleagues conduced an exploratory study using a generic Visual Analogies Scale (VAS) (best imaginable to worst imaginable life) and ranking methods to value a number of measures including EQ-5D-3L and an earlier version of ASCOT called OPUS (Netten, 2002) . We adapted the approach to use a variant of TTO to make it more consistent with the NICE reference case, where the best state is not instrument specific, but described in general terms of a best imaginable life. Separate equations were estimated between EQ-5D-3L and ASCOT and the generic TTO, and then solved as simultaneous equations for the relationship between EQ-5D-3L and ASCOT (Rowen et al, 2012).

2.2 Valuation Methodology

A sample of states from each descriptive system (EQ-5D-3L and ASCOT) was valued using a common valuation method, conducted by the same interviewers, on the same sample of the general population.

A standard TTO methodology based on the original measuring and valuing health (MVH) methods for states better than and worse than dead (Dolan, 1997) was used with a generic upper anchor for the best imaginable state defined as "the best life imaginable". This ensures that the two descriptive systems are valued on a common scale. The TTO task began by asking respondents to consider a state. They were asked whether they thought it was better or worse than dead. Their response determined whether they did a better than or worse than dead version of the TTO.

For better than dead, respondents were asked to consider a choice between Life A which was t years (t<10) in full health and Life B, which was 10 years in the state being valued.

For worse than dead respondents were asked to consider a choice between Life A which was 10-t years in the state, followed by t years in perfect health and Life B, which was to die immediately. The value of t representing indifference was determined using the titration method.

2.3 Selection of states

50 states were selected from each descriptive system (EQ-5D-3L and ASCOT) to include a range of severity across the spectrum according to the existing value sets.

For each descriptive system, the 50 states selected were sorted into 10 blocks of 5 states. Each respondent valued a total of 10 states made up from 1 block of 5 EQ-5D-3L states and 1 block of 5 ASCOT states. The order in which the blocks appeared in the interview was randomised. Blocks were also randomised across respondents. The order in which attributes appeared within a state was randomised across individuals (but not within an interview).

2.4 Interviews

Computer assisted personal interviews (CAPI) were undertaken by a survey company in five locations throughout England and Wales using a hall test methodology, whereby participants were recruited to a community location. All locations had internet access and the interview survey was carried out online via a weblink. A University of Sheffield company hosted and produced the online survey in collaboration with the research team.

Two hundred members of the adult (age 18 years or over) general population in England and Wales were surveyed. Quotas for age and gender were applied. After completing some socio demographic background questions, respondents completed both descriptive systems in order to familiarise themselves with them, then undertook a practice TTO question followed by 10 TTO questions. Following the interview, a thank you and £5 voucher note was issued.

2.5 Analysis: Estimating a relationship between EQ-5D 3L and ASCOT

Regression analysis was used to estimate the relationship between the new TTO values and the original value set for the EQ-5D-3L and to estimate the relationship between these new TTO values and the original value set for ASCOT. The relationship between the new and original values was first plotted to inform what form the model should take, for example linear, cubic or quadratic. Once the two regression equations had been estimated, they were solved as simultaneous equations in order to produce a single mapping function that can convert an ASCOT utility value into the corresponding value on the utility scale of EQ-5D-3L (as used in Rowen et al, 2012).

2.6 Ethics

The study received ethical approval from The University of Sheffield Ethics Committee on 20/05/2015.

3. Results

3.1 Interviews and sample

Interviews were carried out in June 2015. The interviewers observed that the CAPI method worked well and the online system was easy to operationalise. The interview team were highly experienced and focused and respondents engaged well in the interviews.

The age, gender, education level, ethnicity, income, general health, EQ-5D and ASCOT scores of the sample are reported in table I.

<<INSERT TABLE I HERE>>

3.2 Health state values

Descriptive statistics for all states valued are provided in Tables II and III. The states are ordered by mean state value. The average number of valuations per state varied between 19 and 23 per state. The median health state value exceeded the mean in all cases. The mean health state value for the best ASCOT state was 0.93 (SD=0.10) compared to 0.96 (0.07) for the EQ-5D-3L, though the gap between the best and mildest impaired state was 0.02 on ASCOT compared to 0.18 for EQ-5D-3L. The worst state had a value of -0.28 for ASCOT and -0.51 for the EQ-5D-3L.

<<INSERT TABLES II AND III HERE>>

A scatter plot of the new and original EQ-5D-3L values is presented in Figure 1 and a scatter plot of the new and original ASCOT values is presented in Figure 2.

<<Figure 1 here>>

<<Figure 2 here>>

3.3 Regression results

The relationship between the new and original values for EQ-5D-3L was clearly linear (Figure 1) and this was also true for ASCOT (Figure 2), therefore mean level OLS regression was used for estimating the relationships between these (new and original values).

