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Comparing Increments in Utility of Health: An Individual-based Approach

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ABSTRACT

Background: Many economic evaluations of health care changes rely on quality-adjusted life year (QALY) estimates. Notably, though, the QALY approach values health *states* rather than *changes* in health states. Hence, a gain in utility of health is only indirectly valued through an *ex ante* preference elicitation of health states and the subsequent subtraction of health state values from one another, rather than being valued directly. There is therefore an underlying assumption that individuals, from an ex ante perspective *ceteris paribus*, would be indifferent between equal utility increments from health states with different baseline utilities. **Objective:** The aim of this paper is to develop a method that would allow us to measure individual-based preferences over utility increments from different baselines. We elicit our data using face-to-face interviews on a sample of UK individuals. **Results:** Overall, we find that gains of "equal" utility increments from different baselines are not found to be equally preferable by the individual. **Conclusions:** The results indicate that the subtraction approach could lead to sub-optimal resource allocations and suggest that a new approach which values health changes directly would better reflect individual preferences. This paper provides the foundations for a method to achieve this.

Keywords: QALY, quality of life, stated preference, utility.

Introduction

A cost-utility analysis involves a comparison of the quality-adjusted life-years (QALYs) gained for a given intervention with the incremental costs, where the QALY measure captures both quality and quantity gains [1]. Using the standard QALY procedure, the change in health utility resulting from a health care intervention is indirectly approximated through ex ante preference elicitation on health state and subsequent subtraction of health state values from one another [2]. This subtraction method will in practice be carried out using QALYs based on average health state values for several individuals (often a sample of the general population).

The method implicitly assumes that, on average and from an ex ante perspective ceteris paribus, individuals would be indifferent between an incremental gain in health utility from a health state associated with a higher utility and an equally sized incremental gain in utility from a health state associated with a lower utility. If gains of equal utility increments are not empirically found to be equally preferable by the individual on average, an assumption underlying the subtraction method is called into question and might suggest that a new approach, one that values health changes directly, would better reflect individual preferences.

The aim of this article is to develop a method that would allow us to measure individual-based preferences over utility increments from different baselines. Note that this issue differs from the one of equity when the potential recipients are different individuals [3–6]. We elicit our data using existing utility scores and face-to-face interviews on a sample of individuals in the United Kingdom. By asking individuals to make direct comparisons between equal utility increments (from health states with different baseline utilities), we obtain rankings at the individual level, allowing for a direct test of an assumption that underlies the subtraction methodology.

A test of the subtraction method is implicitly a test of the intraperson interval property, as defined by Torrance [7]: "a gain of equal utility increments anywhere on the scale should be equally preferable *for the individual whose utilities are being represented*. For example, if an individual's utilities are A = 0.2, B = 0.4, C = 0.6 and D = 0.8, the person should be indifferent to whether the change is from A to B or from C to D." According to Torrance

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[7] and to the best of our knowledge, the intraperson interval property has, so far, not been tested.

Although not central to this article, we show that our data have the potential to measure the strength of such individual-based preferences and hence to indicate the size of the potential bias when using the subtraction method. We leave to the end of the article a discussion as to how the findings in this article may be translated into a health policy tool.

The article proceeds as follows: in section 2, we describe the empirical study and analytical approach; and section 3 presents the results; and the final section reflects on the implications for future research and policy formation.

The Framework for Comparing Increments in Utility

In the experiment, we follow the suggestion by Torrance [7] and test whether individuals looking through a "veil of ignorance," that is, not knowing which outcomes and choices might occur to them in the future, would agree in advance that a change from 0.2 to 0.4 is equally preferable compared with a change from 0.6 to 0.8. Hence, we compare two *changes* at a time (Gain X and Gain Y) from two proposed levels of an individual's baseline utility of health (A and C). The changes are represented using the visual analogue scale (VAS), the HUI Mark 3 (HUI:3) [8] descriptive system, or the EQ-5D-5L.

