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Modelling valuations for health states: the effect of duration

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Abstract

An important issue which has been raised in the measurement of health status is the effect that the time spent in a health state may have on the way that state is perceived. Recently a set of valuations for health states defined in terms of the EuroQol Descriptive System was generated from a study of over 3000 members of the UK general public. The valuations were elicited using the visual analogue scale (VAS) and time trade-off (TTO) methods and were for states that lasted for 10 years. Using VAS valuations for states lasting 1 month, 1 year and 10 years derived from a subset of respondents to the general population study, this paper presents valuation 'tariffs' for all EuroQol states based on the different durations. The results support those of previous studies which suggest that poor states of health become more intolerable the longer they last. Such findings suggest that the results of studies in which the value given to a health state is assumed to be linearly related to the time spent in that health state should be treated with caution and subjected to sensitivity analysis over an appropriate range of values.

Keywords: Health status measurement; Duration; Chronic illness; Adaptation

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1. Introduction

An important part of the benefit of any health care intervention is the effect that it has on the health-related quality-of-life (HRQoL) of the population it affects. Consequently, it is becoming increasingly common for preference-based measures of health status to be used in the evaluation of the outcomes of particular policies and interventions. This has led to a number of questions concerning how HRQoL should be described, and to issues regarding the most appropriate ways to elicit valuations for health states so described. There is also the question of how to weight valuations for health states that last for different lengths of time. It has been common for researchers to weight each year of added life equally, i.e. to assume that the value given to a health state is linearly related to the time spent in that health state. This is an implicit assumption of the conventional Quality-Adjusted Life-Year (QALY) approach which attempts to combine the value of HRQoL with the value of length of life into a single index number

However, there is evidence to suggest that duration can have a significant effect on health state valuations. From a sample of about 200 members of the general public, Sackett and Torrance [1] found that when health states are specified for durations of 3 months, 8 years and a lifetime, mean health state valuations (as measured by the time trade-off technique, or TTO) declined as the time spent in the state increased. Using the same three time periods but a different valuation technique (the visual analogue scale, or VAS), Sutherland et al. [2] found (from a convenience sample of 20 professional colleagues) that the proportion preferring immediate death to varying durations in each of five health states increased as the duration of the states increased. Most of the change in preferences took place between 3 months and 8 years, with little additional effect between 8 years and a lifetime. More recently, Ohinmaa and Sintonen [3] elicited VAS valuations (from a convenience sample of 60 health economics students) for states lasting 1 month, 1 year and 10 years and found valuations to be a decreasing function of duration.

In a recent study of over 3000 members of the general public (referred to hereafter as the 'Main Study'), valuations were elicited (using both the VAS and TTO methods) for health states that lasted for 10 years (see [4] for a description of the study design, [5] for the results from the VAS method, and [6] for a discussion of the TTO results). The health states were defined in terms of the EuroQol Descriptive System which describes health in five dimensions, each comprising three levels of 'severity', thus generating $3^5 = 243$ theoretically possible health states (see Fig. 1).

The raison d'etre of the EuroQol is to provide a simple 'abstracting' device for use alongside more detailed measures of HRQoL. It aims to serve as a basis for comparing health care outcomes using a basic 'common core' of HRQoL characteristics that most people are known to value highly [7]. Using regression analysis, valuations for all 243 EuroQol states were interpolated from direct valuations on a subset of 43 states [8]. This 'tariff' of valuations can be used in a variety of ways; e.g. in clinical trials where HRQoL is an important feature, in association with population surveys to measure levels and trends in community health, and in the calculation of QALYs.

However, because valuations were elicited for only one (relatively long) time period, given the evidence cited above, it is necessary to test whether the tariff of valuations based on health states lasting 10 years would be a good approximation for situations in which the same states were experienced for much shorter durations. With this problem in mind, the study reported here uses VAS valuations (from a subset of the respondents to the Main Study) for states lasting 1 month, 1 year and 10 years to estimate valuation tariffs for all EuroQol states based on the different durations.

2. Methods

2.1. Study design

Three hundred and twelve respondents who expressed a willingness to be re-interviewed in the Main Study were chosen for inclusion in this study. It was expected that this would yield a sample of at least 208 respondents which, assuming that the standard deviations associated with the VAS valuations would be similar to those found in the Main Study, would enable a 0.1 difference in valuations between the different durations to be detected at the 0.05 significance level with 80% power. The sample was chosen to be representative of the 3395 respondents in the main study (who themselves were found to be broadly representative of the general population). The interviews were carried out between March and May 1994 by 20 interviewers from Social and Community Planning Research. Each respondent was interviewed by the same interviewer as in the Main Study.

