Results from a Preliminary Study to Develop the Quality Adjustments for Quality Adjusted Life Year Values for Trinidad and Tobago

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ABSTRACT

Objective: *No country can afford to provide all necessary healthcare for its citizens, so prioritization among interventions must feature in all health systems. Resources in health should be allocated among interventions/facilities/patients in such a way as to be in line with the objectives of the health system. To achieve this, resource allocation decisions must be informed by the relative contributions that prospective interventions will make to societal health and to costs. Internationally, the EQ-5D based quality adjusted life year (QALY) now dominates this kind of analysis. This paper reports on a pilot study to develop an EQ-5D-3L value set for Trinidad and Tobago based on a protocol that avoids some of the issues that are associated with other approaches to developing such value sets such as the complex elicitation tasks that respondents must carry out, and the large respondent samples required for collecting multiple valuation subset values using blocked designs.*

Methods: *An orthogonal discrete choice experiment design was used to elicit a set of choices from a sample of respondents.*

Results: *The choice data were analysed using mixed multinomial logistic regression to produce an internally valid model that predicts well.*

Conclusion: *This paper marks an important milestone in the development of health resource allocation in the Caribbean. It sets out the importance of incorporating the impact of health interventions to inform health resource allocation decisions, describes the elicitation and analysis methods used in the pilot and provides an illustration of the use of the EQ-5D value set.*

Keywords: Discrete choice experiment, EQ-5D, quality adjusted life year (QALY)

Resultados de un Estudio Preliminar para Desarrollar Ajustes de Calidad para los Valores de un Año de Vida Ajustado por Calidad en Trinidad y Tobago

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RESUMEN

Objetivo: *Ningún país puede permitirse ofrecer toda la atención a la salud necesaria para sus ciudadanos, de modo que la necesidad de establecer prioridades en las intervenciones constituye un rasgo característico de todos los sistemas de salud. Los recursos de salud deben asignarse entre las intervenciones/instalaciones/pacientes de tal manera que se correspondan con los objetivos del sistema de salud. Para lograr esto, las decisiones en cuanto a la asignación de recursos deben reportarse en términos de las contribuciones relativas que las intervenciones prospectivas representarán para la salud social y los costos. Internacionalmente, el EQ – 5D basado en el año de vida ajustado por calidad (AVAC), domina ahora este tipo de análisis. El presente trabajo reporta un estudio piloto para desarrollar un conjunto de valores EQ – 5D – 3L para Trinidad y Tobago, basado en un protocolo que evite algunos de los problemas asociados con otros enfoques usados para desarrollar estos conjuntos de valores, tales como tareas complejas de obtención de datos, que los encuestados tienen que llevar a cabo, y las grandes muestras de respuestas requeridas para recoger varios subconjuntos de valoración múltiple utilizando diseños bloqueados.*

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Métodos: *Un diseño de experimento de elección discreta ortogonal se utiliza para obtener un conjunto de opciones de una muestra de encuestados.*

Resultados: *Los datos de la elección se analizaron mediante regresión logística multinomial mixta para producir un modelo internamente válido que predice bien.*

Conclusion: *Este documento marca un hito importante en el desarrollo de la asignación de recursos de salud en el Caribe. El mismo establece la importancia de incorporar el impacto de las intervenciones de salud para informar las decisiones de asignación de recursos de salud, describe los métodos de obtención y análisis utilizados en el programa piloto, y proporciona una ilustración del uso del conjunto de valores EQ – 5D.*

Palabras claves: Experimento de elección discreta, EQ – 5D, año de vida ajustado por calidad (AVAC)

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INTRODUCTION

No country can afford to provide all necessary healthcare for all of its citizens. Health needs are infinite, and the resources available for healthcare are finite. Part of the reason for health needs being infinite lies in the very success of the health system itself. A patient who is treated for and survives a heart attack today can live on to develop cancer and be treated with chemotherapy, surgery and other tertiary services 15 years later (1). Health systems must face an ageing population with a growing prevalence of chronic disease. In an environment characterized by finite resources available to fill infinite needs, choices have to be made about which needs are to be filled and to what extent each identified need is to be filled. Some needs can be fully satisfied, others partially and still others, not at all (2). Interventions must be prioritized.

By allocating resources consistently according to a set of criteria that are aligned with the objectives of the health system, the output of the health system would be better aligned with these objectives. The broad objectives of health systems that are usually put forward are the maximization of population health and the reduction of inequalities in health. Explicit prioritization criteria are usually based on some notion of these broad objectives, subject to a resource constraint (3). In order to pursue such objectives, resource allocation decisions must be informed by the amount to health 'created' by a programme or treatment under consideration. Prioritization based on epidemiological criteria such as burden of disease or health needs assessment data will lead to neither the maximization of the health of the population, nor the minimization of inequalities in health. Needs or epidemiology based prioritization strategies will channel health resources toward high incidence/prevalence conditions which in many instances may not be as amenable to treatment as other conditions. The opportunity costs of such resource allocations are the greater health gains that could have been produced had these resources been channelled into interventions targeting conditions of lower prevalence and incidence that produce higher levels of 'health' per dollar spent on them (4, 5). Prioritization decisions that take into account the extent to which a given treatment will reduce the burden of disease will in turn produce outcomes that are consistent with the generalized goals of health maximization and inequality minimization (6).