Using the VAS, we ask respondents for an individual assessment of the changes directly. However, for the HUI:3 and EQ-5D-5L, the health state change is described using the descriptive system, and associated individual scores are assumed to be the population scores generated by the HUI:3 algorithm [8] and the official crosswalk EQ-5D-5L values for the United Kingdom (http://www.euroqol.org). The ranking of the two changes constitute stage 1 of our analytical approach. By keeping Gain X fixed and varying Gain Y until the individual identifies his or her indifference point between the two utility increments from different proposed baselines, we also illustrate (as stage 2) how strength of individual preferences can be elicited for different gains and baselines, providing an indication of the size of the potential bias using the subtraction method.

EQ-5D is a widely used generic health status measurement method, and in the United Kingdom, preference values are derived using the time trade-off method. Throughout this article, we consider the elicited preference values to be a proxy for individual utility even though only preferences measured using standard gamble are based directly on von Neumann Morgenstern utility theory. The time trade-off method is framed in a riskless world [9], and because this article takes the existing application of the QALY framework as a starting point, our method correspondingly is designed in a world of certainty. However, it would be relatively straightforward to extend this method to a world of uncertainty.

Experimental Design

A "common" experiment was designed, varying only in terms of the method used to represent health states: the VAS, HUI:3, or EQ-5D-5L. Due to the potential for fatigue, if subjects were asked to answer all variants, the experiment was applied on two separate samples: sample I, students (from the Universities of York and Newcastle); and sample II, members of the general public (Newcastle-upon-Tyne). Subjects in sample I were randomized into either VAS_S or HUI_S, whereas subjects in sample II were randomized into either VAS_P or $EQ5D_P$ (Table 1).

Experimental Procedures

A total of 170 participants took part in the experiment. All experimental sessions were face-to-face interviews attended by only one participant and the interviewer. An example of the experimental instructions is included in the online Appendix (in Supplemental Materials found at http://dx.doi.org/10.1016/j.jval.2016.12.009). Prior to the experiment itself, a piloting phase was carried out to test for comprehension. After the pilot, experimental instructions were further amended and more training exercises included. This process allowed us to verify that the experimental instructions were understood by as many participants as possible, a crucial feature of any new method, and, as much as is possible, to establish that subjects understood the concept of a health *change*.

Core procedures, questions, and so on, were identical across the samples. However, a more extensive introduction and explanation were required for sample II to ensure participants understood the task. Thus, although the experiment generates treatment-specific results, we refrain from any direct comparisons due to this difference in information communication. Nevertheless, we are still able to draw broad qualitative conclusions from the two sets of responses. After the warm-up and training exercises, the actual preference elicitation exercise was carried out on both sample I and II. This is described in the following section.

Eliciting Preferences Over Changes in Health States

Table 2 contains the full set of incremental changes offered to respondents. In each question, the respondent was shown two health changes, Gain X and Gain Y, described in terms of initial baseline health and a final health state. States corresponding to Gain X are labeled "A" and "B," and those corresponding to Gain Y are labeled "C and "D." The utility scores for these different states are contained in Table 2. It can be observed that the initial baseline state in Gain X is always better than the initial baseline state in the corresponding Gain Y.

In all variants (e.g., EQ5D; HUI; VAS), six questions were asked. In the question identifiers, the subscript refers to the specific utility gain (offered in both X and Y) that a respondent was asked to compare; that is, $Q1_{0.25}$ means that, in question 1, respondents had to choose between an increment of 0.25, in this case from baselines of 0.75 (A) and 0.5 (C). In $Q2_{0.25}$ and $Q3_{0.25}$, although the utility gains are the same, the initial baseline states differ. The same principle applies in the $Q4_{0.5}$ to $Q6_{0.5}$. In all questions, a respondent was asked to indicate whether X or Y offered the "better" change. These responses will be reported as stage 1 results. Examples of the visual presentation of Gain X are shown in the online Appendix (for VAS_{S+P}, HUI and EQ5D; see the Appendix in Supplemental Materials found at http://dx.doi.org/10.1016/j.jval.2016.12.009). It was explicitly emphasized that respondents should imagine themselves in the health states

Table 1 – Experimental design.

Sample	VAS	Method HUI:3*	EQ5D*
I	VAS_S n = 35	HUI_S n = 35	
II	VAS_P n = 51		$EQ5D_P$ n = 51

VAS, visual analogue scale; HUI:3, HUI Mark 3; EQ5D, EuroQol 5 Dimension 5 Levels.
Note: Subscript s denotes students and p denotes general public.