Each respondent was presented with the same 15 states that they valued in the Main Study. Since this number was deemed to be too small to estimate the entire valuation space, 45 states were chosen in total and each respondent was asked to value a subset of these (see Fig. 2). Respondents were told that each state (except 'Immediate Death') would last 10 years without any change and what happens thereafter is not known and should not be taken into account. They were first asked to rank the 15 states in order from best to worst and then to rate them on a VAS, with endpoints of 100 (best imaginable health state) and 0 (worst imaginable health state), using a method of 'bisection'.

The 'bisection' method is designed to generate an interval scale [9]. Respondents first rate their best and worst ranked states on the VAS. They then choose from the remaining states the one whose value on the VAS is roughly halfway between the values assigned to the two extreme states, and assign a value to that state. They are then asked to rate the state whose value on the scale is roughly halfway between this mid-state and the best state, and then to rate the state whose value on the scale is roughly halfway between the mid-state and the worst state. Respondents are then left to rate the remaining ten states in any order they chose.

The cards describing each state were then taken up and shuffled, and presented once more to the respondent, who was asked to rank and rate them again but this time to imagine that they would last for 1 month. When this second cycle was complete, a third cycle was initiated in which the duration of the state was 1 year.

2.2. Data analysis

VAS valuations have been transformed onto a 'standard' 0–1 scale in order to produce a 'unit of health' which is comparable across all respondents [10]. In this transformation full health (the 11 111 state in this study) and dead are assigned scores of 1 and 0, respectively, for each respondent and all other health state scores

Mobility

1. No problems walking about
2. Some problems walking about
3. Confined to bed

Self-Care

1. No problems with self-care
2. Some problems washing or dressing self
3. Unable to wash or dress self

Usual Activities

1. No problems with performing usual activities (e.g. work, study, housework, family or leisure activities)
2. Some problems with performing usual activities
3. Unable to perform usual activities

Pain/Discomfort

1. No pain or discomfort
2. Moderate pain or discomfort
3. Extreme pain or discomfort

Anxiety/Depression

1. Not anxious or depressed
2. Moderately anxious or depressed
3. Extremely anxious or depressed

Note: For convenience each composite health state has a five digit code number relating to the relevant level of each dimension, with the dimensions always listed in the order given above. Thus 11223 means:

1 No problems 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

Fig. 1. The EuroQol Descriptive System.

Each respondent valued 11111, Immediate Death, 33333 and unconscious

plus

2 from 5 "very mild" states: 11112 11121 11211 12111 21111

plus

3 from 12 "mild" states:

11122 11131 11113 21133 21222 21312 12211 11133 22121 12121 22112 11312

plus

3 from 12 "moderate" states:

13212 32331 13311 22122 12222 21323 32211 12223 22331 21232 32313 22222

plus

3 from 12 "severe" states:

33232 23232 23321 13332 22233 22323 32223 32232 33321 33323 23313 33212

Fig. 2. Health states valued in the study.

are adjusted accordingly, by implication allowing for negative scores. The transformed score, T, for a health state, h, is given by the formula:

$$T = (\text{score for } h - \text{score for Death})/(\text{score for full health} - \text{score for Death})$$

In generating a social tariff of values from the Main Study data, a number of different models and estimation procedures were tested for their consistency (i.e. a higher score must be predicted for state A than state B if A is better than B on at least one dimension and no worse on any other dimension), goodness-of-fit and, for models with comparable goodness-of-fit statistics, parsimony [8]. The model used in this paper is identical to the one that was considered to be the 'best' at explaining the data from the Main Study according to these criteria.

A generalised least-squares regression technique is used (for reasons outlined below) in which the functional form is additive. The dependent variable is defined as $1 - S$ where S is the value given to a particular health state. Besides the intercept (which, given that by definition the value of 11 111 is 1, can be interpreted as representing any disutility associated with the move away from full health), the specification of the remaining independent variables derive from the ordinal nature of the EuroQol descriptive system.

