Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/vhri

Toward Explicit Prioritization for the Caribbean: An EQ-5D Value Set for Trinidad and Tobago

Henry Bailey, PhD[1,2,], Elly Stolk, PhD[3], Paul Kind, MPhil[4]*

[1]Arthur Lok Jack Graduate School of Business, University of the West Indies, Champs Fleurs, Trinidad and Tobago; [2]HEU, Centre for Health Economics, University of the West Indies-St. Augustine Campus, Trinidad and Tobago; [3]Erasmus University Rotterdam, Rotterdam, The Netherlands; [4]University of Leeds, Leeds, UK

ABSTRACT

Background: Resource allocation decision making in the Caribbean can be greatly enhanced by the introduction of cost per quality-adjusted life-year (QALY) analysis on the basis of local preferences. In the valuation literature there have been recommendations for the elicitation methods of the EuroQol five-dimensional questionnaire (EQ-5D) that combine discrete-choice experiment (DCE) for bulk valuation with a time trade-off component for rescaling. **Objectives:** To create a three-level EQ-5D value set for Trinidad and Tobago using an elicitation method that takes into account the local constraints, and that can be easily deployed in other Caribbean islands. **Methods:** A D-efficient DCE was completed by a representative sample of 307 adults. A time trade-off procedure was used to obtain values for rescaling the DCE model on a scale anchored at 0 (dead) and 1 (full health). **Results:** A mixed logit analysis of the DCE data produced an internally valid model that is similar to the results obtained in earlier pilot studies. **Conclusions:** This EQ-5D value set allows cost per QALY analyses to be carried out on the basis of preferences from Trinidad and Tobago, and the approach to the DCE design can be taken for similar value sets to be created in the small, resource-constrained health systems of the Caribbean. Some guidelines for the initial application and introduction of cost per QALY analysis into the Trinidad and Tobago health system are also presented.

Keywords: Caribbean, discrete-choice experiment, EQ-5D, prioritization.

Introduction

No society can provide all types of health interventions for all its people, and so health interventions must be “rationed” among the population. Some health needs are completely met, whereas others are met partially and some others are not met at all [1]. Internationally, there has been a shift toward using explicit methods of prioritization in health care [2] in which health interventions are prioritized and provided on the basis of clear criteria. This is in contrast to implicit prioritization in which health resource allocations emerge in a health system by default—that is, in an ad hoc manner without clear, consistent criteria. Resource allocation decisions in health care are taken at many levels and can potentially include many aspects of efficiency, equity, and other factors as the basis for prioritization [3]. The efficiency criteria are generally based on methods of economic evaluation of health programs, interventions, initiatives, and so forth. The use of quality-adjusted life-years (QALYs) in the numerator of economic evaluations offers the ability to compare initiatives with qualitatively different outcomes. The QALY approach to economic evaluation has become widely used in developed countries [4].

In 2002, a survey on health care resource allocation decision making in four English-speaking Caribbean territories concluded that such decision making is generally highly centralized and relies on implicit methods supported by line-item historical budgeting [5,6]. Little has changed in this regard since the survey—other than further centralization (e.g., in Trinidad and Tobago, the number of regional health authorities has been reduced from six to five) and increasingly severe fiscal constraints [7]. Intensifying resource constraints is known to promote further centralization of resource allocation decision making [8].

This article provides a starting point for the introduction of explicit prioritization methods into the health system of Trinidad and Tobago. A review of the experience with explicit prioritization in middle-income and developing countries suggests the following [3,9]:

1. Countries that phase-in explicit prioritization on a small scale and build gradually tend to be more successful in introducing

Conflicts of interest: The authors have indicated that they have no conflicts of interest with regard to the content of this article.

* Address correspondence to: Henry Bailey, Arthur Lok Jack Graduate School of Business, University of the West Indies, Champs Fleurs, Uriah Butler Highway, Mt. Hope, Trinidad and Tobago.

E-mail: hhbailey@gmail.com

2212-1099$36.00 – see front matter Copyright © 2016, International Society for Pharmacoeconomics and Outcomes Research (ISPOR). Published by Elsevier Inc.

http://dx.doi.org/10.1016/j.vhri.2016.07.010

and using explicit prioritization methods than those that undertake sweeping reforms.

2. The use of technical solutions/methods should be seen as having the purpose of informing but not replacing judgment in decision making.
3. Resource allocation decision making in health should be carried out at the level of the margin. That is, comparisons should be made on the basis of the levels of marginal benefit relative to marginal costs.
4. An agency responsible for health technology assessment is an essential element if the health system is to obtain the benefits of explicit prioritization. Such an agency would be responsible for performing economic evaluations, updating, and introducing new methods and tools into the explicit prioritization framework.

   On this last point, no matter which direction is eventually taken as explicit prioritization develops and gains more widespread use in Trinidad and Tobago, one element that will be necessary is a framework that can be used to evaluate the efficiency of all interventions in health. This should allow for comparisons between any interventions even if they have qualitatively different outcomes.