The results of a basic mean level OLS regression for the EQ-5D-3L are shown in Table IV and for ASCOT in Table V.

<<INSERT TABLE IV HERE>>

<<INSERT TABLE V HERE>>

For both models the adjusted R-squared exceeded 0.8. The results from these models gave equations for predicting new utility values from the original ones (for both the EQ-5D-3L and ASCOT). These equations were then solved simultaneously to give the relationship between ASCOT and EQ-5D-3L as shown below.

New generic TTO utility = 0.057+ (0.884 *ASCOT original value)

New generic TTO utility = 0.094+ (0.916*EQ-5D-3L original value)

Therefore

0.0574337+ (0.884 *ASCOT) =0.094+ (0.916*EQ-5D-3L)

EQ-5D-3L= -0.040 + (0.965*ASCOT)

Table V1 shows some examples of ASCOT values and their corresponding EQ-5D-3L values using this equation. EQ-5D-3L values are consistently lower than ASCOT, but the differences are always less than 0.1. The largest differences are at the upper end, where EQ-5D-3L values are 0.08 lower than ASCOT at 1.0, and 0.07 at 0.8.

<<INSERT TABLE V1 HERE>>

4. Discussion

This research estimated an exchange rate between ASCOT and EQ-5D-3L using a preference-based approach that does not compromise the descriptive systems of the two measures. It applied methods developed by Rowen et al (Rowen, 2012) using a generic version of TTO to value each instrument. The analysis was straightforward because the relationship between the original values and the new generic TTO values was linear for both instruments. The relationship between the measures is a linear transformation with an intercept of -0.0404 and gradient of 0.965 for moving from ASCOT to EQ-5D-3L. The differences between the original scales of the instruments are never larger than 0.1. The differences between the intervals (e.g. 0.8 to 1.0) are less, with for example a move of 0.2 on the ASCOT being between 0.19 and 0.2 on EQ-5D-3L. This would suggest that for many interventions QALY gain generated by ASCOT will be comparable to that for the EQ-5D-3L. However, this does not suggest that an individual completing the EQ-5D-3L and ASCOT would give comparable values since this is also driven by the descriptive system. It means that given the initial selection of measure, values on the ASCOT can be converted into EQ-5D-3L currency using this equation.

This method could be applied to other measures, such as ICECAP which is the other recommended measure in social care from NICE (NICE). It could also provide another method for moving between generic and condition specific measures in health care.

5. Acknowledgements:

We would like to acknowledge The UK Department of Health for funding the study, Accent for recruiting participants and carrying out the interviews and all the participants who took part in the valuation interviews.

6. References

Alava MH, Brazier J, Rowen D, Tsuchiya A. 2013. Common scale valuations across preference-based measures: estimation using rank data. *Medical Decision Making* ***33*** *(6):839-52.*

Dolan P. 1997. Modeling valuations for EuroQol health. *Medical Care* **35**: 1095-108.

Longworth L, Yang Y, Young T, Mulhern B, et al. 2014. Use of generic and condition specific measures of Health Related Quality of Life in NICE decision making. *Health Technology Assessment* **18** (9).

Netten A, Ryan M, Smith P et al. 2002. The Development of a Measure of Social Care Outcome for Older People. *PSSRU Discussion Paper.* 1690/2.

Netten A, Burge P, Malley J, et al. 2012. Outcomes of social care for adults: developing a preference-weighted measure. *Health Technology Assessment* **16**:1.

National Institute for Health and Care Excellence. 2013. Guide to the methods of technology appraisal. [http:// https://www.nice.org.uk/article/pmg9/resources/non-guidance-guide-to-the-methods-of-technology-appraisal-2013-pdf] Accessed 14/12/2015

National Institute for Health and Care Excellence. The Social Care Guidance Manual. 2013. [https://www.nice.org.uk/article/pmg10/chapter/7-incorporating-economic-evaluation.] Accessed 14/12/2015

https://www.ohe.org/news/ohe-seminar-launches-eq-5d-5l-value-set-england (accessed 18/01/2016

Rowen D, Brazier J, Tsuchiya A, Hernandez Alava M. 2012. Valuing states from multiple measures on the same VAS: A feasibility study. *Health Economics* **21;**715-29.

Sculpher MJ, Walker S, Hinde S, K. C. 2014. Research to Inform Resource Allocation in Health and Social Care. Results of a Scoping Study. Sheffield: Policy Research Unit in Economic Evaluation in Health and Care Interventions (EEPRU), Universities of Sheffield and York.