The model contains two dummy variables for each dimension: one to represent the (assumed equal) move between levels and one to represent the move from level 2 to level 3 which allows the effect of the move from level 1 to level 2 to be different from the effect of the move from level 1 to level 3. The model also contains an intercept dummy for whether any of the dimensions is at level 3. Without this additional dummy, which can be interpreted as reflecting the much greater disutility associated with 'Extreme problems', the residuals are systematically related to the predicted values in that the model underestimates the values of less severe states and overestimates the values of more severe ones. Fig. 3 defines the 12 independent variables used in the analysis and thus the regression equation is as follows:

$$Y = \alpha + \beta_1 MO + \beta_2 SC + \beta_3 UA + \beta_4 PD + \beta_5 AD$$
$$+ \beta_6 M2 + \beta_7 S2 + \beta_8 U2 + \beta_9 P2 + \beta_{10} A2 + \beta_{11} N3$$

It was decided that analysis should take place on individual-level rather than aggregate-level data since it makes the maximum use of the available data. However, analysis at the individual-level is complicated by the fact that each respondent valued 12 EuroQol states for each duration and thus it is reasonable to assume that these 12 scores will be related to one another, i.e. if a respondent gives one valuation that is lower than the population mean, then they are more likely to give a value lower than the population mean to the other states that they value. This means that the variance of the error term is unlikely to be constant, thus violating one of the key assumptions underlying ordinary-least squares regression analysis

To address this issue a random effects (RE) model is used in which there is an overall intercept and an error term with two components; $e_{it} + u_i$. The e_{it} is the traditional error term unique to each observation. The u_i is an error term representing the extent to which the intercept of the ith respondent differs from the overall intercept. Using the RE model means that limited dependent variable models, such as Tobit, are impractical since the functional form of these models with an RE component is yet to be specified.

Variable	Definition
a	Constant: associated with any move away from full health
MO	1 if mobility is level 2; 2 if mobility is level 3; 0 otherwise
SC	1 if self-care is level 2; 2 if self-care is level 3; 0 otherwise
UA	1 if usual activities is level 2; 2 if usual activities is level 3; 0 otherwise
PD	1 if pain/discomfort is level 2; 2 if pain/discomfort is level 3; 0 otherwise
AD	1 if anxiety/depression is level 2; 2 if anxiety/dep. is level 3; 0 otherwise
M2	1 if mobility is level 3; 0 otherwise
S2	1 if self-care is level 3; 0 otherwise
U2	1 if usual activities is level 3; 0 otherwise
P2	1 if pain/discomfort is level 3; 0 otherwise
A2	1 if anxiety/depression is level 3; 0 otherwise
N3	1 if any dimension is level 3; 0 otherwise

Fig. 3. Definition of variables used in the modelling.

Table 1
Characteristics of the sample (figures are percentages)

		Sample ($n = 236$)	GHS (1992)
Sex	Male	45	47
	Female	55	53
Age	18-34	28	31
	35-49	30	27
	50-59	13	15
	60+	29	28
Education	Degree	10	8
	Higher	12	10
	A/0 levels	42	45
	None	35	35
	Foreign/other	1	3
Social class	I and II	31	30
	III non-manual	21	22
	III manual	23	21
	IV and V	23	21
	Other	2	3
Marital status	Single	15	21
	Married	66	64
	Widowed	7	9
	Divorced	13	6

The models were tested for general heteroscedasticity in the error terms. The test is undertaken in a two-stage process. In the first stage, the model is estimated and the linear function is calculated. From this stage, a new variable is created by squaring the value of the residuals. In the second stage, this new variable is regressed on the estimated values. The significance of the squared residual term can be used a test for heteroscedasticity. The modelling has been carried out using the LIMDEP statistical package [11].

3. Results

3.1. Study population

Of the 312 people selected for sampling, 236 (76%) yielded an interview. Unsuccessful interviews were largely due to a refusal by the selected person or to the interviewer being unable to make contact with the selected person. Table 1 shows that the sample was broadly representative of the general population in terms of age, sex and educational attainment. Two respondents had to be excluded from further analysis because they had not given valuations for the 1 month and 1 year durations. The data for the remaining 234 respondents, however, was highly complete: only 1.2% of the valuations data was missing.