   Internationally, cost per QALY analysis has become the most commonly used method of evaluating the efficiency of health interventions, and the EuroQol five-dimensional questionnaire (EQ-5D) descriptive system has become the most widely used instrument for quantifying the value of health states required for the computation of QALYs [10]. The three-level EQ-5D (EQ-5D-3L) instrument comprises five dimensions: mobility (MO), self-care (SC), usual activities (UA), pain/discomfort (PD), and anxiety/depression (AD). Each of these five dimensions can have one of three levels: no problems, moderate problems, and extreme problems. This creates $3^5 = 243$ possible combinations within the descriptive system. These combinations are coded using the levels and dimensions in order: MO, SC, UA, PD, and AD. So, for example, the EQ-5D state 21232 refers to the following:

   2: Some problems walking about (MO)
   1: No problems bathing or dressing (SC)
   2: Some problems performing usual activities (work, study, leisure, etc.) (UA)
   3: Extreme pain or discomfort (PD)
   2: Moderate anxiety or depression (AD)

If societal values can be established for all 243 possible combinations (or states), then these values can form the basis for QALY adjustments to inform resource allocation decisions in health.

Academics and policymakers wishing to carry out cost per QALY analysis in countries where such value sets do not exist must use value sets from other countries. Societal preferences among health states are influenced by many factors including infrastructural and cultural factors that can differ considerably even between neighboring countries [11]. The use of QALY values that are inconsistent with local preferences can potentially lead to resource allocation decisions that are as suboptimal as decisions that are made in the absence of cost per QALY analysis.

This article presents a small sample, low-cost method of developing an EQ-5D-3L value set. There has been considerable interest in the use of discrete-choice experiments (DCEs) as a means of developing EQ-5D value sets [12,13]. DCEs allow models of preference to be developed using simple ordinal tasks for the respondent. By doing so, they do not require the use of highly trained interviewers, complex props, and cognitively demanding valuation tasks, and they avoid the pitfalls of other valuation methods such as time trade-off (TTO) [14,15]. In this study, a DCE design was used as the valuation method and a TTO component was included in the interview to enable anchoring of the DCE-derived health state utilities on the scale for QALY computation anchored at 0 (dead) and 1 (full health).

Methods

The DCE was designed to take into account certain local challenges. With Internet diffusion at 60% and heavily skewed toward the young, an online survey would not have been able to capture a representative sample [16]. Checks with local survey providers and marketing consultants revealed that postal surveys are generally not used in Trinidad and Tobago because of the very low response rates and the difficulty in obtaining a representative sample using postal surveys. The survey had to be conducted face-to-face. The limited budget for this study meant that a small number of respondents could be contacted (~300) and so ideally each respondent should represent one replicate of the DCE (i.e., a large DCE design would require blocking, which would substantially increase the required number of respondents). DCE was selected as the main valuation technique because this approach does not depend on a large team of highly trained interviewers and it would also be ideal for creating EQ-5D value sets in the other small islands of the Caribbean where resources and support (e.g., specialized interviewers or health economics researchers) are generally not easily available for this kind of research.

A D-efficient DCE design in 20 rows was developed using Ngene software (ChoiceMetrics Pty Ltd., W201/599 Pacific Highway, St Leonards, Sydney, NSW 2065 Australia). To keep the cognitive burden on respondents to a minimum, the DCE design comprised choice sets of two states. Pilot cognitive debriefing exercises performed with subjects drawn from the general public in Trinidad and Tobago showed that respondents had no problems performing 20 paired comparisons of EQ-5D-3L states; some combinations, however, were considered "difficult" by many respondents. On the basis of this feedback, constraints were placed on the D-efficient DCE design to exclude all combinations that these respondents found to be "implausible." These were states that brought together the following:

1. MO at level 3 combined with UA at level 1;
2. MO at level 3 combined with SC at level 1; and
3. SC at level 3 combined with UA at level 1.

The creation of D-efficient DCE designs is reviewed in the Ngene User's Manual [17] and elsewhere [18]. D-efficient designs seek to produce models that generate estimates with the smallest possible standard errors. Herein, the algorithm for generating an efficient design exploits the fact that the asymptotic variance-covariance (AVC) matrix of the model estimated from data collected using the design can be derived if the parameters are known. The AVC matrix is a mathematical property of the choice model and is obtained by taking the negative inverse of the expected second derivatives of the log-likelihood function [19]. The information contained in the AVC matrix is summarized in a measure, the D-error, calculated by taking the determinant of the AVC matrix and scaling this value by the number of parameters. Obviously, the asymptotic standard errors of the parameters can be estimated if the parameters are known. The purpose of the DCE, however, is to actually estimate these parameters. The AVC matrix can be determined if priors are available for the parameters. (The AVC matrix that is estimated will then be based on the assumption that the priors are correct.) Priors were taken from a pilot small DCE design that had been previously conducted in Trinidad [20]. The AVC matrix is derived using Monte-Carlo simulation generating a sample, and estimating the coefficients on the basis of simulated choices. The simulated choices are developed by using the prior estimates to develop the observed utilities, and adding some random draws for the unobserved utilities. In each pair, the chosen alternative is assumed to be the one that provides the highest utility. This process produces a VC matrix and is repeated many times and the average VC matrix obtained is used as the AVC matrix.