To have resource allocation decisions in health informed by the amount of 'health' that a given intervention can 'produce' requires a measure on which interventions can be compared. This becomes a challenge when the consequences of two or more interventions differ qualitatively. For example, if another $1 million became available to the health system of Trinidad and Tobago, and policy-makers were aware that the knee implant, angioplasty, and dialysis programmes all needed to be expanded, how can decisions be made about the allocation of this new funding among three such 'competing' programmes? Such a decision should at least take into account the amount of health that each of these programmes would create per dollar of expansion. To ignore this could result in the new funds being allocated in such a way that greater gains and greater equity could have been achieved by redistributing the funds among the three programmes. The problem here is that to make such a decision, a common measure is required that would facilitate comparison of the value that society would place on receiving dialysis, with the value of a hip replacement, and with the value of an angioplasty procedure. Years of life gained have been used in some such situations (7), but this measure does not take into account the quality of life during those years, and some interventions may result in a great improvement in quality of life, without directly affecting the number of years of life. The quality adjusted life year (QALY) has become the dominant output measure in the economic evaluation of health interventions (8). The QALY measure captures both the number of years of life added by an intervention, and the quality of those years. Full health is given a value of 1.000 and dead is given a QALY value of 0.000. Thus, for some society, the quality of life for condition A may be 0.7 QALYs per year (or 70% of full health) while that for condition B may be 0.8 QALYs per year. If we know the treatment cost for conditions A and B, as well as the consequences in QALY terms, we can calculate the cost per QALY for the interventions.

There are now several instruments that can be used to provide these health state values that will allow QALY estimates to be made. Such instruments describe health states in terms of a set of dimensions, each of which will have several levels. This simplifies the health state valuation process by placing a finite limit on the number of health states possible, and reducing the number of attributes presented to a valuing respondent to a manageable level. Multi-attribute instruments also facilitate analysis, comparison between health states and communication by providing simple coding systems based on dimensions and levels.

The most commonly used approach is the EuroQol EQ-5D-3L instrument. This is a framework based on five dimensions of health status, each of which can take any one of three levels for a given health state. These are displayed in Table 1.

Table 1: The EQ-5D dimensions and levels

Level	Mobility	Self-care	Usual activities	Pain/discomfort	Anxiety/depression
1	No problems in walking about	No problems with self-care	No problems performing usual activities (*eg* work, study, housework, family or leisure activities)	No pain or discomfort	Not anxious of depressed
2	Some problems in walking about	Some problems washing or dressing self	Some problems with performing usual activities	Moderate pain or discomfort	Moderately anxious or depressed
3	Confined to bed	Unable to wash or dress self	Unable to perform usual activities	Extreme pain or discomfort	Extremely anxious or depressed

The EQ-5D-3L system produces a code for a state of health by presenting the level of each state in the order of dimensions given in Table 1. Thus state 21223 describes the following state:
2: some problems in walking about
1: no problems with self-care
2: some problems with performing usual activities
2: moderate pain or discomfort
3: extremely anxious or depressed

The EQ-5D-3L instrument comprises $3^5 = 243$ states. If the relative values of all of these states for Trinidad and Tobago society were known, then these values could be used to provide the quality-of-life adjustment for health states which would in turn allow policy-makers to compare health interventions on the basis of cost per QALY.

A scoring formula is used to convert the five digit codes into a value for the quality-of-life adjustment associated with an EQ-5D state. This is based on coefficients for the level two and three cells for each of the five dimensions in Table 1.

These coefficients vary significantly between countries and it has been shown that these are generally not transferable (9). To use the EQ-5D-3L system in Trinidad and Tobago, it would be necessary to develop a set of coefficients that represent the preferences of the Trinidad and Tobago public. This is done by obtaining societal values for a small set of EQ-5D states (known as a valuation subset), and then using regression analyses to obtain coefficients. Three approaches have been used to obtain the values for the valuation subset. There have been important criticisms of two of these approaches (10, 11). This study reports results from a pilot using a discrete choice experiment (DCE) con-ducted in Trinidad. The motivation behind using a DCE for this purpose is that respondents are given a relatively simple set of valuation tasks (when compared to other valuation tasks) and efficient DCE design methods allow for the crea-tion of small valuation subsets, which in turn allow smaller respondent samples than would be necessary if experimental blocking had to be applied as in other approaches.

METHODS

In preparation for a national study, a pilot study was conducted to test the results of a 'small sample' DCE design and protocol. A DCE is an elicitation exercise in which respondents make a set of choices out of small sets of options by indicating which member of each set they believe is 'best'. Conditional logit regression analysis can be carried out on these choices to produce a set of coefficients for each level of each dimension. An orthogonal DCE design was constructed by taking a suitable orthogonal array (12) with 18 rows as a starting design and adding generator 11111 using modulo 3 arithmetic to produce a second orthogonal array. These two arrays were converted to produce a DCE design comprising 18 pairs of EQ-5D-3L states. A convenience sample of 230 university students completed the DCE. The respondents were first given some 'warm up tasks' to gain familiarity with the EQ-5D-3L instrument, and then given the DCE comprising 20 paired comparisons (18 from the orthogonal design plus two pairs to be used for testing models using out of sample predictive ability). A paper DCE was used in which pairs of EQ-5D-3L states were printed side-by-side and respondents had to indicate their preferred state by ticking a box.