3.2. Comparisons with the Main Study

Since VAS valuations for the 10 year duration were elicited in exactly the same way as in the Main Study, it is possible to compare the two sets of valuations, and hence to make some judgements about whether the 1 month and 1 year valuations elicited in this study would be likely to be those that would have been obtained had the sample been larger. A stringent test involves comparing the 243 estimated values from the 10-year valuations in this study with those derived from the Main Study. The following ordinary least-squares regression equation was used to compare the estimates:

$$y = \alpha + \beta x$$

where y is the 10 year VAS valuation from this study and x is the 10 year VAS valuation from the Main Study. The results were as follows:

$$y = 0.02 + 0.98\,x$$

$$(6.75) \quad (118.6)$$

$$R^2 = 0.98$$

Since the intercept term is very close to zero and the slope term is very close to 1 and given that this simple specification did not suffer from any heteroscedasticity, it seems reasonable to conclude that the corresponding valuations are very close to each other.

3.3. Model estimates

The coefficients on the 12 independent variables for three durations are shown in Table 2. The R^2 values (ranging from 0.55 to 0.63) are very high given the type of data analysed here. However, all models suffered from general heteroscedasticity but this problem is difficult to overcome since the conventional means of dealing with it (i.e. transformation of one or more independent variables) is not feasible given the (categorical) nature of the independent variables. In any case, although heteroscedasticity will result in inefficient parameter estimates, it is unlikely to result in estimates that are biased to any great extent.

Table 2 shows that the constant for all three durations is highly significant suggesting that any move away from full health is associated with a substantial loss of utility and the size and significance of the coefficient on N3 highlights the aversion that respondents in general have to 'extreme problems' on any of the dimensions. It can be seen that for all three durations the largest decrement for a move from level 1 to level 2 is associated with pain or discomfort, which continues to dominate the weighting for level 3, although mobility level 3 (confined to bed) is given a somewhat similar decrement. With respect to differences across durations, the largest and most systematic shifts occur in the constant term and in the N3 term, where the decrement associated with each increases as duration increases. There is little or no systematic shift apparent for most dimensions, except perhaps for self-care where the decrements associated with both levels 2 and 3 increase marginally as the time spent in the health state increases.

The algorithm for computing the tariff from the model output is quite straightforward. For example, the value of the state 11223 when it lasts for 1 month is given by: $1-[a\text{-UA-PD-2(AD)-A2-N3}] = 1-[0.107\text{-}0.041\text{-}0.079\text{-}2(0.056)\text{-}0.003\text{-}0.147] = 0.511$. The actual (mean) and estimated values for the 42 states directly valued in the study are compared in Fig. 4. The difference between actual and estimated values for all three durations is remarkably small. The biggest discrepancy is for state 32211 for a duration of 10 years where the estimated value is 0.093 greater than the mean value for this state, but for only 23 of the 126 comparisons does the difference exceed 0.05.

Fig. 5 compares the estimated values of the same 42 states for the three durations. It is clear from the figure that the effect of duration is not uniform across the range of health states, being more pronounced for more severe states than for less severe ones. As would be expected, and as can be inferred from the coefficients in Table 2, the largest differences in valuations are between the 10-year and 1-month durations. For less severe states, the values when the states last for 10 years are about 0.05 below those when the states last for 1 month. This difference increases with severity, reaching about 0.15 for the more severe states. Interestingly, the differences between the values for states lasting 10 years and 1 year are of approximately the same magnitude as the difference between 1 year and 1 month values. In both comparisons, the value for the longer duration is about 0.03 below that for the shorter duration for less severe states, and about 0.07 lower for more severe states.

Table 2
Coefficients on independent variables for different durations

Variable	1 Month	1 Year	10 Years
a	0.107	0.113	0.144
MO	0.055	0.052	0.050
SC	0.064	0.073	0.078
UA	0.041	0.045	0.067
PD	0.079	0.096	0.096
AD	0.056	0.063	0.047
M2	0.045	0.047	0.059
S2	−0.006	−0.008	0.001
U2	0.020	0.005	−0.044
P2	0.036	−0.005	−0.021
A2	0.003	0.014	0.031
N3	0.147	0.183	0.211
Adjusted R^2	0.63	0.62	0.55