A D-efficient design is produced through simulation by comparing the D-errors of many possible designs. A candidate set of alternatives is constructed (this could be the full factorial or a fractional factorial excluding any disallowed combinations). A DCE is created by assembling the required number and size of choice sets from the candidate set. The efficiency error (D-error) for this DCE design is then computed (as given by the determinant of the AVC matrix). This process is repeated for another DCE design, and if the D-error is lower than the lowest value from the previous iterations, the design is stored. The process ends when all possible designs have been exhausted or when the investigator stops the process.

To allow for mixed logit (MXL) analysis of the DCE data for a design in which each respondent provides one complete replicate, the DCE design required a minimum of 20 pairs of states. This is necessary to allow for the estimation of a mean and an SD for levels 2 and 3 of the five dimensions of the EQ-5D. Respondents completed 20 choices. Paired comparisons using the EQ-5D-3L had been conducted in Trinidad and Tobago previously in pilot studies comprising 16 and 20 pairs. No difficulties or issues were reported with the use of these numbers of pairs.

The MXL model allows for unobserved respondent heterogeneity by allowing the parameters to follow their own distributions rather than to assume them to be fixed across respondents. The utility associated with option j in choice set t for respondent n is given by:

$$U_{njt} = \beta_n X_{njt} + \varepsilon_{njt},$$

where the error term ε_{njt} is the iid extreme value. For a sequence of choice sets, the probability that a respondent makes a particular sequence of choices is the product of logit formulas (one for each choice set):

$$L_{ni}(\beta) = \prod_{t-1}^{T} \left[\frac{\exp(\beta X_{nijt})}{\sum_{i-1}^{j} \exp(\beta X_{nijt})} \right].$$

Because the ε_{njt} values are independent over respondents, alternatives, and choice sets, the unconditional probability is the integral of this over all the values of β. If the coefficients β_n are distributed with density $f(\beta|\theta)$, where θ gives the parameters of the distribution of β, then this becomes:

$$P_{ni} = \int \left[(\beta) f(\beta] \middle| \theta \right) \mathbf{d}\beta.$$

In the case in which the β_n values are assumed to be normally distributed, θ would be the mean and SD. Simulation methods are used to approximate the probabilities given the values of θ. Train [19] outlines the process as follows:

1. A value is drawn for β from $f(\beta|\theta)$ and labeled β^r, where $r = 1$ for the first draw.
2. $L_{ni}(\beta^r)$ is calculated for this draw, where L_{ni} is the logit probability evaluated at β^r.
3. This process is repeated many times and the average of the results is taken.

These simulated probabilities are inserted into the log-likelihood function to produce a simulated log likelihood, and the maximum simulated likelihood estimator is the θ that maximizes the simulated log-likelihood function.

In addition to the DCE choices, respondents also completed a self-reported health "warm-up" task using the standard EuroQol visual analogue scale (VAS) [21], and a ranking-VAS task that had been developed in a previous study [22]. VAS values were obtained for six states: 11112, 11121, 22222, 33332, 33333, and another card labeled "Dead."

The interviewer entered the VAS values into a tablet, and the respondent moved on to the 20 choices of the DCE exercise. This was done using a set of five printed cards (8½″ × 11″) each of which displayed four pairs of the DCE. The respondent was asked to imagine being in each state for "a long time like 10 years" and indicate which state was preferred out of each pair by pointing to it. The five cards were presented to each respondent in a random order. The choices were entered into a tablet by the interviewer.

Although the objective of this study was to use a simplified valuation task (hence the DCE), it was necessary to anchor the values obtained from the model on a scale of 0 (dead) to 1 (full health). Some studies have included duration in DCE designs [23]; this, however, increases the complexity of the DCE task as well as the size of the DCE design, necessitating larger numbers of respondents. To anchor the DCE values, respondents were taken through a simplified TTO exercise limited to the same five states for which they had earlier given VAS values. The TTO exercise used the "standard" TTO boards, cards, and props as described in the Measurement and Valuation of Health study [24]. The TTO elicitation protocol was based on a modified Measurement and Valuation of Health protocol which is described elsewhere [25]. TTO alternatives were presented increments of 1 year so that the minimum deviation from the value of full health that could be observed would be 0.5 years. This would occur when a respondent prefers 9 years in the full health state to 10 years in state X, but prefers full health when the durations of state X and full health are both set at 10 years. In such a valuation, an indifference point can be recognized as being 9.5 years, that is, at the midpoint between 9 and 10 years. Similarly, the worse than dead scale was set such that the values possible for such a state were between −0.5 and −9.5 years. This adaptation eliminated the need for any transformation of the worse than dead values. It also shortened and simplified the TTO task for both the interviewer and the respondent.

After the TTO task, respondents were asked to answer some demographic questions. This information was also entered into the tablet by the interviewer.

A survey company was asked to carry out the survey. Eight interviewers conducted the elicitations working in pairs. Interviewers were given a script and they received three training sessions (including role plays) lasting 2.5 hours each and the principal investigator accompanied the teams on their first field visits.

Stratified random sampling was used so that the respondents comprised a representative sample of the Trinidad and Tobago population. Streets were randomly chosen from the regions served by the five regional health authorities in Trinidad and Tobago, and alternate households were visited. Persons aged 18 years and older were selected on the basis of either being the next or the most recent adult in the household to celebrate their birthday. Once 220 respondents had been interviewed, a comparison with the national population was carried out, and the survey company was given demographic guidelines for the remaining respondents to bring the sample as close as possible to the national population.