In the conditional logit model, the probability (P) of one EQ-5D state (i) being preferred out of a pair (inferred from the percentage of respondents who made that choice out of the pair) is given by:

$P_i = \exp(V_i) / \Sigma \exp(V_i)$
Where $V_i = \beta_1 MO_{12} + \beta_2 MO_{13} + \beta_3 SC_{13} + \beta_4 SC_{13} + \beta_5 UA_{12} + \beta_6 UA_{13} + \beta_7 PD_{12} + \beta_8 PD_{13} + \beta_9 AD_{12} + \beta_{10} AD_{13}$
V_i is a 'utility function' expressing respondents' preferences in the five dimensions of the EQ-5D instrument (MO = mobility, SC = self-care *etc*). The β parameters are estimated by finding their values that maximize a likelihood function that is in turn based on the percentages of respondents making each choice. This model treats the choices as pooled data. This study involved 18 choices made by 230 respondents, so a model that allows for individual heterogeneity would better represent the preferences of the group. Hence a mixed multinomial logistic (MMNL) regression (using Stata version 12 software) was used because this allows for random parameters.

RESULTS

Results of the MMNL model are displayed in Table 2. This model predicted the choices made by the respondents with a mean absolute deviation of 7% across the 18 pairs of the DCE. The high and significant likelihood ratio in Table 2 shows that the MMNL model represents an improvement over the conditional logit model. The high standard deviations of the level 3 coefficients indicate considerable respondent heterogeneity and justify the use of the MMNL model.

The coefficients in Table 2 needed to be rescaled using a monotonic transformation to produce health state values along a scale on which 1.000 is full health and dead is zero. This was done by obtaining a value for 'dead' from respondents using another method (visual analogue scale) and rescaling the coefficients in Table 2, producing the rescaled coefficients in Table 3.

Table 2: The mixed multinomial logistic model

Means	Coefficient	Std. err	*p*-value	95% confidence interval	
MO2	-0.6878	0.0872	0.000	-0.8587	-0.5168
MO3	-2.9724	0.1935	0.000	-3.3517	-2.5931
SC2	-0.4345	0.0858	0.000	-0.6027	-0.2663
SC3	-1.6452	0.1198	0.000	-1.8800	-1.4104
UA2	-0.5141	0.0859	0.000	-0.6825	-0.3457
UA3	-1.6629	0.1287	0.000	-1.9151	-1.4108
PD2	-0.5306	0.0959	0.000	-0.7185	-0.3426
PD3	-2.3818	0.1496	0.000	-2.6751	-2.0886
AD2	-0.5300	0.0773	0.000	-0.6814	-0.3786
AD3	-1.4063	0.1361	0.000	-1.6731	-1.1396
Standard deviations					
MO3	1.7240	0.1606	0.000	1.4092	2.0387
SC3	1.0403	0.1211	0.000	0.8030	1.2776
UA3	0.7618	0.1207	0.000	0.5252	0.9984
PD3	1.0149	0.1216	0.000	0.7766	1.2532
AD3	1.3183	0.1325	0.000	1.0586	1.5781
Log likelihood		-1638.19	LR Chi-square		352.2600
			Prob > Chi-square		0.0000

CONCLUSION

The coefficients in Table 3 can be used to calculate the value of any EQ-5D state for this population of respondents. The value of state 21223 is calculated in Table 4.

Table 4: The value of state 21223

Dimension	Level	Coefficient
Full health score		1.0000
Constant		-0.0943
Mobility	2	-0.0587
Self-care	1	0.0000
Usual activities	2	-0.0439
Pain/discomfort	2	-0.0453
Anxiety/depression	3	-0.1200
	Value for 21223	0.6378

This value of 0.6378 can be used as the quality adjustment in performing QALY calculations for this group of respondents. A treatment that would restore a patient from state 21223 to full health would have a value of 1.000 – 0.6378 = 0.3622 and therefore 'produce' 0.3622 QALYs per patient-year.

This study shows that an orthogonal DCE design can be used to develop an EQ-5D value set that produces an internally valid MMNL model which predicts well, despite some of the issues that have been raised with orthogonal DCE designs (13). The simplicity of the elicitation task, small respondent sample, and minimal involvement of the interviewer (compared to other elicitation methods) make this DCE protocol particularly attractive for use in the Caribbean.

Table 3: The rescaled coefficients

	Constant	Mobility	Self-care	Usual activities	Pain/ discomfort	Anxiety/ depression
	-0.0943					
Level 2		-0.0587	-0.0371	-0.0439	-0.0453	-0.0452
Level 3		-0.2537	-0.1404	-0.1419	-0.2033	-0.1200

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