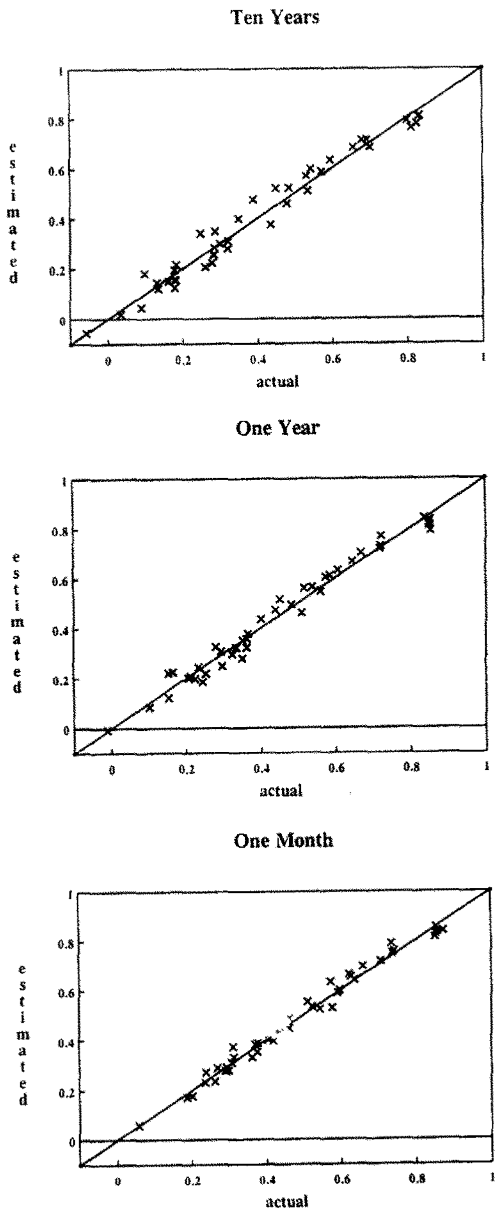

Fig. 4. Comparison of estimated with mean values.

4. Discussion

One of the most important issues in the measurement of HRQoL is the effect that the time spent in a particular health state may have on its subsequent valuation. There is evidence from the literature that poor states of health become more intolerable the longer they last. The purpose of this study was to elicit valuations for health states (defined in terms of the EuroQol descriptive system) that last for different durations, using precisely the same protocol as that employed in a large scale general population study which elicited valuations for states lasting ten years. The same statistical methods were adopted in order to interpolate valuation 'tariffs' for all EuroQol states for durations of

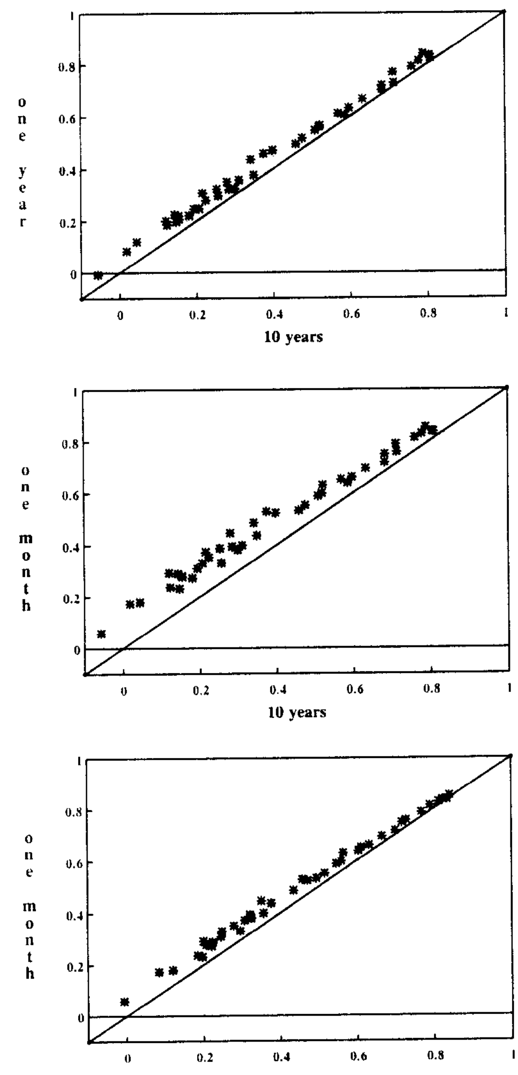

Fig. 5. Comparison of estimated values.

1 month and 1 year, in addition to those already generated for 10 years.