Tsuchiya A, Brazier JE, Roberts J. 2006. Comparison of valuation methods used to generate the EQ5D and the SF6D value sets in the UK. *Journal of Health Economics* **25**;334-46.

Table I: Characteristics of the sample (n=200)

Age	Mean 44.24 (min 18, Max 84)
Gender	42% male
Education Level	32.5% have a degree or equivalent professional qualification
Ethnic Group (%)	White (94) Mixed (1.5) Asian or Asian British (2.5) Black or Black British (1.5) Chinese or Other Ethnic Group (0.5)
Household Income (%)	Less than £9,999 (10.5) £10,000 - £19,999 (15.5) £20,000 - £29,999 (15) £30,000 - £39,999 (6) £40,000 - £49,999 (8) Greater than £50,000 (9) Would rather not say/Don't know (36)
Mean EQ-5D score	0.81
Mean ASCOT score	0.87
General Health (%)	Excellent (14.5) Very good (30) Good (32) Fair (18.5) Poor (5)

Table II: Health State Values for ASCOT (ordered by mean value)

Health State	Mean	Median	SD	N
11111111	0.93	0.98	0.10	23
11212111	0.91	0.98	0.23	19
11122121	0.87	0.95	0.19	20
11212221	0.85	0.90	0.16	19
12122232	0.85	0.90	0.16	23
11131212	0.80	0.95	0.36	19
11121111	0.76	0.88	0.30	19
32132411	0.75	0.90	0.30	19
21123141	0.73	0.88	0.48	19
11222212	0.72	0.85	0.36	20
32132221	0.71	0.88	0.37	20
22221141	0.70	0.73	0.27	20
12121211	0.68	0.91	0.48	20
41213321	0.64	0.75	0.38	21
12322212	0.64	0.68	0.39	19
13232223	0.63	0.73	0.35	19
24211142	0.63	0.88	0.57	20
21431231	0.62	0.70	0.46	19
42321323	0.60	0.65	0.40	19
24121142	0.60	0.73	0.50	23
22221144	0.60	0.68	0.32	20

32312414	0.59	0.65	0.45	19
22323144	0.58	0.68	0.35	21
13122233	0.58	0.65	0.34	19
21141143	0.57	0.66	0.44	20
14112232	0.57	0.70	0.46	19
32322322	0.53	0.73	0.53	20
13232432	0.53	0.63	0.59	19
14212232	0.52	0.79	0.55	20
14422232	0.47	0.60	0.53	20
32223414	0.47	0.73	0.60	23
43132322	0.43	0.63	0.62	19
32424414	0.42	0.41	0.44	20
44123323	0.42	0.50	0.52	21
24342141	0.40	0.49	0.46	20
43322213	0.40	0.51	0.56	20
44322323	0.36	0.50	0.69	19
44242323	0.34	0.50	0.59	23
42233321	0.31	0.63	0.75	20
43121323	0.30	0.50	0.64	20
42243322	0.19	0.50	0.67	19
34444432	0.19	0.20	0.61	19
32224414	0.18	0.66	0.79	20
43333444	0.13	0.38	0.62	21

33333343	0.12	0.33	0.72	19
44444444	0.05	-0.17	0.71	20
32343444	0.01	0.18	0.63	19
33343434	-0.04	0.26	0.69	20
44344431	-0.13	-0.38	0.59	20
43232434	-0.28	-0.39	0.58	20

Table III: Health State Values for EQ-5D-3L (ordered by mean value)

Health State	Mean	Median	SD	N
11111	0.96	0.98	0.07	23
12112	0.78	0.88	0.23	19
12111	0.76	0.93	0.36	19
21112	0.72	0.73	0.31	19
11222	0.69	0.81	0.44	20
22212	0.66	0.88	0.46	19
22211	0.64	0.81	0.43	20
12213	0.63	0.70	0.40	23
21113	0.61	0.83	0.44	19
13111	0.59	0.74	0.44	20
23111	0.57	0.71	0.47	20
22123	0.55	0.65	0.47	19
11223	0.55	0.73	0.42	19
21223	0.51	0.60	0.54	19
23112	0.50	0.61	0.53	20
22221	0.49	0.58	0.47	20
12321	0.49	0.56	0.46	20
22312	0.49	0.58	0.46	21
13211	0.48	0.69	0.55	20
22222	0.44	0.50	0.54	21
23222	0.43	0.65	0.52	23