Models were evaluated on the basis of coefficient properties (statistical significance, all coefficients bearing the correct sign, with level 3 having a higher absolute value than level 2 on any single dimension) and goodness-of-fit statistics: log likelihood and likelihood ratio.

Results

The interviews took place in March and April of 2015. The valuation tasks were performed by 307 respondents. A comparison of the respondent sample characteristics with the Trinidad and Tobago population is presented in Table 1. On comparing the sample with the Trinidad and Tobago census data, it was found that Afro-Trinidadian, North Central regional health authority residents, and university-educated persons were over-represented. The largest deviation of the sample from the population is in the number of university-educated respondents. The response rate was 75%. There were no exclusions.

The mean times taken to complete the components of the survey were as follows: ranking and VAS section, 8.2 minutes; DCE, 9.0 minutes; and TTO, 9.3 minutes. The VAS and TTO mean values and their standard errors are presented in Table 2. The VAS values are based on a 0 to 100 scale (best and worst imaginable health) and the TTO values are on a scale anchored at 0 for dead and 1 for full health. State 11112 had a higher mean VAS value than state 11121, whereas the mean TTO value for state 11112 was lower than that for state 11121. Nevertheless, the 95% confidence intervals for the TTO values of these two states overlap and so these values are not statistically different. The over-representation of university-educated respondents in the sample is not expected to affect the results as can be concluded from Table 2, which shows that the mean TTO and VAS valuations of university-educated respondents are very similar to the values for the whole sample. The 95% confidence intervals of mean TTO values for the whole sample and university-educated respondents overlap for states 11112, 11121, 22222, and 33332. In the case of state 33333, the 95% confidence intervals are –0.13 to –0.20 (whole sample) and –0.21 to –0.37 (university-educated respondents).

The coefficients that were obtained with the MXL model on the DCE data are presented in Table 3. This MXL model produced a high and significant likelihood ratio (representing an improvement over the unrestricted conditional logit model). The SDs of the level 3 coefficients and two of the level 2 coefficients are all significant, evidencing respondent heterogeneity and further justifying the use of the MXL model. The SD of the AD level 2 coefficient is negative. The signs of the means of estimated SDs of the random coefficients produced by STATA (StataCorp, College Station, TX) are irrelevant. The values of the SDs should be interpreted as being positive [26].

The performance of this model versus observed choices is displayed in Figure 1. On comparing this model with the 20 observed choices, we found that the Mean Absolute Deviation (MAD) was 4.3%. For one pair, the MAD was more than 10% and for six pairs it was more than 5%. The model correctly predicted 19 of the 20 paired comparisons.

The coefficients in Table 3 were rescaled using the highest and the lowest values obtained in the TTO exercise. These are states 11121 and 33333 in Table 2. The TTO values (rather than the VAS values) were used for anchoring to keep all the valuation data "choice-based" and to maintain the implicit standard in this regard.

Simple algebra was used to find a monotonic transformation that would convert the values of these two states on the basis of the DCE model to their TTO values:

$$a - 0.432b = 0.843,$$

$$a - 7.196b = -0.163.$$

Table 1 – Demographic characteristics of the sample and the Trinidad and Tobago population.

Characteristics	N	Sample (%)	Trinidad and Tobago (%)
Sex			
Male	155	50	51
Female	152	50	49
Total	307	100	100
Ethnicity			
Indo-Trinidadian	113	37	39
Afro-Trinidadian	136	44	39
Mixed/other	58	19	22
Total	307	100	100
Age group (y)			
18–24	49	16	19
25–34	78	25	22
35–44	64	21	22
45–54	50	16	16
55–64	33	11	10
65+	33	11	10
Total	307	100	100
Education			
Primary or less	68	22	28
Secondary	146	48	49
University	54	18	11
Technical/vocational	39	13	12
Total	307	100	100
RHA area			
Northwest RHA	61	20	24
Southwest RHA	123	40	41
North central RHA	79	26	23
Tobago RHA	15	5	4
Eastern RHA	29	9	8
Total	307	100	100

RHA, regional health authority.

Table 2 – VAS and TTO results.

Variable	11112	11121	22222	33332	33333	Dead
			Whole sample			
Mean VAS	83.63	80.06	52.17	22.68	15.47	2.77
SEM VAS	**0.76**	0.89	1.00	0.94	0.76	0.69
Mean TTO	0.820	0.843	0.696	−0.032	−0.163	–
SEM TTO	0.020	0.018	0.040	0.037	0.034	–
			University-educated respondents			
Mean VAS	83.98	80.73	54.33	20.48	12.73	2.88
SEM VAS	2.14	1.92	2.31	2.10	1.54	1.51
Mean TTO	0.869	0.855	0.710	−0.103	−0.288	–
SEM TTO	0.036	0.036	0.063	0.087	0.080	–

SEM, standard error of the mean; TTO, time trade-off; VAS, visual analogue scale.

The values obtained for *a* and *b* were 0.907 and 0.149, respectively. This transformation was then used to convert the coefficients from the DCE model to produce EQ-5D state values on a 0 to 1 scale. A constant term was included in the rescaled coefficients to show the effect on health state value for any movement away from full health. The rescaled coefficients are presented in Table 4.