Regression analysis is used to explain health state valuations in terms of the levels and dimensions generated by the EuroQol descriptive system. Analysis is of individual-level data and is based on a form of generalised least-squares known as the random effects model. The data is explained in terms of a main effects model with one additional term to account for the much greater disutility associated with being in level 3 on any dimension. The results from the modelling are encouraging and suggest that the same functional form used in the Main Study is equally applicable to this data. As with the Main Study, none of the models which allowed for interactions between different dimensions improved the model significantly and many introduced inconsistencies into the estimated values. The R^2 values (of between 0.55 and 0.63) can be considered very good given the type of data analysed, and the estimated values for all three durations are in the majority of cases very close to the actual ones.

The results suggest that the valuation given to a health state is a decreasing function of both its severity and its duration: the (estimated) score for a state lasting 10 years is lower than when the same state lasts for 1 year which in turn is lower than when that state lasts for only 1 month. It appears that the differences between 10 year and 1 year values are approximately equal to the differences between 1 year and 1 month values. The differences are about 0.03 for the less severe states and, because of large differences in the 'N3' variable, about 0.07 for the more severe ones. Although there is little evidence in the literature regarding what size difference is required to be considered meaningful [12], it is likely that such differences, particularly those for the severe states, will be considered important in many contexts.

The hypothesis, then, that dysfunctional health states will be seen as increasingly intolerable the longer they last is supported by the data analysed here. However, the coefficients on the dummy variables for the different dimensions show no systematic pattern, suggesting that the effect of duration is not dimension-specific. Although the results of previous studies support the former finding, very few have looked at whether the effect of duration on one attribute of health is different from its effect on another attribute. The results presented here suggest that it is not, implying that it is the severity of the health state overall that matters.

Given that the valuations for states lasting 10 years were very similar in both the Main Study and this study, it seems reasonable to conclude that, if respondents in the Main Study were asked to value states of 1 month and 1 year duration, they would have given very similar values to the corresponding ones obtained in this study. Therefore, the results presented here suggest that, for the same descriptive system (the EuroQol), different weights are required for different durations. Such findings are likely to have implications for the use of other instruments, such as the McMaster health state classification system [13] which incorporates lifetime duration into the procedure used to derive valuations.

Valuations for health states in this study were elicited by the VAS method which has been widely used in measuring health state preferences. However, it is unclear whether the differences between the tariffs generated for the three time periods would be more or less pronounced if valuations had been elicited by other methods, such as the time trade-off or standard gamble, which are generally preferred by economists. The evidence currently available on this subject is very limited although some of the research that has been conducted suggests that using these choice-based methods to elicit valuations for very short durations is problematic [14].

Since this study has shown it is feasible to use the VAS to elicit valuations for different durations, an alternative strategy might involve the following two stage process: first, to elicit VAS and TTO (or SG) valuations for a long duration and to derive a functional relationship between the two sets of values; second, to elicit VAS valuations for shorter durations and to use the mapping function estimated in stage 1 to 'convert' short-duration VAS valuations into short-duration TTO (or SG) ones. Given that the Main Study elicited both VAS and TTO valuations for states lasting 10 years, this strategy is a feasible one and will be explored in due course. Of course, this strategy is based on the assumption that the relationship found for the 10 year duration will hold for other durations and thus it is important that research into eliciting valuations for short durations from choice-based methods should continue.

One final word of caution. A number of studies have shown a direct positive link between time in chronic illness and adaptation to that illness [15,16]. The suggestion that those in poor health successfully compensate for it may result from an adjustment or response to 'cognitive dissonance' whereby people adjust their expectations in the light of changes in their circumstances [17]. It might be expected, therefore, that valuations of the milder health states would actually increase as the time spent in them increases. That this was not observed in this study may be because valuations here were elicited for hypothetical health states from a relatively healthy general population, as opposed to those actually experiencing a chronic illness.

More generally, a number of studies have shown that direct personal experience of illness may influence respondents' valuations of health states. For example, Rosser and Kind [18], from pairwise comparisons of patients, nurses, physicians and the general public, found significant differences between medical patients and physicians and between medical patients and psychiatric patients, and Sackett and Torrance [19] reported that home dialysis patients assigned higher values to kidney dialysis than did the general public. It seems entirely plausible that the preferences of the general public might also differ from those of patients with regard to the effect of duration.