21231	0.36	0.50	0.54	21
11131	0.34	0.63	0.62	19
32221	0.33	0.50	0.52	23
12323	0.29	0.48	0.57	21
31121	0.26	0.50	0.65	19
13322	0.26	0.50	0.67	20
22331	0.23	0.48	0.60	23
31311	0.22	0.50	0.68	19
11231	0.22	0.48	0.70	19
11331	0.19	0.40	0.61	20
23123	0.13	0.44	0.68	20
33211	0.12	0.39	0.71	20
21132	0.11	0.33	0.71	19
21131	0.10	0.45	0.74	20
23312	0.09	0.14	0.60	20
21331	0.07	0.36	0.64	20
22231	0.05	-0.02	0.64	19
13323	0.03	0.20	0.78	19
31322	0.03	0.20	0.65	19
23323	0.03	0.03	0.72	19
31131	-0.08	-0.13	0.70	19
21332	-0.08	-0.02	0.57	19
31333	-0.09	-0.17	0.61	21

22132	-0.11	-0.15	0.61	20
13233	-0.14	-0.38	0.55	19
32223	-0.20	-0.47	0.67	20
31133	-0.21	-0.40	0.63	20
31323	-0.30	-0.45	0.58	19
33333	-0.51	-0.63	0.42	20

Table IV: Basic mean level OLS regression for EQ-5D-3L

	Coefficient	Standard error	t	P>|t|
Original EQ-5D-3L Utility	0.916	0.065	14.10	0.000
Constant	0.094	0.024	3.87	0.000

Number of observations=50, F(1,48) =198.73, Prob>F=0.0000, R-squared=0.8055, Adjusted R-squared=0.8014

Table V: Basic mean level OLS regression for ASCOT

	Coefficient	Standard error	t	P>|t|
Original ASCOT Utility	0.884	0.063	14.12	0.000
Constant	0.057	0.035	1.63	0.109

Number of observations=50, F(1,48) =199.25, Prob>F=0.0000, R-squared=0.8059, Adjusted R-squared=0.8018

Table VI: Example transformations

ASCOT	EQ-5D-3L
1	0.92
0.8	0.73
0.6	0.54
0.4	0.35
0.2	0.15
0.0	-0.04
-0.2	-0.23

Figure 1: Scatter plot of original and new EQ-5D-3L values

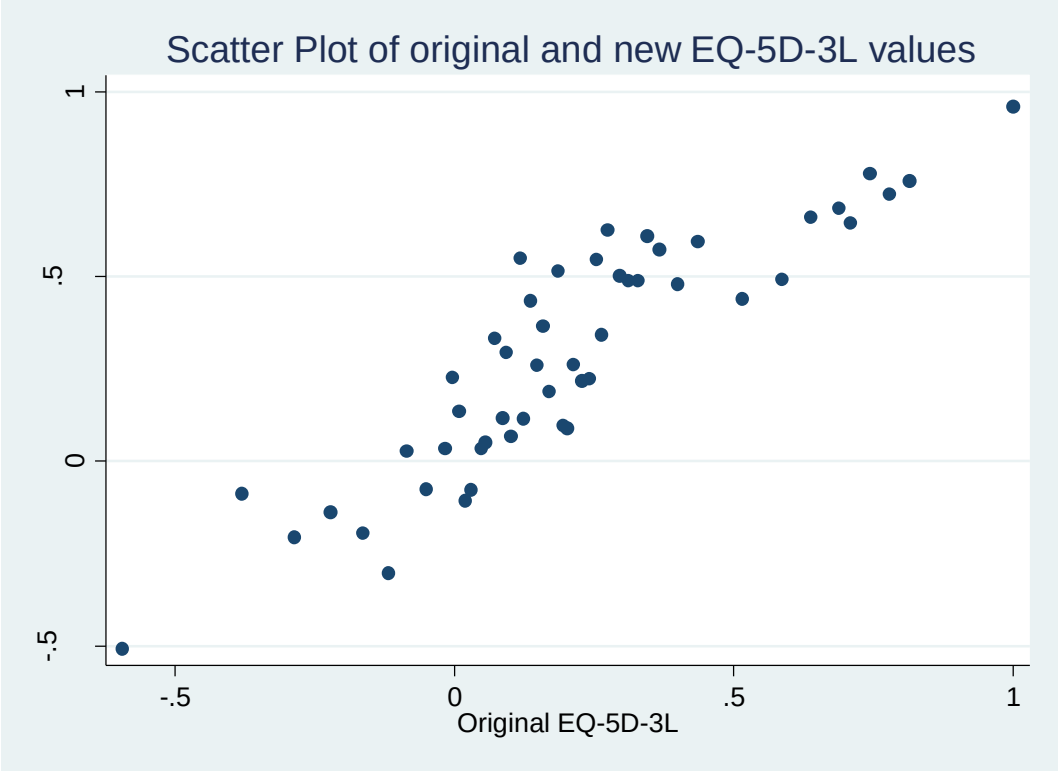

Figure 2: Scatter plot of original and new ASCOT values