Using these coefficients, an EQ-5D-3L value set was developed for Trinidad and Tobago. For example, the value of state 21232 would be calculated using these coefficients by subtracting the value of the coefficient for each dimension in the state from the full health value of 1.000. When a dimension has no problems (as SC in state 21232), there would be no corresponding decrement. The value of state 21232 would therefore be 1 – 0.093 – 0.045 – 0.043 – 0.230 – 0.011 = 0.578. The full value set for Trinidad and Tobago on the basis of the coefficients in Table 4 is presented in Table 5.

On comparing the rescaled DCE values in Table 5 with the observed TTO values in Table 2, state 22222 gives values of 0.679 and 0.696, respectively, and state 33332 gives values of −0.035 and −0.032, respectively. State 11112 produced a higher deviation (0.896 from the model vs. TTO of 0.82) because of the use of state 11121 in the rescaling exercise (PD2 in the DCE model has a higher absolute value than does AD2).

Discussion

The coefficient for level 3 on the MO dimension had the highest absolute value, followed by level 3 on the PD and SC dimensions.

Table 3 – Results of the MXL analysis of the DCE data.

Dimension/Level	Coefficient	SE	*P* value	95% CI	
		Mean			
MO2	−0.301	0.068	0.000	−0.434 to −0.168	
MO3	−2.770	0.259	0.000	−3.278 to −2.262	
SC2	−0.431	0.065	0.000	−0.558 to −0.304	
SC3	−1.155	0.115	0.000	−1.380 to −0.930	
UA2	−0.291	0.066	0.000	−0.420 to −0.162	
UA3	−0.789	0.092	0.000	−0.969 to −0.608	
PD2	−0.432	0.057	0.000	−0.543 to −0.321	
PD3	−1.544	0.121	0.000	−1.782 to −1.307	
AD2	−0.077	0.047	0.103	−0.169 to 0.016	
AD3	−0.938	0.077	0.000	−1.090 to −0.786	
		SD			
MO2	0.335	0.064	0.000	0.209 to 0.461	
MO3	1.636	0.189	0.000	1.266 to 2.006	
SC2	0.201	0.098	0.040	0.009 to 0.393	
SC3	0.562	0.080	0.000	0.404 to 0.719	
UA2	0.025	0.069	0.719	−0.111 to 0.161	
UA3	0.251	0.085	0.003	0.085 to 0.418	
PD2	0.101	0.159	0.525	−0.210 to 0.413	
PD3	0.807	0.069	0.000	0.671 to 0.943	
AD2	−0.145	0.102	0.154	−0.344 to 0.054	
AD3	0.609	0.063	0.000	0.485 to 0.733	
Observations	12,280			LR χ^2 (10)	339.95
Log likelihood	−3,821.485			Probability > χ^2	0.000

CI, confidence interval; DCE, discrete-choice experiment; Dimensions: MO, mobility; SC, self-care; UA, usual activities; PD, pain/discomfort; AD, anxiety/depression; LR, likelihood ratio; MXL, mixed logit; SE, standard error.

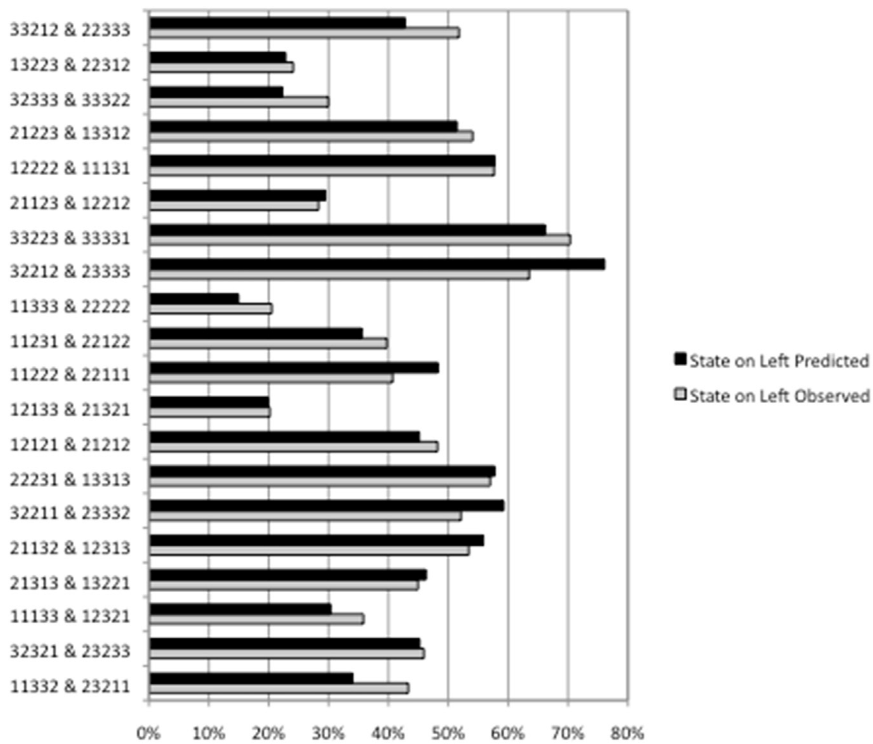

Fig. 1 – Predictive performance of the MXL model. MXL, mixed logit.