The issue that arises here is whose preferences should be used in determining priorities in health care. It could be argued that it is appropriate to weight more heavily the preferences of those who have most direct experience of the health states in question. For example, values for chronic health states could be elicited from people who have been in such states for a period of time which is considered long enough for them to have adapted to their dysfunction and/or to have made the necessary adjustments to their expectations. On the other hand, there are also grounds for supporting the notion that the preferences of the general public should be given greatest weight, not least because they ultimately pay for health care. In addition, since resource allocation decisions primarily affect future (rather than current) patients, it seems legitimate to give weight to the ex ante preferences of potential patients when making ex ante resource allocation decisions.

Of course, this is ultimately a political issue. But as health status measurement becomes more widespread, it seems likely that policy-makers will, in the very least, want to have some idea about the preferences of the public and hence valuations from general population samples will become increasingly important. From the results presented in this paper, it is clear that a large number of the general public consider dysfunctional health states, particularly more severe ones, to be increasingly intolerable as the time spent in them increases. This has important implications for those involved in measuring the benefits associated with health care and suggests that the results of studies in which the value given to a health state is assumed to be linearly related to the time spent in that health state should be treated with caution, and subjected to sensitivity analysis over an appropriate range of values.

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References

[1] Sackett, D.L. and Torrance, G.W., The utility of different health states as perceived by the general public, Journal of Chronic Diseases, 31 (1981) 697–704.
[2] Sutherland, H.J., Llewellyn-Thomas, H., Boyd, N.F. and Till, J.E., Attitudes towards quality of survival: the concept of maximal endurable time, Medical Decision Making, 2 (1982) 299–309.
[3] Ohinmaa, A. and Sintonen, H., The effect of duration on the value given to the EuroQol states. In J. Busschbach (Ed.), EuroQol Conference Proceedings, Erasmus University, Rotterdam, 1994, pp. 51–60.
[4] Erens, R., Health-related quality-of-life: General population survey, SCPR, Technical Report, London, 1994.
[5] Gudex, C., Dolan P., Kind, P. and Williams, A., Health state valuations from the general public: using the visual analogue scale, Quality of Life Research, (1996).
[6] Dolan, P., Gudex, C., Kind, P. and Williams, A., The time trade-off method: results from a general population study, Health Economics, 5 (1996) 141–154.
[7] The EuroQol Group, EuroQol — a new facility for the measurement of health-related quality of life, Health Policy, 16 (1990) 199–208.

[8] Dolan, P., Gudex, C., Kind, P. and Williams, A., A social tariff for EuroQol: Results from a general population study, CHE Discussion Paper No. 138, Centre for Health Economics, University of York, (1995).
[9] Stevens, S.S., Issues in psychological measurement, Psychological Review, 78, 1971, 426–450.
[10] Torrance, G.W., Measurement of Health State Utilities for Economic Appraisal: A Review, Journal of Health Economics, 5 (1986) 1–30.
[11] Greene, W.H., LIMDEP Version 6.0: User's Manual and Reference Guide, Econometric Software Inc., New York, (1992).
[12] O'Brien, B.J. and Drummond, M.F., Statistical versus quantitative significance in the socioeconomic evaluation of medicines, PharmacoEconomics, 5 (1994) 389.
[13] Torrance, G.W., Boyle, H.H. and Horwood, S.P., Application of multi-attribute utility theory to measure social preferences for health states, Operational Research, 30 (1982) 1043–1069.
[14] Dolan, P. and Gudex, C., Time preference, duration and health state valuations, Health Economics, 4 (1995) 289–299.
[15] Meyerowitz, B.E., Postmastectomy coping strategies and quality of life, Health Psychology, 2 (1983) 117–132.
[16] Cassileth, B.R., Lusk, E.J., Strouse, T.B., Miller, D.S., Brown, L.L., Cross, P.A. and Tenaglia, A.N., Psychosocial status in chronic illness: a comparative analysis of six diagnostic groups, New England Journal of Medicine, 311 (1984) 506–511.
[17] Festinger, L., A Theory of Cognitive Dissonance, Stanford University Press, (1957).
[18] Rosser, R. and Kind, P., A scale of evaluations of states of illness: is there a social consensus?, International Journal of Epidemiology, 7 (1978) 347–358.
[19] Sackett, D.L. and Torrance, G.W., The utility of different health states as perceived by the general public, Journal of Chronic Diseases, 31 (1978) 697–704.