This suggests that to the Trinidad and Tobago population, level 3 on the MO dimension (followed by PD and SC) represents the greatest decrements in full health. This follows the patterns obtained in the pilot studies conducted in Trinidad and Tobago [20,27]. The pattern of EQ-5D-3L coefficients found in this study differs from those found in other countries (e.g., the Netherlands and the United Kingdom where PD is the most important dimension). Such differences highlight the importance of using local societal values to inform resource allocation decisions in healthcare [11].

Caution may in general be warranted when comparing this value set to those of other countries for which TTO or VAS values have been used. This is the first study to derive an EQ-5D-3L national value set on a DCE/TTO combination in the way described in this article. Although by anchoring on TTO values for state 33333 guarantees that the value range in this study is similar to what has been reported elsewhere, there may be systematic differences in the relative value of each state related to methods effects. A nonlinear relationship has been reported between TTO and DCE [12]. This has not yet been fully explored, but it may trace back to TTO being affected by time preference, whereas DCE is not. Differences are in fact small, and in the absence of a criterion standard there have been recommendations for combined approaches that exploit the strengths of the two techniques in combination: DCE for bulk data and TTO for anchoring [28]. Another potential source of difference would be the absence of an N3 term in the Trinidad and Tobago DCE model. The N3 term is included in some EQ-5D-3L models as an interaction term to capture the additional decrement in utility that may come about by having at least one dimension at level 3 [21].

A single criterion that would allow the complete, clear comparison between health programs and interventions and provide unambiguous guidance for resource allocation continues to be an elusive goal. A prioritization framework for Trinidad and Tobago could be gradually developed using the EQ-5D-3L value set developed in this article as the basis for the comparison of the efficiency of interventions. To this end, new interventions that are proposed for introduction into the health system can be evaluated on the basis of the societal value of their impact on health by using the EQ-5D value set. The value set can also be used to evaluate resource allocation among existing interventions so that objectives of the health system are met to a greater extent. For example, there has been some discussion about the ability of the country to provide certain interventions (e.g., dialysis and angioplasty) for all patients. To explore such resource allocation questions, policymakers can apply health technology assessment methods such as cost-utility analysis using a program budgeting marginal analysis approach [29]. This can be done by starting with a short list of interventions that are particularly problematic in this regard, and evaluating the efficiency of these interventions using the preferences of the Trinidad and Tobago citizens as embodied in the EQ-5D-3L value set developed in this article, along with other criteria (such as considerations of equity). These trade-offs can be made explicit

Table 4 – The rescaled DCE coefficients.

Constant	MO2	MO3	SC2	SC3	UA2	UA3	PD2	PD3	AD2	AD3
−0.0930	−0.045	−0.412	−0.064	−0.172	−0.043	−0.117	−0.064	−0.230	−0.011	−0.139

DCE, discrete-choice experiment; Dimensions: MO, mobility; SC, self-care; UA, usual activities; PD, pain/discomfort; AD, anxiety/depression.

Table 5 – The EQ-5D-3L value set.

State	Value	State	Value	State	Value	State	Value
11111	1.000	13132	0.494	22223	0.551	31321	0.314
11112	0.896	13133	0.366	22231	0.525	31322	0.302
11113	0.768	13211	0.692	22232	0.514	31323	0.174
11121	0.843	13212	0.681	22233	0.386	31331	0.148
11122	0.831	13213	0.552	22311	0.681	31332	0.137
11123	0.703	13221	0.628	22312	0.669	31333	0.009
11131	0.677	13222	0.616	22313	0.541	32111	0.431
11132	0.666	13223	0.488	22321	0.617	32112	0.420
11133	0.538	13231	0.462	22322	0.605	32113	0.292
11211	0.864	13232	0.451	22323	0.477	32121	0.367
11212	0.852	13233	0.323	22331	0.451	32122	0.355
11213	0.724	13311	0.618	22332	0.440	32123	0.227
11221	0.799	13312	0.607	22333	0.312	32131	0.201
11222	0.788	13313	0.478	23111	0.690	32132	0.190
11223	0.660	13321	0.554	23112	0.679	32133	0.062
11231	0.634	13322	0.542	23113	0.551	32211	0.388
11232	0.623	13323	0.414	23121	0.626	32212	0.376
11233	0.495	13331	0.388	23122	0.615	32213	0.248
11311	0.790	13332	0.377	23123	0.487	32221	0.323
11312	0.778	13333	0.249	23131	0.461	32222	0.312
11313	0.650	21111	0.862	23132	0.449	32223	0.184
11321	0.725	21112	0.851	23133	0.321	32231	0.158
11322	0.714	21113	0.723	23211	0.647	32232	0.147
11323	0.586	21121	0.798	23212	0.636	32233	0.019
11331	0.560	21122	0.786	23213	0.508	32311	0.314
11332	0.549	21123	0.658	23221	0.583	32312	0.302
11333	0.421	21131	0.633	23222	0.571	32313	0.174
12111	0.843	21132	0.621	23223	0.443	32321	0.249
12112	0.831	21133	0.493	23231	0.418	32322	0.238
12113	0.703	21211	0.819	23232	0.406	32323	0.110
12121	0.779	21212	0.807	23233	0.278	32331	0.084
12122	0.767	21213	0.679	23311	0.573	32332	0.073
12123	0.639	21221	0.755	23312	0.562	32333	−0.055
12131	0.613	21222	0.743	23313	0.434	33111	0.323
12132	0.602	21223	0.615	23321	0.509	33112	0.312
12133	0.474	21231	0.589	23322	0.497	33113	0.184
12211	0.800	21232	0.578	23323	0.369	33121	0.259
12212	0.788	21233	0.450	23331	0.344	33122	0.248
12213	0.660	21311	0.745	23332	0.332	33123	0.120
12221	0.735	21312	0.734	23333	0.204	33131	0.094
12222	0.724	21313	0.605	31111	0.495	33132	0.082
12223	0.596	21321	0.681	31112	0.484	33133	−0.046
12231	0.570	21322	0.669	31113	0.356	33211	0.280
12232	0.559	21323	0.541	31121	0.431	33212	0.269
12233	0.430	21331	0.515	31122	0.419	33213	0.141
12311	0.726	21332	0.504	31123	0.291	33221	0.216
12312	0.714	21333	0.376	31131	0.265	33222	0.204
12313	0.586	22111	0.798	31132	0.254	33223	0.076
12321	0.661	22112	0.787	31133	0.126	33231	0.050
12322	0.650	22113	0.659	31211	0.452	33232	0.039
12323	0.522	22121	0.734	31212	0.440	33233	−0.089
12331	0.496	22122	0.722	31213	0.312	33311	0.206
12332	0.485	22123	0.594	31221	0.388	33312	0.195
12333	0.357	22131	0.568	31222	0.376	33313	0.067
13111	0.735	22132	0.557	31223	0.248	33321	0.142
13112	0.724	22133	0.429	31231	0.222	33322	0.130
13113	0.596	22211	0.755	31232	0.211	33323	0.002
13121	0.671	22212	0.743	31233	0.083	33331	−0.024
13122	0.660	22213	0.615	31311	0.378	33332	−0.035
13123	0.531	22221	0.691	31312	0.366	33333	−0.163
13131	0.506	22222	0.679	31313	0.238		

EQ-5D-3L, three-level EuroQol five-dimensional questionnaire.

and transparent. The consequences of resource reallocation decisions can be estimated in terms of QALYs produced, equity, and any other considerations. Interventions and programs can then be expanded/contracted as necessary (e.g., using clinical guidelines) to accommodate resource allocation shifts.

A move toward this kind of explicit prioritization will improve the outcomes of the health system. A prioritization framework can then be gradually developed around these methods. This gradual approach to improving the outcomes of the health system would minimize the resources required at the beginning of the process, take advantage of pre-existing data (such as existing cost data and self-reported EQ-5D states for some conditions), and present a flexible phase-in. This will also reduce the (political and financial) risk of introducing explicit prioritization, give the health system an opportunity to develop capacity, and give stakeholders the time to become accustomed to explicit prioritization. Over time the methods and tools can be developed and refined. For example, a five-level EQ-5D value set can be generated using the crosswalk approach [30], which eventually can be replaced by an actual five-level study in Trinidad and Tobago. The creation of a five-level value set is a much larger undertaking with significantly larger resource requirement. The three-level value set can be used in the "early phase" of economic evaluations of health interventions. The separate consideration of efficiency and other criteria fall short of the "single formula" ideal to be found in approaches such as multicriteria decision analysis, and it would still be considered by some to be in the realm of implicit prioritization [31]. It would, however, represent the start of a process toward explicit prioritization [32] and it would have the potential to greatly improve health outcomes even if existing aggregate health expenditure levels were not increased.

This EQ-5D value set allows cost per QALY analyses to be carried out on the basis of preferences from Trinidad and Tobago, and this approach to DCE design allows for similar value sets to be created in the small, resource-constrained health systems of the Caribbean, thereby facilitating a low-cost, low-risk phase-in of explicit prioritization methods. Such initiatives can benefit from the lessons learned in this study. In these islands, priors for the DCE design can be taken from the Trinidad and Tobago model, or from small local pilot studies using an orthogonal design [27].

Acknowledgments

We acknowledge the support of the Ministry of Health of Trinidad and Tobago and the EuroQol Research Group for this project. We also acknowledge the efforts of Gabrielle Ghany as research assistant during the data collection process, and the comments of two anonymous reviewers.

Source of financial support: This study was funded by the Ministry of Health of Trinidad and Tobago.

REFERENCES

[1] Liss P. The concepts of allocation, priority-setting and rationing. In: Nordenfelt L, Liss P,eds., Dimensions of Health and Health Promotion. Amsterdam, The Netherlands: Rodopi B.V., 2003:165–75.
[2] Gordijn B, Ten Have H. Prioritization in healthcare—still muddling through. Med Health Care Philos 2011;14:109–10.
[3] The Global Challenge of Health Care Rationing. In: Ham C, Coulter A, eds. Buckingham, UK: Open University Press, 2000.
[4] Cookson R. Willingness to pay methods in health care: a sceptical view. Health Econ 2003;12: 891–4.
[5] Mills A, Antonius R, Daniel J, et al. The distribution of health planning and management responsibilities between centre and periphery: historical patterns and reform trends in four Caribbean territories. Health Policy 2002;62:65–84.
[6] Rutten F, Lapré R, Antonius R, et al. Financing of health care in four Caribbean territories: a comparison with reforms in Europe. Health Policy 2002;62:103–13.
[7] International Monetary Fund. Caribbean Small States: Challenges of High Debt and Low. Growth. Washington, DC: International Monetary Fund, 2013.
[8] Mintzberg H. Structure in Fives: Designing Effective Organizations. Englewood Cliffs, NJ: Prentice-Hall International, 1992.
[9] Glassman A, Chalkido K. Priority-Setting in Health: Building Institutions for Smarter Public Spending. Washington, DC: The Center for Global Development, 2012.
[10] Obradovic M, Arun L, Hiltrud L. Validity and responsiveness of EuroQol-5 dimension (EQ-5D) versus short form-6 dimension (SF-6D) questionnaire in chronic pain. Health Qual Life Outcomes 2013;11:110.
[11] Bailey H, Kind P. Preliminary findings of an investigation into the relationship between national culture and EQ-5D value sets. Qual Life Res 2010;19:1145–54.
[12] Stolk E, Oppe M, Scalone L, Krabbe P. Discrete choice modeling for the quantification of health states: the case of the EQ-5D. Value Health 2010;13:1005–13.
[13] Bansback N., Brazier J., Tsuchiya A., Anis A. Using a discrete choice experiment to estimate societal health state utility values. HEDS Discussion Paper 10/03, University of Sheffield, Sheffield, UK, 2010.
[14] Bailey H., Kind P. Does time trade-off capture "true" ordinal preferences for EQ-5D health states? Presented at: 26th Scientific Plenary Meeting of the EuroQol Group, Paris, France, September 3–5, 2009.
[15] Augestad L, Rand-Hendriksen K, Kristiansen I, Stavem K. Learning effects in time trade-off based valuation of EQ-5D health states. Value Health 2012;15:340–5.
[16] Usage and Population Statistics. Internet World Stats. Available from: ⟨http://www.internetworldstats.com⟩. [Accessed October 29, 2015].
[17] ChoiceMetrics. Ngene Manual. ChoiceMetrics Pty Ltd. W201/599 Pacific Highway, St Leonards, Sydney, NSW 2065 Australia, 2010.
[18] Tang L, Luo X, Cheng Y, et al. Comparing the state-of-the-art efficient stated choice designs based on empirical analysis. Math Probl Eng 2014;2014: Article ID 740612.
[19] Train K. Discrete Choice Experiments with Simulation. New York, NY: Cambridge University Press, 2003.
[20] Bailey H. A framework for the prioritization of health programmes for Trinidad and Tobago. PhD Thesis, University of the West Indies-St. Augustine Campus, 2013.
[21] EQ-5D Value Sets—Inventory. In: Szende A, Oppe M, Devlin N,eds. Comparative Review and User Guide. Dordrecht, The Netherlands: Springer, 2007.
[22] Bailey H, Kind P, LaFoucade F. Results from an exploratory study to test the performance of EQ-5D-3L valuation subsets based on orthogonal designs, and an investigation into some modeling and transformation alternatives for the utility function. Health Econ Rev 2014;4:29.
[23] Bansback N, Hole A, Mulhern B, Tsuchiya A. Testing a discrete choice experiment including duration to value health states for large descriptive systems: addressing design and sampling issues. Soc Sci Med 2014;114:38–48.
[24] Gudex C, ed. Time trade-off user manual: props and self-completion methods. Working Paper 020cheop, Centre for Health Economics, University of York, York, UK, 1994.
[25] Kind P. A Revised Protocol for the Valuation of Health States Defined by the EQ-5D-3L Classification System: Learning the Lessons from the MVH Study. York, UK: Centre for Health Economics, University of York, 2009.
[26] Hole A. Fitting mixed logit models by using maximum simulated likelihood. Stata J 2007;7:388–410.
[27] Bailey H. Results from a preliminary study to develop the quality adjustments for quality adjusted life year values for Trinidad and Tobago. West Indian Med J 2013;62:543–7.
[28] Rowen D, Brazier J, Van Hout B. A comparison of methods for converting DCE values onto the full health-dead QALY scale. Med Decis Making 2015;35:328–40.
[29] Mitton C, Donaldson C. Setting priorities and allocating resources in health regions: lessons from a project evaluating program budgeting and marginal analysis (PBMA). Health Policy 2003;64:335–48.
[30] van Hout B, Janssen M, Feng Y, et al. Interim scoring for the EQ-5D-5L: mapping the EQ-5D-5L to EQ-5D-3L value sets. Value Health 2012;15:708–15.
[31] Baltussen R, Youngkonga S, Paoluccic F, Niessend L. Multi-criteria decision analysis to prioritize health interventions: capitalizing on first experiences. Health Policy 2010;96:262–4.
[32] Brousselle A, Lessard C. Economic evaluation to inform health care decision-making: promise, pitfalls and a proposal for an alternative path. Soc Sci Med 2011;72:832–9.